KOMODITAS : KAPAS

SCIENCEDIRECT 2006-2010

CROP HUSBANDRY (5 jdl)

Guo-zheng YANG, Ming-yan ZHOU, Multi-Location Investigation of Optimum Planting Density and Boll Distribution of High-Yielding Cotton (G. hirsutum L.) in Hubei Province, China,
Agricultural Sciences in China, Volume 9, Issue 12, December 2010, Pages 1749-1757, ISSN 1671-2927, DOI: 10.1016/S1671-2927(09)60273-X.
(http://www.sciencedirect.com/science/article/B82XG-51SFPYJ-6/2/2a24f0dfcab66dd427189490ab44e51d)

Abstract:

Cotton yield per unit ground area has stagnated for a dozen years in Hubei Province, China, although a series of new high-yielding varieties have been commercialized. A multi-location investigation was carried out in 2008 and 2009 in 13 counties to determine if increased planting population density (PPD) would break the stagnant yield. The results showed that significant differences among the fields existed in theoretical yield, PPD, and bolls per square meter (BPM). The lowest yield of 1 641.1 kg ha-1 was resulted from the lowest PPD of 1.7 plants m-2 and the lowest BPM of 71.8 bolls m-2, while the highest yield of 2 779.7 kg ha-1 was resulted from the highest PPD of 2.5 plants m-2, and the highest BPM of 129.4 bolls m-2. Plant mapping revealed that boll retention rate (BRR) was maintained over 30 or 40% for the first 17-18 fruiting branches (FBs) and decreased dramatically thereafter, rotten boll rate (RBR) decreased, but open boll rate (OBR) rose first and dropped later with rising FB from the bottom to the top. But BRR, RBR, and OBR were all dropped with the fruiting positions (FPs) extending outwards. The optimum range of plant density would be 2-3 plants m-2 and the proper individual plant structure would be 16-19 FBs with 5-7 FPs for cotton production in Hubei Province.

Keywords: cotton (Gossypium hirsutum L.); planting population density (PPD); lint yield; boll retention rate (BRR)

Hezhong Dong, Weijiang Li, Wei Tang, Dongmei Zhang, Early plastic mulching increases stand establishment and lint yield of cotton in saline fields,
Field Crops Research, Volume 111, Issue 3, 3 April 2009, Pages 269-275, ISSN 0378-4290, DOI: 10.1016/j.fcr.2009.01.001.
(http://www.sciencedirect.com/science/article/B6T6M-4VJBCKY-1/2/3ef4362ed907cfe597255f91f09f4ed2)

Abstract:

Row covering with polyethylene film (plastic mulching) is a common practice for improving emergence, plant growth and yield of cotton in China. This is usually applied

after sowing (conventional mulching, CM), but pre-sowing evaporation in spring would cause accumulation of salts and moisture loss in the surface layer of saline soils. Two experiments were conducted in Yellow River delta from 2004 to 2005 and during 2006, respectively to determine if row covering with plastic film 30 d before sowing (early mulching, EM) supports better productivity of cotton than CM in saline fields. In the first experiment, we studied the effects of EM versus CM and no-mulching (NM), on soil microclimate, seedling physiology, cotton yield and earliness. The second experiment was conducted in seven sites to compare cotton yield between the two mulching systems. Results from the first experiment showed that both EM and CM could effectively improve stand establishment, plant growth, earliness and lint yield of cotton relative to NM control. However, compared with CM, EM increased stand establishment rate by 11.4% and plant biomass by 9.9% and lint yield by 7.1%. EM, relative to CM and NM, increased the photosynthesis (Pn) rate 6.8% and decreased malondialdehyde (MDA) concentration 7.4% and Na+ level 8%. These improvements were due mainly to delayed accumulation of salts, elevation of soil temperature and reduction of moisture loss with EM. The revenue from EM was higher than that from CM and NM, suggesting the increased yield by EM was enough compensate for additional costs. The multi-site experiment in 2006 showed that the yield advantage of EM over CM was not significant in two sites with lower salinity (ECe = ~6 dS/m), but substantial (from 9 to 14%) in five sites with higher salinity (ECe = 10-12 dS/m). The overall results suggest that EM is a promising cotton production technique in the saline Yellow River Delta and other cotton-growing areas with similar ecologies.
Keywords: Cotton; Plastic mulching; Saline soil; Stand establishment; Lint yield

R.L. Raper, D.W. Reeves, J.N. Shaw, E. van Santen, P.L. Mask, Benefits of site-specific subsoiling for cotton production in Coastal Plain soils,
Soil and Tillage Research, Volume 96, Issues 1-2, October 2007, Pages 174-181, ISSN 0167-1987, DOI: 10.1016/j.still.2007.05.004.
(http://www.sciencedirect.com/science/article/B6TC6-4P3M81D-1/2/971381443a385ccab34ea6a62433db40)
Abstract:
The negative impacts of soil compaction on crop yields can often be alleviated by subsoiling. However, this subsoiling operation is often conducted at unnecessarily deep depths wasting energy and excessively disturbing surface residue necessary for erosion control and improved soil quality. A corn (Zea mays L.)-cotton (Gossypium hirsutum L.) rotation experiment was conducted over 4 years on a Coastal Plain soil with a hardpan in east-central Alabama to evaluate the potential for site-specific subsoiling (tilling just deep enough to eliminate the hardpan layer) to improve crop yields while conserving energy. Seed cotton yield showed benefits of subsoiling (2342 kg/ha) compared to the no-subsoiling treatment (2059 kg/ha). Averaging over all years of the study, site-specific subsoiling produced cotton yields (2274 kg/ha) statistically equivalent to uniform deep subsoiling at a 45 cm depth (2410 kg/ha) while not excessively disturbing surface soil and residues. Significant reductions in draft force were found for site-specific subsoiling (59% and 35%) as compared to uniform deep subsoiling at a 45 cm depth in shallow depth hardpan plots (25 cm) and medium depth hardpan plots (35 cm), respectively.

Calculated fuel use for site-specific subsoiling was found to be reduced by 43% and 27% in the shallow and medium depth hardpan plots, respectively, as compared to uniform deep subsoiling in these same plots. Producers in the Coastal Plains who can determine (or who know) the depth of their root-impeding layer and perform site-specific subsoiling can have comparable cotton yields to traditional uniform depth subsoiling with reduced energy requirements.

Keywords: Site-specific; Precision agriculture; Subsoiling; Soil compaction; Draft; Drawbar power

Hezhong Dong, Weijiang Li, Wei Tang, Zhenhuai Li, Dongmei Zhang, Yuehua Niu, Yield, quality and leaf senescence of cotton grown at varying planting dates and plant densities in the Yellow River Valley of China,

Field Crops Research, Volume 98, Issues 2-3, August-September 2006, Pages 106-115, ISSN 0378-4290, DOI: 10.1016/j.fcr.2005.12.008.
(http://www.sciencedirect.com/science/article/B6T6M-4J32JFY-1/2/b1aadd0786db7c8e54b9e1e660bc7eeb)

Abstract:

Cotton is usually managed with a normal planting production system (NPPS) that involves planting in mid-April at a moderate plant density (4.5 plants/m2) in the Yellow River Valley of China, but drought or cold stress in spring often delays cotton planting, and results in reduced yield and maturity at this plant density. Two experiments were conducted for 4 consecutive years, to test if yield and fiber quality can be maintained or improved by increased plant density for relatively late-planted cotton. Results in the first experiment in 2001 and 2002 showed that average lint yields were not significantly affected by plant density (3.0, 4.5, 6.0 or 7.5 plants/m2) or by planting date (mid-April or early May), but significant interactions between planting date and plant density on lint yield were detected in both years. Normal planted cotton at a plant density of 3.0-4.5 plants/m2, and late-planted cotton at 7.5 plants/m2 produced higher lint yield than other planting date and density combinations. Experiment 2 compared NPPS with a late planting production system (LPPS) which involves planting in early May at 7.5 plants/m2 over 2 years. The NPPS and LPPS had similar lint yields in both years. Cotton plants in both systems produced approximately 75% of total lint in the first two harvests, indicating no significantly delayed earliness in LPPS relative to NPPS. Fiber from late-season bolls exhibited reduced strength and micronaire in both systems, but there were no significant differences in fiber properties for early- and mid-season fiber between the two systems. In terms of green leaf area index and leaf chlorophyll content, leaf senescence or premature senescence of cotton plants was considerably alleviated by either altered source to sink balance or the uptake of K in LPPS compared to NPPS. It was concluded that the LPPS, a relatively late-planted cotton production system with increased plant density under intensive field management, might be a potential alternative for growing cotton.

Keywords: Cotton; Late planting; Plant density; Yield; Fiber quality; Leaf senescence; Boll load

Yanmin Yang, Zhu Ouyang, Yonghui Yang, Xiaojing Liu, Simulation of the effect of pruning and topping on cotton growth using COTTON2K model,
Field Crops Research, Volume 106, Issue 2, 5 March 2008, Pages 126-137, ISSN 0378-4290, DOI: 10.1016/j.fcr.2007.10.019.
(http://www.sciencedirect.com/science/article/B6T6M-4RPM45K-1/2/75d660e9b565b2e372090cc5b4016d5a)

Abstract:

COTTON2K, like most other cotton production models, does not always adequately represent local growth conditions owing to the fact that it fails to take into account some indigenous cultivation practices. For instance, pruning and topping, a common practice for cotton cultivation in China is not included in the model simulation of COTTON2K. The objective of this research therefore was to: (1) modify COTTON2K source code and slot pruning and topping simulation switch on to the model, and (2) calibrate and validate the modified COTTON2K model with field data from pruning and topping cultivation practice. First, field collected data in 2003 and 2004 were compared between the treatments, with and without pruning and topping, and the COTTON2K source code updated with the `pruning and topping' switch. This was followed by the calibration and validation of the updated model with field data and simulation of the effect of pruning and topping on cotton performance. It was noted from field observations that pruning and topping reduced total fruit sites, but at the same time, increased retained boll number, possibly due to significant reductions in abscised fruit sites. Though total dry matter production dropped, more dry matter allocation to reproductive organs, however, enhanced higher cotton lint yield in the pruning and topping treatment. Results of the modified model simulation showed that growth in the number of main-stem node ceased after topping. Furthermore, there was more biomass allocation to reproductive organs, such as green and open bolls under pruning and topping. Coefficient of determination above 0.8 for most of the growth factors was obtained in the calibration and validation processes under pruning and topping, a strong indication of the level of success of the model modification.

Keywords: Cotton; COTTON2K; Pruning and topping; Model; Calibration; Validation

PLANT PROPAGATION (5 JDL)

Sheng WANG, Guo-hong ZHAO, Yin-hua JIA, Xiong-ming DU, Molecular Cloning, and Characterization of an Adenylyl Cyclase-Associated Protein from Gossypium arboreum L.,
Agricultural Sciences in China, Volume 8, Issue 7, July 2009, Pages 777-783, ISSN 1671-2927, DOI: 10.1016/S1671-2927(08)60278-3.
(http://www.sciencedirect.com/science/article/B82XG-4WV72XV-3/2/70344baf1905e59c9aa3fb28d2b239b8)

Abstract:

The aim of this study was to clone CAP (adenylyl cyclase-associated protein) gene from Gossypium arboreum L. and develop a platform for expressing and purifying CAP protein, which is a base for the construction and function researches of CAP. In

this work, a CAP homolog from cotton (DPL971) ovule was identified and cloned. And the cDNA sequence consisted of an open reading frame of 1 416 nucleotides encoding a protein of 471 amino acid residues with a calculated molecular weight of 50.6 kDa. To gain insight on the CAP role in cotton fiber development, the cloned CAP cDNA was expressed. A significant higher yield pure protein was obtained with the chromatographic method. Further experiments showed that the purified protein can bind with the actin in vitro indicating that the recombinant cotton CAP is functional. The procedure described here produced high yield pure protein through one chromatographic step, suitable for further structure-function studies.

Keywords: adenylyl cyclase-associated protein; CAP; cotton fiber; protein expression; protein purification; Gossypium arboreum L.

Dong FANG, Jun-Hong LU, Wang-Zhen GUO, Tian-Zhen ZHANG, Cloning and Mapping of a New MYB Transcription Factor (GhTF1) in Cotton,

Acta Agronomica Sinica, Volume 34, Issue 2, February 2008, Pages 207-211, ISSN 1875-2780, DOI: 10.1016/S1875-2780(08)60009-7.
(http://www.sciencedirect.com/science/article/B94TW-4T5JDPK-4/2/43bd69de2ef68d8e9072acda1b83c7fe)

Abstract:

Plant MYB transcription factors are characterized by the presence of a structurally conserved MYB domain, with important roles in regulation of plant development and metabolism. To clone new MYB genes and furthermore put a foundation to illustrate the function of these genes in cotton (Gossypium spp.) fiber developmental stages, a MYB transcription factor gene, GhTF1 (GenBank No. EF651783) was isolated from developmentally different cotton fiber pools of elite material '7235'. The gene has a 771 bp open reading frame and encodes a polypeptide containing 256 amino acids. Gene GhTF1 showed different expression levels in all tissues, e.g., with higher levels in fiber cells at initiation and elongation stages. The gene had conserved coding region in A and D diploid cotton species, G. herbaceum and G. raimondii. However, there existed a large DNA fragment insertion/deletion and base substitutions in their corresponding intron regions. Southern blotting analysis showed that there were 2 copies of GhTF1 in the genome of upland cotton, deducing with each copy in the sub-genome At and sub-genome Dt. GhTF1 was located on chromosome 10 by the BC1 mapping population derived from the hybridization between an upland cotton standard line TM-1 (recurrent parent) and G. barbadense cultivar Hai 7124.

Keywords: Gossypium spp.; MYB gene; cloning; expression; gene tagging

Jing DONG, Meng-Hui YIN, Fan YANG, Juan ZHAO, Shan QIN, Lei HOU, Ming LUO, Yan PEI, Yue-Hua XIAO, Cloning and Expression Profile of Gibberellin Insensitive Dwarf GID1 Homologous Genes from Cotton,

Acta Agronomica Sinica, Volume 35, Issue 10, October 2009, Pages 1822-1830, ISSN 1875-2780, DOI: 10.1016/S1875-2780(08)60110-8.
(http://www.sciencedirect.com/science/article/B94TW-5004N46-5/2/cf69298cdeb41ee2ff1231f9d72ff6a4)

Abstract:

To advance the understanding of gibberellins (GA) functions in cotton (Gossypium hisutum L.) development, especially fiber development, 6 cotton GID1 homologous genes, GhGID1-1 to GhGID1-6 (GenBank accession numbers FJ790125 to FJ790130), were cloned by searching expressed sequence tag (EST) sequences, extending the flanking sequences by Y-shaped adaptor dependent extension (YADE) method, and amplifying the full-length cDNA by 3' rapid amplification of cDNA ends (RACE). Multiple sequence alignment indicated that the deduced GhGID1-1 to GhGID1-6 proteins shared high sequence identity with GID1s from other species and contained multiple binding sites with GA and DELLA protein, as well as HGG and GXSXG domains conserved in hormone-sensitive lipase (HSL) family. Three amino acid residuals (G169, G196, and R251) related to rice (Oryza sativa L.) GID1 were also conserved in cotton GID1s. In the phylogenetic tree of GhGID1s and GID1 proteins with known functions, GhGID1-1 to GhGID1-6 were clustered together with 3 Arabidopsis GID1 proteins, and distantly related to GID1s from rice and Selaginella moellendorffii. According to the results by quantitative reverse transcription polymerase chain reaction (RT-PCR), the transcripts of GhGID1-1 to GhGID1-6 were detected in roots, hypocotyls, leaves, petals, anthers, ovules, and fibers. GhGID1-1 and GhGID1-2 were expressed mainly in floral organs, and GhGID1-4 was expressed preferentially in fiber and root. Exogenous GA in medium resulted in alteration of gene expression level in the ovules cultivated in vitro, and the expression of GhGID1-1 and GhGID1-2 was obviously inhibited by GA. These results suggested that the 6 GhGID1 homologous genes might encode biologically functional GID1 homologues involved in GA signaling in cotton. GhGID1-1 was predominantly expressed in ovules; its expression level reached the climax at 10 d post anthesis (DPA) and maintained the high level at 14 DPA and 18 DPA. In fibers, GhGID1-4 was the main GID1 homologue expressed, and its highest-level expression occurred at 6 DPA and declined to a very low level at 14 DPA and 18 DPA. This result strongly suggested that these are relatively independent GA signaling systems in ovules and attached fibers.

Keywords: GID1; cotton; fiber development; expression specificity

Gen-hai HU, Shu-xun YU, Shu-li FAN, Mei-zhen SONG, Cloning and Expressing of a Gene Encoding Cytosolic CopperEinc Superoxide Dismutase in the Upland Cotton, ***Agricultural Sciences in China***, Volume 6, Issue 5, May 2007, Pages 536-544, ISSN 1671-2927, DOI: 10.1016/S1671-2927(07)60080-7.
(http://www.sciencedirect.com/science/article/B82XG-4NX345H-4/2/81b544ef1e7eac3cb79c9a530f2f9170)

Abstract:

In this study, a gene encoding a superoxide dismutase (SOD) was cloned from senescent leaves of cotton (Gossypium hirsutum), and its expressing profile was analyzed. The gene was cloned by rapid amplification of cDNA ends (RACE) method. Northern blotting was used to show the profile of the gene expression, and the enzyme activity was mensurated by NBT deoxidization method in different growth periods. The full length of a gene of cytosolic copper/zinc superoxide dismutase (CulZn-SOD) was isolated from cotton (GenBank Accession Number: DQ445093). The sequence of cDNA

contained 682 bp, the opening reading frame 456 bp, and encoded polypeptide 152 amino acids with the predicted molecular mass of 15.03 kD and theoretical PI of 6.09. The amino acid sequence was similar with the other plants from 82 to 87%. Southern blotting showed that the gene had different number of copies in different cotton species. Northern blotting suggested that the gene had different expression in different tissues and development stages. The enzyme activity was the highest in peak flowering stage. The cotton cytosolic (CuIZn-SOD) had lower copies in the upland cotton. The copper/zinc superoxide dismutase mRNA expressing level showed regular changing in the whole development stages; it was lower in the former stages, higher in latter stages and the highest at the peak flowering stage. The curve of the copper/zinc superoxide dismutase mRNA expressing level was consistent with that of the Cu/Zn-SOD enzyme activity. The copperlzinc superoxide dismutase mRNA expressing levels of different organs showed that the gene was higher in the root, leaf, and lower in the flower.

Keywords: cotton; copperlzinc superoxide dismutase; gene; cloning

Long-Guo Jin, Jin-Yuan Liu, Molecular cloning, expression profile and promoter analysis of a novel ethylene responsive transcription factor gene GhERF4 from cotton (Gossypium hirstum),
Plant Physiology and Biochemistry, Volume 46, Issue 1, January 2008, Pages 46-53, ISSN 0981-9428, DOI: 10.1016/j.plaphy.2007.10.004.
(http://www.sciencedirect.com/science/article/B6VRD-4PVPVMJ-3/2/55c8112a91f584e94c56a4a386a63991)

Abstract:

Ethylene-responsive element binding factors (ERFs) are plant-specific transcription factors, many of which have been linked to stress responses. A novel ERF gene, designated GhERF4, was isolated by RACE-PCR from Gossypium hirstum. The GhERF4 cDNA has a total length of 1061 bp with an open reading frame of 669 bp, encoding a protein of 222 amino acids with a molecular weight of 23.5 kDa and a calculated pI of 9.03. Sequence alignment shows that GhERF4 contains a 58 amino acid long AP2/ERF domain and a RKRP nuclear localization signal, and belongs to a group II protein in the ERF subfamily as typified by the C-terminal ERF-associated Amphiphilic Repression (EAR) motif. Southern blot analysis indicates that GhERF4 is a single copy gene in cotton genome. Using green fluorescent protein fusion, we demonstrate that GhERF4 accumulates specifically in the nucleus of onion epidermis cells. Semi-quantitative RT-PCR reveals that GhERF4 is constitutively expressed in true leaves, roots, seeds and stems. The transcripts of GhERF4 accumulate highly and rapidly when plants are treated with exogenous ethylene, salt, cold, drought stresses and exogenous abscisic acid (ABA) treatment, suggesting that GhERF4 is regulated by certain components of the stress signaling pathway. Promoter analysis indicates that the 5' upstream region of GhERF4 possesses some elements induced by physiological and environmental factors. These results indicate that GhERF4 may play an important role in response to ethylene, ABA and environmental stresses.

Keywords: Abiotic stress; Cotton; EAR motif; Ethylene responsive element binding factor; Nuclear localization; Promoter analysis

SEED PRODUCTION AND PROCESSING (2 jdl)

Yuksel Bolek, Mustafa Oglakci, Kamil Ozdin, Genetic variation among cotton (G. hirsutum L.) cultivars for motes, seed-coat fragments and loading force,
Field Crops Research, Volume 101, Issue 2, 5 March 2007, Pages 155-159, ISSN 0378-4290, DOI: 10.1016/j.fcr.2006.11.001.
(http://www.sciencedirect.com/science/article/B6T6M-4MG6P80-2/2/126752e6f03bb9e9db8903a323993bec)

Abstract:

Seed quality is one of the important objectives in cotton production and breeding. Seed-coat fragments (SCFs) and motes are the main impurities in lint cotton and are major concerns in the textile industry. A 2-year study was conducted to compare 10 cotton (Gossypium hirsutum L.) cultivars for the number of SCFs, motes, and resistance to loading force (RL).

Although cultivars were not significantly different for the number of SCFs in both years, mean values changed among cultivars and between years. Heritability for the number of SCFs was 0.52 indicating almost equal genotypic and environmental effects on phenotype. There was no correlation between the number of SCFs and RL. Cultivars were different for number of motes. Genotypic and environmental effects on the number of motes were 0.71 and 0.29, respectively. No significant correlation was detected between number of SCFs and RL.

Keywords: Cotton; Mote; Resistance; Seed coat; Seed quality

Jing WANG, Peng JIANG, Dong LI, Qiang MA, Shu-Jin TAI, Zhen-Peng ZUO, Qing-Quan SUN, Lu-Hao DONG, Moisture Variation and Modeling of Cotton and Soybean Seeds under Different Storage Conditions,
Acta Agronomica Sinica, Volume 36, Issue 7, July 2010, Pages 1161-1168, ISSN 1875-2780, DOI: 10.1016/S1875-2780(09)60061-4.
(http://www.sciencedirect.com/science/article/B94TW-51VB3CD-3/2/6a68095c43aa1ee96c80d87b7309061c)

Abstract:

Seed equilibrium moisture is an important indicator to evaluate dynamic change of seed moisture absorption or desorption. In this study, soybean (Glycine max cv. Liaodou 11 and Hedou 13) and cotton (Gossypium hirsutum cv. Fengkangmian 6) seeds with high (12%), medium (8%), and low (4%) initial moisture contents (IMCs) were stored in different levels of storage temperature and relative humidity (RH) to construct models for predicting equilibrium time during storage. Seeds with the 3 IMCs presented desorption under RH = 18.78% except for Liaodou 11 seeds with low IMC under RH 18.78% at 40(C, Fengkangmian 6 with low IMC under RH 18.78% at 15(C and 40(C. All seeds presented desorption under RH 100% regardless of storage temperature. However, under RH 48.10%, moisture desorption or absorption was associated with species/cultivar, IMC, and temperature. Generally, absorption was shifted to desorption with the increase of IMC. In cotton, the equilibrium moisture content (EMC) of seed was increased with the increase of RH under the same storage temperature; whereas it was reduced with the increase of storage temperature under

the same IMC. For soybean seed, there was also a positive correlation between EMC and RH under the same temperature, but the EMC was the highest at 25[degree sign]C and the lowest at 40[degree sign]C under the same seed IMC except for Liaodou 11 with seed IMC of 8%. In cotton, the safe water contents (SWCs) of seed were 10.5% at 15[degree sign]C, 9.5% at 25[degree sign]C, and 6.5% at 40[degree sign]C. In soybean, the SWCs of seed were 12% at 15[degree sign]C, 11% at 25[degree sign]C, and 8% at 40[degree sign]C. Under some temperature and RH combinations, the seed EMC exceeded its SWC. For instance, RH > 55% at 15[degree sign]C and 25[degree sign]C and RH > 60% at 40[degree sign]C for cotton seeds and RH > 55% at 25[degree sign]C and RH > 60% at 25[degree sign]C for soybean seeds. The equilibrium time of seeds was stimulated with the following equations: d = 36.97 + 1.78x - 0.58y - 0.58z - 0.016xy - 0.021xz - 0.0012yz + 0.007y2 for Fengkangmian 6; d = 23.29 + 3.72x - 0.19y - 0.86z - 0.02xy - 0.09xz - 0.008yz + 0.005y2 + 0.03z2 for Liaodou 11; and d = 48.64 + 0.36x - 0.44y - 1.49z - 0.008yz + 0.006y2 + 0.026z2 for Hedou 13. Where d is equilibrium time, x is IMC, y is RH, z is storage temperature. These models were verified using another set of data obtained from the same cultivars with seed IMCs of 5%, 10% and 16% under RH of 12.5%, 25.0%, 75.0%, 85.0% and 100.0% and storage temperatures of 15, 25 and 40[degree sign]C. F-test showed that there were no significant differences between the predicted values and the observed values, indicating the effectiveness of and fitness of the models.

Keywords: seed storage; moisture absorption and desorption; equilibrium moisture; initial moisture content

FERTILIZER (3 jdl)

J. Colby Torbett, Roland K. Roberts, James A. Larson, Burton C. English, Perceived improvements in nitrogen fertilizer efficiency from cotton precision farming,
Computers and Electronics in Agriculture, Volume 64, Issue 2, December 2008, Pages 140-148, ISSN 0168-1699, DOI: 10.1016/j.compag.2008.04.003.
(http://www.sciencedirect.com/science/article/B6T5M-4SPSH9N-2/2/ee26d29d0c16714fd4690433f0d1f0f2)

Abstract:

Site-specific information technologies help cotton farmers make decisions to improve nitrogen (N) fertilizer efficiency. Various information technologies, as well as farm and farmer characteristics, could affect fertilizer decisions differently. Knowing these differences could assist the targeting of specific groups of farmers for the adoption of various site-specific information technologies to improve N fertilizer efficiency and reduce negative environmental impacts. Ordered logit analysis was used to identify the information technologies and farm and farmer characteristics that influence the importance farmers place on precision farming (PF) technologies in improving the efficiency of N fertilization of cotton (Gossypium hirsutum L.). Data were obtained from a 2001 mail survey of cotton farmers in six southeastern states in the United States of America. Results indicated that yield monitoring, management zone and grid soil sampling, and on-the-go sensing increased farmers' perceptions of the

importance of PF in improving N fertilizer efficiency. Farmers who used geospatial mapping were more likely than other farmers to find PF unimportant. Older cotton farmers who rented a larger portion of the land they farmed were more likely to place greater importance on PF for improving N efficiency.

Keywords: Site-specific information technologies; Precision farming; Nitrogen; Cotton; Efficiency; Order logit

Hezhong Dong, Xiangqiang Kong, Weijiang Li, Wei Tang, Dongmei Zhang, Effects of plant density and nitrogen and potassium fertilization on cotton yield and uptake of major nutrients in two fields with varying fertility,
Field Crops Research, Volume 119, Issue 1, 9 October 2010, Pages 106-113, ISSN 0378-4290, DOI: 10.1016/j.fcr.2010.06.019.
(http://www.sciencedirect.com/science/article/B6T6M-50M96PJ-1/2/7b71cd81326dbd43bd065350e718dc56)

Abstract:

As the most important cultural practices for cotton production, the single effects of plant density and [nitrogen (N) and potassium (K)] fertilization on yield and yield components are well documented but their combined effects on Bt cotton are poorly understood. Using a split-split plot design with four replications, we conducted a two-year field experiment in two fields, one with lower fertility and the other with higher fertility, in the Yellow River Valley of China. The aim was to evaluate both the individual and combined effects of plant density and nitrogen and potassium fertilization on yield, yield components and uptake of major nutrients. The main plots were assigned to plant density (4.5 and 7.5 plants/m2), while nitrogen (0 and 240 kg N/ha) and potassium fertilization (0 and 150 kg K/ha) were assigned to the sub- and sub-subplots. Lint yield was improved with high plant density (7.5 plants/m2) in the lower fertility field, particularly without N and K application, but not in the higher fertility field. Nitrogen or K application also increased lint yield, and a combination of high plant density, N and K application further improved lint yield in the lower fertility field, while only K application increased lint yield in the higher fertility field. Lint percentage was not affected by any of the variables studied. Thus, the yield increase due to plant density, fertilization or their combinations was attributed to increases in boll number or boll weight. The ratio of seed cotton to stalk (RSS) was linearly correlated with harvest index, and thus can be a simple indicator of dry matter allocation to reproductive structures. Increased yield due to plant density and fertilization was mainly attributed to the enhanced biological yield in the lower fertility field, while the yield increase due to K fertilization was mainly due to increased RSS in the higher fertility field. The plants used approximately equal N and P to produce 100 kg lint in both fields, but the uptake of K to produce 100 kg lint in the higher fertility field was about 21% more than that in the lower fertility field. Ratios of N:P:K were 1:0.159:0.604 in the lower fertility field and 1:0.159:0.734 in higher fertility field. This study suggests that K fertilization was extremely important for maintaining high yield, although luxury consumption occurred in the higher fertility field; N was applied more than required in the highly fertile field, and increased plant density would be beneficial to cotton yield in the lower fertility field.

Keywords: Cotton; Plant density; Nitrogen fertilizer; Potassium fertilizer; Yield; Nutrient uptake; Nutrient use efficiency

H. Tewolde, M.W. Shankle, A. Adeli, K.R. Sistani, D.E. Rowe, Macronutrient concentration in plant parts of cotton fertilized with broiler litter in a marginal upland soil, ***Soil and Tillage Research***, Volume 105, Issue 1, September 2009, Pages 1-11, ISSN 0167-1987, DOI: 10.1016/j.still.2009.04.007.
(http://www.sciencedirect.com/science/article/B6TC6-4WJ919J-1/2/be4195b68a43209579fcac32974647f4)

Abstract:

Effectiveness of surface-applied unincorporated broiler litter as a fertilizer relative to conventional inorganic fertilizers under no-till or conventional-till cotton (Gossypium hirsutum L.) production systems in the upland soils of the southern and southeastern USA is not well documented. The objectives of this research were to (1) test if broiler litter improves plant macronutrient (N, P, K, and Mg) nutrition of cotton above that of cotton fertilized with conventional inorganic fertilizers and (2) determine if lack of incorporating litter into the soil reduces macronutrient concentration in cotton plant parts in an upland soil considered marginal for cotton. Six treatments consisting of an unfertilized control, a fertilized standard (STD), two litter-only, and two litter plus inorganic N as urea-ammonium nitrate solution (UAN) were tested in two adjacent fields, one under no-till (NT) and the other under conventional-till (CT) systems. Litter alone, UAN, or a combination of litter plus UAN were applied to supply 101 kg ha-1 plant available N assuming nearly all of the UAN-N and 50% of the total litter N becomes plant available during the cotton growing season. Concentration of N, P, K, and Mg were measured in leaves, stems, and reproductive parts on three or four dates between early flowering and maturity. Cotton fertilized with the litter-only treatments always had less N concentration but greater P and K concentration in leaves, stems, and reproductive parts than cotton that received the STD treatment. Leaf and stem Mg concentration seems to depend on the N concentration in these plant parts. Lack of incorporating litter into the soil reduced N concentration in nearly all plant parts at all growth stages, suggesting some amount of the litter-derived N is lost due to lack of incorporation. Lack of incorporation also reduced leaf and stem Mg concentration, which seemed to be due to its reducing effect on N concentration. Unlike N and Mg, lack of incorporation did not consistently affect concentrations of P and K in all plant parts. Regardless of the incorporation treatment, fertilization with the litter-only treatments increased tissue P and K concentration and supported lint yield exceeding that of the STD without increasing tissue N concentration.

Keywords: Poultry litter; Manure; Incorporation; Tillage; Tissue nutrients

IRRIGATION (11 jdl)

S.J. Yeates, G.A. Constable, T. McCumstie, Irrigated cotton in the tropical dry season. III: Impact of temperature, cultivar and sowing date on fibre quality,
Field Crops Research, Volume 116, Issue 3, 3 April 2010, Pages 300-307, ISSN 0378-4290, DOI: 10.1016/j.fcr.2010.01.006.
(http://www.sciencedirect.com/science/article/B6T6M-4YDYW8P-2/2/568a03478c3fe2bc9860ababecdbced5)

Abstract:

Depending on sowing month, temperatures during boll growth in the tropical dry season are potentially sub- or supra optimal for the fibre quality parameters length and strength. The aims of this research were to: (1) measure the effect of sowing date on the quality of fibre from cotton grown during the dry season as this was not known; (2) use the range in temperature created by varying sowing date in the dry season, to derive relationships with gin turnout, the fibre quality parameters length, strength and micronaire. Over three seasons, two Gossypium hirsutum (upland) cultivars and one Gossypium barbadense cultivar were sown from March to June at the Ord River (15.5[degree sign]S), Western Australia. For the highest yielding sowing months of March and April, fibre length and strength were at or below market preference due to relatively low temperatures and solar radiation during early fibre development. Fibre micronaire achieved market preference at all sowing months due to favourable late season temperatures and radiation. It is likely that current G. barbadense cultivars will have short fibre when grown in the dry season. For fibre length and gin turnout quadratic responses ($p < 0.05$) to weighted minimum temperature were fitted for each cultivar, where the optimum minimum temperature was 18-20 and 16-17 [degree sign]C, respectively. The cultivar differences in fibre properties observed here suggest that wider screening may identify G. hirsutum cultivars with suitable fibre length and strength in the dry season. It was demonstrated by weighting of temperatures for the contribution of the cohort of bolls pollinated each day; the variation in crop fibre quality and gin turnout in the field due to temperature can be predicted.

Keywords: Cotton; Fibre length; Fibre strength; Micronaire; Temperature; Semi-arid tropics; Gossypium barbadense

Xiao-tang HU, Hu CHEN, Jing WANG, Xiao-bin MENG, Fu-hong CHEN, Effects of Soil Water Content on Cotton Root Growth and Distribution Under Mulched Drip Irrigation, ***Agricultural Sciences in China,*** Volume 8, Issue 6, June 2009, Pages 709-716, ISSN 1671-2927, DOI: 10.1016/S1671-2927(08)60269-2.
(http://www.sciencedirect.com/science/article/B82XG-4WKTN1K-D/2/07f77d2e21cbfa405d4134f92818ddc1)

Abstract:

The relation between soil water content and the growth of cotton root was studied for the scheme of field water and cotton yield under mulched drip irrigation. Based on the field experiments, three treatments of soil water content were conducted with 90%[theta]f, 75%[theta]f, and 60%[theta]f ([theta]f is field water capacity). Cotton roots and root-shoot ratio were studied with digging method, and the soil moisture was observed with TDR (time domain reflector), and cotton yield was measured. The results indicated that the growth of cotton root accorded with Logistic growth curve in the three treatments, the cotton root grew quickly and its weight was very high under 75%[theta]f because of the suitable soil water condition, while grew slowly and its weight was lower under 90%[theta]f due to water moisture beyond the suitable condition, and the root weight was in between under 60%[theta]f. For the three water treatments, the cotton root weight decreased with soil depth, and decreased more significantly in deeper soil layer with the soil moisture increasing. And the ratio of cotton root weight in 0-30 cm soil

layer to the total root weight was the highest under 75%[theta]f. The cotton root system was distributed mainly in the soil of narrow row and wide row mulched with plastic film, and little in the soil outside plastic film. The weight of cotton root was the highest in the soil of narrow row or wide row mulched with plastic film under 75%[theta]f. Root-shoot ratio decreased with the soil moisture increasing. The soil water content affected cotton yields, and cotton yield was the highest under 75%[theta]f. The higher soil moisture level is unfavorable to the growth of cotton root system and yield of cotton under mulched drip irrigation.

Keywords: mulched drip irrigation; cotton (Gossypium hirsutum L.); soil water content; root

Clemens Scheer, Reiner Wassmann, Kirsten Kienzler, Nazar Ibragimov, Ruzimboy Eschanov, Nitrous oxide emissions from fertilized, irrigated cotton (Gossypium hirsutum L.) in the Aral Sea Basin, Uzbekistan: Influence of nitrogen applications and irrigation practices,

Soil Biology and Biochemistry, Volume 40, Issue 2, February 2008, Pages 290-301, ISSN 0038-0717, DOI: 10.1016/j.soilbio.2007.08.007.
(http://www.sciencedirect.com/science/article/B6TC7-4PP1XCP-1/2/13293811136b962e674cd4e2beb32f9a)

Abstract:

Nitrous oxide emissions were monitored at three sites over a 2-year period in irrigated cotton fields in Khorezm, Uzbekistan, a region located in the arid deserts of the Aral Sea Basin. The fields were managed using different fertilizer management strategies and irrigation water regimes. N2O emissions varied widely between years, within 1 year throughout the vegetation season, and between the sites. The amount of irrigation water applied, the amount and type of N fertilizer used, and topsoil temperature had the greatest effect on these emissions.

Very high N2O emissions of up to 3000 [mu]g N2O-N m-2 h-1 were measured in periods following N-fertilizer application in combination with irrigation events. These 'emission pulses' accounted for 80-95% of the total N2O emissions between April and September and varied from 0.9 to 6.5 kg N2O-N ha-1.. Emission factors (EF), uncorrected for background emission, ranged from 0.4% to 2.6% of total N applied, corresponding to an average EF of 1.48% of applied N fertilizer lost as N2O-N. This is in line with the default global average value of 1.25% of applied N used in calculations of N2O emissions by the Intergovernmental Panel on Climate Change.During the emission pulses, which were triggered by high soil moisture and high availability of mineral N, a clear diurnal pattern of N2O emissions was observed, driven by daily changes in topsoil temperature. For these periods, air sampling from 8:00 to 10:00 and from 18:00 to 20:00 was found to best represent the mean daily N2O flux rates. The wet topsoil conditions caused by irrigation favored the production of N2O from NO3- fertilizers, but not from NH4+ fertilizers, thus indicating that denitrification was the main process causing N2O emissions. It is therefore argued that there is scope for reducing N2O emission from irrigated cotton production; i.e. through the exclusive use of NH4+ fertilizers. Advanced application and irrigation techniques such as subsurface fertilizer application, drip

irrigation and fertigation may also minimize N2O emission from this regionally dominant agro-ecosystem.

Keywords: Denitrification; Irrigation; Nitrogen; Soil moisture; Arid climate; Greenhouse gases; Climate change; Emission pulse

N.R. Hulugalle, B.E. McCorkell, T.B. Weaver, L.A. Finlay, J. Gleeson, Soil properties in furrows of an irrigated Vertisol sown with continuous cotton (Gossypium hirsutum L.), ***Soil and Tillage Research***, Volume 97, Issue 2, December 2007, Pages 162-171, ISSN 0167-1987, DOI: 10.1016/j.still.2007.09.012.
(http://www.sciencedirect.com/science/article/B6TC6-4R5G7X8-2/2/b9691c7998a93ff525dfa46fcbacc54e)

Abstract:

Average in-field water application efficiency in furrow-irrigated cotton (Gossypium hirsutum L.) in Australia is less than optimal, and The underlying reasons may include surface sealing, exposure of sodic soil by laser levelling, and soil compaction due to wheel-trafficking. The objective of this study was to quantify the effects of reducing traffic and tillage intensity on furrow soil properties in an irrigated Vertisol. Soil was sampled during the growing seasons of 2001-02, 2003-04 and 2005-06 from the surface 50-mm of adjacent wheel-tracked and non-wheel-tracked furrows in an experiment in north-western New South Wales, Australia. The treatments were: cotton sown either after conventional tillage (disc-ploughing and incorporating cotton stalks to 0.2 m, chisel ploughing to 0.3 m followed by bed construction) or on 'permanent beds' (slashing cotton plants after harvest, followed by root cutting and bed renovation with a disc-hiller). Irrigation water was alkaline but had low salinity and sodium adsorption ratio. Soil properties measured were pH, EC1:5, geometric mean diameter (GMD) and specific volume (SV) of dry soil aggregates, exchangeable cations and plastic limit. Permanent bed systems had generally lower pH and higher SOC than conventionally tilled furrows, although differences were small. Soil pH and SOC averaged over the three growing seasons was 6.9 and 0.89 g/100 g, respectively, in permanent bed furrows, and 7.1 and 0.84 g/100 g, respectively, in conventionally tilled furrows. Compared to non-wheel-tracked furrows, plastic limit was lower (0.24 vs. 0.25 g/g), and EC1:5 (0.24 vs. 0.20 dS/m) and GMD (2.6 vs. 2.1 mm) higher in wheel-tracked furrows. Intra-seasonal changes in soil properties of furrows were also small, and are unlikely to significantly affect any hydrological processes. Inter-seasonal differences were, however, significant, and could affect hydrological processes in this soil.

Keywords: Cracking clay; Haplustert; Permanent beds; Trafficking; Tillage system; Vertisol

S.J. Yeates, G.A. Constable, T. McCumstie, Irrigated cotton in the tropical dry season. II: Biomass accumulation, partitioning and RUE,
Field Crops Research, Volume 116, Issue 3, 3 April 2010, Pages 290-299, ISSN 0378-4290, DOI: 10.1016/j.fcr.2010.01.007.
(http://www.sciencedirect.com/science/article/B6T6M-4YDYW8P-1/2/fdffd530bc60a3ccc7b28451cb941fe3)
Abstract:

Growing cotton during the tropical dry season avoids many insect pests endemic in the wet season. The impact of low mid-season radiation and night temperature that characterise the dry season, on the conversion of radiation to biomass (RUE) and the partitioning of this biomass were measured as these were largely unknown. Over three seasons, two Gossypium hirsutum (upland) cultivars and a Gossypium barbadense cultivar were sown from March to June at the Ord River (15.5[degree sign]S), Western Australia. For the highest yielding March and April sowings, final biomass was similar to high yielding temperate grown cotton (~30[degree sign] latitude) and was generally greater than May or June sowings. However, biomass was accumulated differently: maximum growth rate was 6-12 g/m2/day for 78-134 days compared with 15-25 g/m2/day for 25-60 days reported for temperate grown cotton. RUE changed significantly with ontogeny, peaking between squaring and early flowering. The range in RUE of 1.2-2.0 g/MJ throughout the crop lifecycle for the upland cultivars was similar to temperate climates where biomass was corrected to a glucose equivalent. The RUE of 1.2-2.3 g/MJ measured over the lifecycle of G. barbadense cultivar was the first reported for this species. From first square to first flower the variation in RUE could be explained by a linear decline ($p < 0.05$) with temperature, which may limit vegetative biomass in May and June sowings and in cooler than average seasons for March and April sowings. Due to favourable temperatures and water supply, sowing in March would have the greatest risk of rank growth. It was concluded the low temperature and radiation during flowering and boll growth combined to reduce crop growth rate but high yields were achieved when the crop boll filling phase was extended. Management must be tailored to ensure a high proportion of boll growth (60-80%) can occur after vegetative growth has terminated.
Keywords: Cotton; Semi-arid tropics; Gossypium barbadense; Dry season; Radiation use efficiency; RUE; Biomass partitioning; Growth rate; Light interception; Night chilling

S.J. Yeates, G.A. Constable, T. McCumstie, Irrigated cotton in the tropical dry season. I: Yield, its components and crop development,
Field Crops Research, Volume 116, Issue 3, 3 April 2010, Pages 278-289, ISSN 0378-4290, DOI: 10.1016/j.fcr.2010.01.005.
(http://www.sciencedirect.com/science/article/B6T6M-4YC39PX-1/2/b8694285ff1f43988da7a7a1ef02bc45)
Abstract:

Growing cotton during the dry (winter) season avoids many insect pests endemic in the wet season (summer) and could permit the reintroduction of cotton to the semi-arid tropics in Australia. This research addressed the questions: (1) what yield is

possible given the lower mid-season radiation and temperature of the dry season, (2) the prediction and management of crop development using a range of sowing months to assess whether cotton can be grown and picked within the dry season. Over three seasons two Gossypium hirsutum L. (upland) cultivars and one Gossypium barbadense L. cultivar were sown from March, to June at the Ord River (15.5[degree sign]S) in Western Australia. For the upland cultivars, lint yields of 1900-2300 kg/ha for March and April sowings were at the high end of Australian and International benchmarks. High lint yields were linearly correlated with a greater proportion of bolls that were located on outer sites on fruiting branches than for high yielding crops in temperate climates (~30[degree sign]lat.). The change in boll position increased the length of the growing season which was also linearly correlated with yield. Future research needs to confirm if low minimum temperatures early in flowering caused the change in boll position and to measure the impact of extreme temperature seasons on yield and time to maturity. The lint yield of the G. barbadense cultivar was highest at a March sowing, at least 87% of the upland cultivars, which is comparable with temperate climates. The frequency of temperatures >35 [degree sign]C and <11 [degree sign]C affected time to squaring, requiring modification of existing development models derived in temperate climates. It was concluded sowing during March to April should achieve the dual objectives of high yields and avoidance of rain at maturity. The wide temperature range observed in these experiments improved the prediction of boll period from mean temperature; this function should be applicable outside the semi-arid tropics.

Keywords: Cotton; Semi-arid tropics; Gossypium barbadense; Dry season; Plant mapping; Crop development; Boll period; Degree days

J.T. Tsialtas, I.S. Tokatlidis, C. Tsikrikoni, A.S. Lithourgidis, Leaf carbon isotope discrimination, ash content and K relationships with seedcotton yield and lint quality in lines of Gossypium hirsutum L.,

Field Crops Research, Volume 107, Issue 1, 11 April 2008, Pages 70-77, ISSN 0378-4290, DOI: 10.1016/j.fcr.2007.12.017.
(http://www.sciencedirect.com/science/article/B6T6M-4RWBCWJ-1/2/aa56daf2a50a5e64716f032313e476a0)

Abstract:

In a two-year (2005-2006) study conducted at three sites in central (Larissa) and northern (Alexandroupolis, Thessaloniki) Greece, we aimed to investigate the relationships between seedcotton yield and lint quality with leaf physiological traits (carbon isotope discrimination-[Delta], ash content and K concentration). Eighteen lines with their original cultivars (Christina, Flora, Corona) were tested under the ultra-low density of 1.2 plants m-2. In combined data over years, a significant, positive correlation between seedcotton yield and [Delta] or ash content was found only in the driest and lowest-yielding site (Larissa), indicating that genotypes that keep their stomata open and in turn exhibit the highest [Delta] values, had an advantage in such environments. In pooled data from the two most productive sites (Thessaloniki and Alexandroupolis), which had the highest [Delta] and ash content values, evidenced a negative correlation between seedcotton yield and both physiological traits. Seedcotton yield was negatively

related with leaf K concentration in Larissa and Alexandroupolis but no significant relationship was found in Thessaloniki where leaf K concentration was below adequacy limit. [Delta] was positively related with ash content which suggests that the latter could be a putative surrogate of [Delta]. Negative correlation between [Delta] and leaf K concentration was found in two out of three sites (Larissa and Thessaloniki) as well as between ash content and K in one site (Larissa). These findings suggest that K accumulation in leaves is not just a passive procedure via transpiration stream. Significant, linear relationships of each physiological trait between sites showed that genotypic ranking was constant in the three sites, an indication of heritability. Ash content had the highest significance levels and correlation coefficients. Even though significant genotypic differentiation was observed for the three physiological and two of the lint quality traits (i.e. fibre length, micronaire) determined in Alexandroupolis, only a weak, negative relationship between fibre length and leaf K concentration was evident. In sum, leaf physiological traits ([Delta], ash content and K concentration) could not be reliably used for yield selection in cotton owing to site-specific effects, which prejudice the yield-physiological traits relationship. Ash content-[Delta] relationship merits further research in order the former to be established as a putative surrogate of [Delta].

Keywords: [Delta]; Drought; Semi-arid regions; Surrogates; Water use efficiency

Ji-yang ZHANG, Ai-wang DUAN, Zhao-jiang MENG, Zu-gui LIU, Suitability of Stem Diameter Variations as an Indicator of Water Stress of Cotton,
Agricultural Sciences in China, Volume 5, Issue 5, May 2006, Pages 356-362, ISSN 1671-2927, DOI: 10.1016/S1671-2927(06)60061-8.
(http://www.sciencedirect.com/science/article/B82XG-4K30SB2-5/2/81acce12cd1b83f890cf2529039d7147)

Abstract:

Water stress effects on stem diameter variations (SDV) were studied in a pot experiment on cotton (Gossypium hirustum L. Meimian99B). Water restriction was imposed at the flowering stage and were compared with a well-watered control treatment. The volumetric soil water content ([theta]v) and SDV were monitored continuously. The objective was to determine the feasibility of using the parameters derived from stem diameter measurements, including maximum daily stem shrinkage (MDS), maximum daily stem diameter (MXSD), and minimum daily stem diameter (MNSD) as indicators of plant water stress. The different behavior of SDV was founded at different growth stages. At stem-maturing stage, MDS increased and MNSD decreased in deficit-irrigated plants compared with the control plants, therefore, it appeared that MDS and MNSD ccould be used as available indicators of plant water status. At stem growth stage, there were no significant differences in MDS values between treatments but MXSD and MNSD responded sharply to soil water deficits. Thus, for rapidly growing cotton, the course of MXSD or MNSD with time offered a consistent stress indicator. SDV was also closely related to atmospheric factors, solar radiation (Rs) and vapor pressure deficit (VPD) were found to be the predominant factors affecting MDS, followed by the relative humidity (RH), while air temperature (Ta) and wind velocity had the least effect. A good linear relationship was founded (r2 = 0.921) between MDS and environmental variables (Rs, VPD, RH, and [theta]v), which

can be used to establish a reference value for detecting plant water stress based on the MDS patterns.

Keywords: stem diameter variations; water stress; atmospheric factors; cotton

Shahenshah, Yasuda Yoshizumi, Mao-song LI, Isoda Akihiro, Assessment of Photochemical Reflectance Index as a Tool for Evaluation of Chlorophyll Fluorescence Parameters in Cotton and Peanut Cultivars Under Water Stress Condition,
Agricultural Sciences in China, Volume 9, Issue 5, May 2010, Pages 662-670, ISSN 1671-2927, DOI: 10.1016/S1671-2927(09)60141-3.
(http://www.sciencedirect.com/science/article/B82XG-504F545-8/2/2652ebc47dc781ecbe6ff335cc5134fc)

Abstract:

The relationships between photochemical reflectance index (PRI) and the chlorophyll fluorescence parameters were examined to assess suitability of PRI as a remote-sensing tool for the chlorophyll fluorescence parameters. A greenhouse experiment was conducted using cotton and peanut crops under water stress condition. Five cotton and six peanut cultivars were grown using Andosole soil in pots maintained at two water levels; the control and water stress treatment (WS) of 100 and 50% of the daily transpiration, respectively. Higher non-photochemical quenching (NPQ) was exhibited by peanut than that of cotton by the water stress. On the other hand, the decreases of the actual quantum yield of photosystem II ([Delta]F/F'm) and PRI by the water stress in cotton were larger than those in peanut. There were positively significant correlation coefficients between PRI and [Delta]F/F'm in cotton at noon and in the afternoon including the control and WS. The correlations of PRI with NPQ were negatively significant at noon and in the afternoon for cotton, and in the afternoon for peanut. No clear relationship was found among these parameters in the morning probably due to the diurnal increase in global solar radiation. It was concluded that there would be a possibility to detect the effects of water stress on [Delta]F/F'm and NPQ by PRI with some exceptions, although PRI could not note varietals differences in [Delta]F/F'm and NPQ for each treatment.

Keywords: actual quantum yield of photosystem II; Arachis hypogaea L.; Gossypium hirsutum L.; non-photochemical quenching; photochemical reflectance index; remote sensing; water stress

Q.D. Richards, M.P. Bange, S.B. Johnston, HydroLOGIC: An irrigation management system for Australian cotton, ***Agricultural Systems***, Volume 98, Issue 1, July 2008, Pages 40-49, ISSN 0308-521X, DOI:
10.1016/j.agsy.2008.03.009(http://www.sciencedirect.com/science/article/B6T3W-4SM20BT-1/2/b299c6d26464b48f6cf4eed18d312d0a)

Abstract:

The worldwide need to improve water use efficiency within irrigated agriculture has been recognised in response to environmental concerns and conflicts in resource use. Within the Australian cotton industry, the imperative to reduce water use and

optimise irrigation management through the understanding of risk, using information generated by computerised decision aids was identified and subsequently developed into the HydroLOGIC irrigation management software. This paper summarises the attributes of the HydroLOGIC irrigation management software, with particular emphasis on functionality and its application to irrigation decisions within the Australian cotton industry. The software development process is documented to provide direction for future software application initiatives, with particular emphasis on a process of user feedback, evaluation and support requirements providing direction to software development. On-farm experiments throughout the development period allowed the validation of internal software logic, irrigator decision processes, and the OZCOT cotton growth model. The software demonstrated the ability to improve yield and water use efficiency by optimising strategic and tactical irrigation decisions in the Australian furrow irrigation cotton production system. In 7 of the 11 on-farm experiments conducted, the use of HydroLOGIC helped improve overall field water use efficiency by optimising the timing of irrigation events or by indicating further irrigations would not provide yield or maturity benefits. The paper also presents useful insights into the development of software targeted for irrigation utilising in-field measurements of soil water, crop growth and a crop growth simulation model.

Keywords: Irrigation management; Cotton; Decision making; Risk; Crop management; Software development; Support

W.J. Busscher, P.J. Bauer, C.R. Camp, Cotton management in a compacted subsurface microirrigated coastal plain soil of the southeastern US,
Soil and Tillage Research, Volume 91, Issues 1-2, December 2006, Pages 157-163, ISSN 0167-1987, DOI: 10.1016/j.still.2005.12.001.
(http://www.sciencedirect.com/science/article/B6TC6-4J43YXR-2/2/3e4769f6b43bab7307c3c4aaf8a25c2b)

Abstract:

A loamy sand Acrisol (Aquic Hapludult) that had been microirrigated for 6 years became so severely compacted that it had root limiting values of soil cone index in the Ap horizon and a genetic hardpan below it. Deep and surface tillage systems were evaluated for their ability to alleviate compaction. Deep tillage included subsoiling or none. Both deep tillage treatments were also surface tilled by disking, chiseling, or not tilling. Subsoiling was located in row or between rows to avoid microirrigation tubes (laterals) that were buried under every other mid row or every row. Cotton (Gossypium hirsutum) was planted in 0.96-m wide rows. Cotton yield was improved by irrigation from 485 to 1022 kg ha-1 because both 2001 and 2002 were dry years. Tillage loosened the soil by an average of 0.5-1.3 MPa; but compacted zones remained outside tilled areas. Subsoiling improved yield by 131 kg ha-1 when performed in row where laterals were placed in the mid rows; but subsoiling did not improve yield when it was performed in mid rows. For subsurface irrigation management in these soils, the treatment with laterals buried under every other mid row was able to accommodate in-row subsoiling

which improved yield; and this treatment was just as productive as and had been shown to be less expensive to install than burying laterals under every row.

Keywords: Microirrigation; Compaction; Deep tillage; Chisel; Hard layer; Disk; Acrisol

SOIL CULTIVATION (24 jdl)

Mehmet Mert, Ece Aslan, Yasar Akiscan, Mehmet Emin Caliskan, Response of cotton (Gossypium hirsutum L.) to different tillage systems and intra-row spacing,

Soil and Tillage Research, Volume 85, Issues 1-2, January 2006, Pages 221-228, ISSN 0167-1987, DOI: 10.1016/j.still.2005.01.016.
(http://www.sciencedirect.com/science/article/B6TC6-4FM0NYM-2/2/f7092cfb981947de0b00e342463e890f)

Abstract:

The earliness is of great importance to cotton production in Mediterranean-type environments due to detrimental effects of autumn rainfall on lint quality. However, farmers commonly avoid early sowing due to risks of cold soil temperature and waterlogging after sowing in spring. Ridge-tillage system is one approach to increase soil temperature and mitigate adverse effects of waterlogging. The ridge-tillage system is also advantageous in reducing inputs in tillage operations. However, a limited experimental data are available about the effects of ridge-tillage system on earliness of harvesting, lint yield and quality of cotton in the Mediterranean-type environments. Thus, the objective of this study was to determine how ridge-tillage (RT)-planting system and intra-row spacing affect cotton lint yield, earliness and fiber quality compared with conventional tillage (CT)-planting system. Field experiments were conducted on a clay soil (Vertisol) in Hatay province (36[degree sign]39'N-36[degree sign]40'E, 83 m a.s.l.) in the Eastern Mediterranean Region of Turkey during 2000 and 2001. The experiment was laid out as a split-plot with three replications with tillage systems as main plots and intra-row spacings (13, 17, 21 and 25 cm) as subplots. The effects of tillage systems on lint yield and earliness were inconsistent among years. The RT-planting system resulted in 13.5% higher lint yield and 14.5% more earliness in 2001 when abundant rainfall occurred after sowing, while significant effects of tillage systems were not observed in 2000. The intra-row spacings significantly affected lint yield and earliness in both years. The earliness increased with closer spacing, while the highest lint yield was obtained from 17 cm intra-row spacing in both years. However, the fiber quality parameters were not significantly affected by tillage systems, intra-row spacings and tillage system x spacing interaction in both years. Finally, the results suggest that RT-planting system with 17 cm intra-row spacing can be used in cotton production instead of CT-planting system in the Eastern Mediterranean Region of Turkey. Ridging in 17 cm intra-row spacing also seems to be suitable to mechanical harvesting.

Keywords: Cotton (Gossypium hirsutum L.); Ridge tillage; Conventional tillage; Intra-row spacing; Lint yield; Earliness; Fiber quality

S.K. Jalota, G.S. Buttar, Anil Sood, G.B.S. Chahal, S.S. Ray, S. Panigrahy, Effects of sowing date, tillage and residue management on productivity of cotton (Gossypium hirsutum L.)-wheat (Triticum aestivum L.) system in northwest India,
Soil and Tillage Research, Volume 99, Issue 1, April 2008, Pages 76-83, ISSN 0167-1987, DOI: 10.1016/j.still.2008.01.005.
(http://www.sciencedirect.com/science/article/B6TC6-4S094V0-1/2/65ff9a0ba7c9332bb37b65042af23cde)

Abstract:

In southwestern region of Punjab in north India, sowing dates of cotton crop in cotton (Gossypium hirsutum L.)-wheat (Triticum aestivum L.) system are staggered from last week of April to mid of May depending upon the surface water supply from canal as ground water is not fit for irrigation. Further, farmers practice intensive cultivation for seedbed preparation and burning of wheat straw before sowing of cotton crop. With the present farmers' practices, yields have become static and system has become non-profitable. Field experiments were conducted on Entisols for two rotations of cotton-wheat system during the years of 2004-2005 and 2005-2006 in split plot design to study the direct and interactive effects of date of sowing and tillage-plus-wheat residue management practices on growth and yield of cotton and wheat and to increase the profitability by reducing the tillage operations, which costs about 50% of the sowing cost. The pooled analysis showed that in cotton crop, there was a significant interaction between year x dates of sowing. Among different tillage-plus-wheat residue management practices yields were 23-39% higher in tillage treatments than minimum-tillage. In wheat, grain yield in tillage treatments were at par. Water productivity amongst the tillage treatments in cotton was 19-27% less in minimum tillage than others tillage treatments. Similar trend was found in wheat crop. Remunerability of the cotton-wheat system was more with a combination of reduced tillage in cotton and minimum tillage in wheat than conventional tillage.

Keywords: Cotton-wheat; Sowing time; Tillage; Crop residue; Entisols; Punjab

K. Ouattara, B. Ouattara, G. Nyberg, M.P. Sedogo, A. Malmer, Ploughing frequency and compost application effects on soil infiltrability in a cotton-maize (Gossypium hirsutum-Zea mays L.) rotation system on a Ferric Luvisol and a Ferric Lixisol in Burkina Faso,
Soil and Tillage Research, Volume 95, Issues 1-2, September 2007, Pages 288-297, ISSN 0167-1987, DOI: 10.1016/j.still.2007.01.008.
(http://www.sciencedirect.com/science/article/B6TC6-4N6Y5DN-1/2/fccd018102c5a98adc70910bdecc1929)

Abstract:

One of the key issues to increase soil productivity in the Sahel is to ensure water infiltration and storage in the soil. We hypothesised that reducing tillage from annual to biennial ploughing and the use of organic matter, like compost, would better sustain soil hydraulic properties. The study had the objective to propose sustainable soil fertility management techniques in the cotton-maize cropping systems. The effects of reduced tillage (RT) and annual ploughing (AP) combined with compost application (Co) on soil infiltration parameters were assessed on two soil types. Topsoil mean saturated hydraulic conductivities (Ks) were between 9 and 48 mm h-1 in the Luvisol, while in the

Lixisol they were between 18 and 275 mm h-1. In the two soil types compost additions with reduced tillage or with annual ploughing had the largest effect on Ks. Soil hydraulic behaviour was in reasonable agreement with soil pore size distribution (mean values varied from 19.5 to 237 [mu]m) modified by tillage frequency and organo-mineral fertilization. Already the first 3 years of this study showed that use of organic matter, improved soil infiltration characteristics when annual ploughing was used. Also biennial ploughing showed promising results and may be a useful strategy for smallholders to manage these soils.

Keywords: Ploughing frequency; Compost; Hydraulic conductivity; Cotton-maize; Burkina Faso

C.O. Gwathmey, J.D. Clement, Alteration of cotton source-sink relations with plant population density and mepiquat chloride,
Field Crops Research, Volume 116, Issues 1-2, 3 March 2010, Pages 101-107, ISSN 0378-4290, DOI: 10.1016/j.fcr.2009.11.019.
(http://www.sciencedirect.com/science/article/B6T6M-4Y0K9PF-3/2/77027b9a46f947c47826eb1bd3949933)

Abstract:

Improvements in carbohydrate source-sink relations are needed to improve efficiency of yield formation in cotton (Gossypium hirsutum L.). Most source-sink research has focused on leaf-boll relationships, with little study of vegetative storage reserves. Possible ways of altering the source-sink balance include increasing the plant population density (PPD) and using a plant growth regulator, mepiquat chloride (MC). We evaluated effects of PPD and MC on plant growth and development, stem starch reserves and lint yield in a 3-year field experiment at Milan, Tennessee. Row spacings of 25, 51, and 102 cm averaged 17.6, 13.2, and 8.3 plants m-2, respectively. Mepiquat chloride rates were 0 and 86 g ha-1. Higher PPD in narrower rows tended to reduce boll number more than leaf area per plant, reducing the number of bolls per unit leaf area. However, boll distribution was more concentrated, implying more synchronous demand for photosynthate in 25-cm rows than in wider rows. Stem starch concentrations during boll filling were similar to, or slightly lower, in 25-cm rows than in wider rows. Findings are consistent with the hypothesis that availability of photosynthate may limit boll load at higher PPD, despite more leaf area per boll. Application of MC tended to reduce leaf area per plant more than boll load, and to increase the number of bolls per unit leaf area. The MC treatment also concentrated the boll set on lower sympodia, increasing the synchrony of boll maturation and demand for photosynthate. Application of MC increased boll set percentage and decreased stem starch reserves slightly. Lint yields were increased by MC application in finger-stripped 25- and 51-cm rows in 2 of 3 years, by an average of 11%, but not in spindle-picked 51- and 102-cm rows. Findings support the hypothesis that MC benefits boll set and yield formation in narrow-row systems by reducing LAI. Source-sink alteration with PPD and MC may be useful in future research to improve carbohydrate use and yield formation in cotton.

Keywords: Gossypium hirsutum; Cotton; Source-sink relations; Plant population density; Mepiquat chloride; Starch reserves

D. Blaise, Effect of tillage systems on weed control, yield and fibre quality of upland (Gossypium hirsutum L.) and Asiatic tree cotton (G. arboreum L.),
Soil and Tillage Research, Volume 91, Issues 1-2, December 2006, Pages 207-216, ISSN 0167-1987, DOI: 10.1016/j.still.2005.12.005.
(http://www.sciencedirect.com/science/article/B6TC6-4J2W081-1/2/d48035ee8604a9bd602e0f809f327c52)

Abstract:

Asiatic diploid (n = 13) cotton (Gossypium arboreum L.) is grown on Vertisols of central India with limited amounts of fertilizers and pesticides under rainfed conditions. In an earlier study it was established that reduced tillage (RT) systems improved productivity of tetraploid (n = 26) upland cotton (G. hirsutum L.). Such information is currently not available for the Asiatic cotton. Field studies were continued from 2002-2003 through 2004-2005, to determine the effect of tillage systems on weed control, yield and fibre quality. Tillage treatments continued for 6 years before this phase of the study. The experiment was conducted in a split plot design, with three tillage systems as main plots and combination of species (G. arboreum and G. hirsutum) and N rates (60 and 75 kg N ha-1) as subplots. Conventional tillage (CT) involved mouldboard ploughing + four to five inter-row cultivations and was compared with two levels of RT. RT1 being pre-emergence herbicide application with two inter-row cultivations by a bullock drawn hoe and RT2 was only herbicide application with no inter-row cultivation. Weed density (monocot and dicot weeds) was significantly lower on the RT than on the CT plots. Consequently, the RT plots had accumulated less weed dry matter. Seed cotton yield was affected by tillage systems in 1 out of 3 years. In 2002-2003, the yield trend was: RT1 > CT > RT2. The tillage x species interaction was significant in 2002-2003 and 2004-2005 and combined-across-years. Averaged over years, Asiatic G. arboreum produced 8% less seed cotton with treatment RT2 than with CT. Upland, G. hirsutum produced 118-134 kg ha-1 additional seed cotton on the RT than with CT. Differences in maturity and rooting habit probably contributed to the two species differing in their tillage requirement. The Asiatic cottons were early maturing and are known to possess a deeper root system than the upland cotton. The tillage x N and species x N interactions were not significant. Average seed cotton yield with the 75 kg N was 15.7% more than the 60 kg N ha-1 plots. Among fibre properties, fibre length was significantly better with treatment RT1 than with the CT in 2 out of 3 years. In summary, seed cotton yield of upland G. hirsutum cotton was higher with RT system, whereas converse occurred with G. arboreum. There were no adverse effects of RT on fibre quality.

Keywords: Conservation tillage; Fibre length; Fibre strength; Nitrogen; Vertisols; Weed biomass

Theodoros D. Stathakos, Theofanis A. Gemtos, Constantinos A. Tsatsarelis, Stella Galanopoulou, Evaluation of three cultivation practices for early cotton establishment and improving crop profitability,
Soil and Tillage Research, Volume 87, Issue 2, June 2006, Pages 135-145, ISSN 0167-1987, DOI: 10.1016/j.still.2005.03.007.

(http://www.sciencedirect.com/science/article/B6TC6-4G361B5-1/2/8b67e6355a4d4f65994145457b64f9c5)

Abstract:

Cultivation practices permitting earlier sowing of cotton (Gossypium hirsutum L.) in Greece are required to maximize yields and facilitate harvesting. An experiment was conducted for 2 years in Central Greece to evaluate two alternative systems. The experiment was carried out in a Vertic Cambisol and a Typic Regosol field. Cultivation practices tested were: (1) conventional tillage (CT) and sowing in a flat field, (2) ridge tillage (RT), using autumn ridging and (3) sowing in a flat field under clear plastic film (PF). Early and normal sowings were compared. The effects of the treatment on the crop establishment, growth and yield, as well as on the soil physical properties, were studied. Performance evaluation of the machinery was carried out. The cost of cultivation practices was estimated. Results of soil physical properties were similar for both years. Soil water contents from sowing to plastic removal in 2000 were 14.2, 13.5 and 18.0 g/100 g and temperatures for the same period at 0.04 m depth were 17.7, 18.1 and 19.8 [degree sign]C for CT, RT and PF, respectively. PF resulted in higher emergence and higher plants with smaller roots. Average yields of seed-cotton in early sowing were 4936, 4591 and 4033 kg/ha for PF, RT and CT, respectively. In late sowing, yields in RT and in CT did not differ significantly. Ridge tillage machinery saved 13.6 kWh/ha (20.9%) compared to conventional tillage machinery. The higher yields under plastic film compensated for the higher cost of the practice at the present prices of seed-cotton.

Keywords: Cotton; Tillage; Plastic film; Energy requirements; Greece

R.P. Simoes, R.L. Raper, F.J. Arriaga, K.S. Balkcom, J.N. Shaw, Using conservation systems to alleviate soil compaction in a Southeastern United States ultisol,
Soil and Tillage Research, Volume 104, Issue 1, June 2009, Pages 106-114, ISSN 0167-1987, DOI: 10.1016/j.still.2009.01.004.
(http://www.sciencedirect.com/science/article/B6TC6-4VVRCHB-1/2/d394d277814283c7ec80f0bcabf5214c)

Abstract:

Coastal Plain soils are prone to compaction layers which restrict root growth and reduce yields. The adoption of non-inversion deep tillage has been recommended to disrupt compacted soil layers and create an adequate medium for crop development. In spite of its efficacy, increased fuel prices could reduce in-row subsoiling adoption due to the cost of the operation. We evaluated three subsoiling implements against a non-subsoiled treatment with and without a rye (Secale cereale L.) cover crop on a 4-year cotton (Gossypium hirsutum L.)-peanut (Arachis hypogaea L.) rotation experiment in Headland, AL on a Dothan loamy sand (Plinthic Kandiudult). Results showed consistently lower yields for non-subsoiled treatments (11 and 51% lower yields for peanuts and cotton, respectively). Soil strength values had a 2 fold increase or greater (1.5-4.0 MPa) in less than a year due to natural reconsolidation and normal vehicle traffic. On average, in-row subsoiling returned $698/ha/year for cotton and $612/ha/year more for all in-row subsoiling than non-subsoiled treatments. No differences between implements were found. A conservation system consisting of annual paratilling

combined with a winter cover crop proved to be the most productive and profitable system.

Keywords: Compaction; Conservation tillage; Cover crop; Subsoiling; Cotton drought resistance

Kipling S. Balkcom, Andrew J. Price, Edzard Van Santen, Dennis P. Delaney, Deborah L. Boykin, Francisco J. Arriaga, Jason S. Bergtold, Ted S. Kornecki, Randy L. Raper, Row spacing, tillage system, and herbicide technology affects cotton plant growth and yield,

Field Crops Research, Volume 117, Issues 2-3, 3 June 2010, Pages 219-225, ISSN 0378-4290, DOI: 10.1016/j.fcr.2010.03.003.
(http://www.sciencedirect.com/science/article/B6T6M-4YX65N8-1/2/4a483707a48507c801648d8fef11b8e9)

Abstract:

Cotton (Gossypium hirsutum L.) producers are faced with numerous production choices including cotton varieties, herbicide technology, tillage systems, and row spacing. A study was conducted to compare cotton production across conventional, glyphosate-tolerant, and glufosinate-tolerant varieties in both conventional and conservation tillage systems for standard row (102 cm) and narrow row (38 cm) cotton planting patterns. The experiment was conducted during the 2004-2006 growing seasons at the Field Crops Unit, E.V. Smith Research Center, near Shorter, AL in long-term tillage plots. Data collection included plant populations within row spacings, plant biomass and height at 1st square, mid-bloom, and lint yields. Plant biomass measured at 1st square and mid-bloom was affected by growing season with 38 cm cotton plant biomass averaging 34% greater in 2004 and 2005, however, the effect of tillage system was contradictory within the growing season. Mid-bloom plant biomass also varied across growing seasons with 21% more plant biomass recorded in 38 cm rows averaged across all three growing seasons. Plant heights were shorter for 38 cm cotton compared to 102 cm cotton, regardless of growth stage or tillage system. No differences in cotton development were observed across varieties. Cotton planted in 38 cm rows yielded equivalent to 102 cm cotton during two of the three experimental years and was superior to 102 cm cotton the remaining year, which corresponded to the best growing season observed during the experimental period. These results indicate that 38 cm cotton production can produce yields that are at least equivalent to standard 102 cm cotton, despite differences in plant development. The productivity of a narrow row cotton production system may be attractive to some growers, but economic evaluations are required to determine if the system is profitable on a large scale based on equivalent or marginal lint yield increases.

Keywords: Coastal Plain soil; Ultra-narrow row cotton

Alan L. Wright, Frank M. Hons, Robert G. Lemon, Mark L. McFarland, Robert L. Nichols, Stratification of nutrients in soil for different tillage regimes and cotton rotations, ***Soil and Tillage Research***, Volume 96, Issues 1-2, October 2007, Pages 19-27, ISSN 0167-1987, DOI: 10.1016/j.still.2007.02.005.
(http://www.sciencedirect.com/science/article/B6TC6-4ND7094-3/2/e3ebcb783679c34b59ef08cf2ed36bfb)

Abstract:

Crop management practices, especially tillage and rotation, can impact soil nutrient stratification, crop growth, and yield. The objectives of this study were to determine the soil-profile distribution of plant-available nutrients in four depth intervals from 0 to 90 cm for different cotton (Gossypium hirsutum L.) cropping systems, tillage regimes, and N fertilization rates in a south-central Texas silty clay loam soil after 5 years of treatment imposition. Distribution of nutrients in the soil profile varied between cropping systems (continuous cotton monoculture and cotton-corn (Zea mays L.) rotation), conventional (CT) and reduced tillage (RT), and N fertilization rates (0, 80, and 160 kg N ha-1). Plant-available P showed the greatest stratification and was 426% higher at 0-15 cm than at 60-90 cm, while SO4 had the greatest increase (42%) with depth. The percentage decrease from 0-15 to 60-90 cm was 47% and 147% for NO3 and K, and 76%, 12%, 43%, and 232% for Mn, Fe, Cu, and Zn, respectively. In contrast, Ca and Mg concentrations increased 22% and 15%, respectively, from 0-15 to 60-90 cm. Increasing the N fertilization rate increased plant-available NO3 and SO4 but decreased K, Fe, Cu, and Zn concentrations. Inclusion of corn in rotation with cotton decreased plant-available Mn, Fe, and Cu from 15 to 90 cm relative to continuous cotton at 160 kg N ha-1. For unfertilized soil, rotation increased micronutrient concentrations at 15-60 cm compared to continuous cotton. On average, CT cotton-corn had significantly lower K, Ca, Mg, Na, and SO4 concentrations than CT continuous cotton. Reduced tillage and diversified cropping systems altered the distribution of plant-available nutrients in soil relative to CT and continuous cotton. In fact, RT increased plant-available P and NO3 in surface soil, which may have contributed to higher lint yields than CT continuous cotton.

Keywords: Cotton; Macronutrients; Micronutrients; Nutrient stratification; Plant-available nutrients; Reduced tillage; Soil-profile distribution

T. Brevault, S. Bikay, J.M. Maldes, K. Naudin, Impact of a no-till with mulch soil management strategy on soil macrofauna communities in a cotton cropping system, ***Soil and Tillage Research***, Volume 97, Issue 2, December 2007, Pages 140-149, ISSN 0167-1987, DOI: 10.1016/j.still.2007.09.006.
(http://www.sciencedirect.com/science/article/B6TC6-4R34DR3-1/2/fec1318c3a0015a7e28667b4fd972051)

Abstract:

Systematic exportation, burning of crop residues and decreases in fallow periods have led to a large-scale depletion of soil organic matter and degradation of soil fertility in the cotton (Gossypium hirsutum L.) cropping systems of Cameroon. The present study tested whether soil management systems based on a no-till with mulch approach intercropped with cereals, which has been shown to restore cotton production, could boost the biological activity of soil macrofauna. The impacts of no tillage with grass

mulch (Brachiaria ruziziensis Germain and Eward) (NTG) and no tillage with legume mulch (Crotalaria retusa L. or Mucuna pruriens Bak.) (NTL) on the abundance, diversity and functional role of soil invertebrates were evaluated during the third year of implementation in northern Cameroon (Winde and Zouana), compared to conventional tillage (CT) and no tillage (NT) without mulch. Macrofauna were sampled from two 30 cm x 30 cm soil cubes (including litter) at the seeding stage of cotton, and 30 days later. The collected organisms were grouped into detritivores, herbivores and predators. Examination of the soil macrofauna patterns revealed that the abundance and diversity of soil arthropods were significantly higher in NTG and NTL than in CT plots (+103 and +79%, respectively), while that of NT plots was in-between the no tillage groups and CT (+37%). Regarding major ecological functions, herbivores and predators were significantly more abundant in NTG and NTL plots than in CT plots at Winde (+168 and +180%, respectively), while detritivores, predators and herbivores were significantly more abundant in the NTG plots than in CT plots at Zouana (+92, +517 and +116%, respectively). Formicidae (53.6%), Termitidae (24.7%) and Lumbricidae (9.4%) were the most abundant detritivores while Julidae (46.1%), Coleoptera larvae (22.1%) and Pyrrhocoridae or Reduviidae (11.8%) were the dominant herbivores. The major constituents of the predatory group were Araneae (33.8%), Carabidae (24.6%), Staphylinidae (15.7%) and Scolopendridae (10.3%). Direct seeding mulch-based systems, NTG and NTL, favoured the establishment of diverse macrofaunal communities in the studied cotton cropping system.

Keywords: Soil; Macrofauna; Conservation agriculture; No tillage; Cover crop; Cotton; Africa

Guillermo Siri-Prieto, D. Wayne Reeves, Randy L. Raper, Tillage systems for a cotton-peanut rotation with winter-annual grazing: Impacts on soil carbon, nitrogen and physical properties,

Soil and Tillage Research, Volume 96, Issues 1-2, October 2007, Pages 260-268, ISSN 0167-1987, DOI: 10.1016/j.still.2007.06.010.
(http://www.sciencedirect.com/science/article/B6TC6-4PB15Y5-1/2/78d1edd52485be274903ba3eceecf531)

Abstract:

Integrating livestock with cotton (Gossypium hirsutum L.) and peanut (Arachis hypogaea L.) production systems by grazing winter-annuals can offer additional income for producers provided it does not result in yield-limiting soil compaction. We conducted a 3-year field study on a Dothan loamy sand (fine-loamy, kaolinitic, thermic plinthic kandiudults) in southern Alabama, USA to determine the influence of tillage system prior to cotton-peanut planting on soil properties following winter-annual grazing. Two winter-annual forages [oat (Avena sativa L.) and annual ryegrass (Lolium mutiflorum L.)] and four tillage practices [chisel + disk, non-inversion deep tillage (paratill) with and without disking and no-till] were evaluated in a strip-plot design of four replications. We evaluated cone index, bulk density, infiltration, soil organic carbon (SOC), and total nitrogen (N). Paratilling prior to cotton or peanut planting, especially without surface soil tillage, reduced compaction initially to 40 cm and residually to 30 cm through the grazing period in winter. There were no significant differences in cone index, bulk

density, or infiltration between forage species. No-tillage resulted in the greatest bulk density (1.65 Mg m-3) and lowest infiltration (36% of water applied), while paratilling increased infiltration in no-tillage to 83%. After 3 years, paratilling increased SOC 38% and N 56% near the soil surface (0-5 cm), as compared to concentrations at the beginning of the experiment, suggesting an improvement in soil quality. For coastal plain soils, integrating winter-annual grazing in a cotton-peanut rotation using a conservation tillage system of non-inversion deep tillage (paratill) with no surface tillage can improve soil quality by reducing cone index, increasing infiltration, and increasing SOC in the soil surface.

Keywords: Annual grazing; Soil compaction; No-till; Soil quality; Soil organic carbon

Upendra M. Sainju, Harry H. Schomberg, Bharat P. Singh, Wayne F. Whitehead, P. Glynn Tillman, Sharon L. Lachnicht-Weyers, Cover crop effect on soil carbon fractions under conservation tillage cotton,
Soil and Tillage Research, Volume 96, Issues 1-2, October 2007, Pages 205-218, ISSN 0167-1987, DOI: 10.1016/j.still.2007.06.006.
(http://www.sciencedirect.com/science/article/B6TC6-4P6MBS5-1/2/5e5ca7f5a9b0bc9d68eaf6a96d3dc9f7)

Abstract:

Cover crops may influence soil carbon (C) sequestration and microbial biomass and activities by providing additional residue C to soil. We examined the influence of legume [crimson clover (Trifolium incarnatum L.)], nonlegume [rye (Secale cereale L.)], blend [a mixture of legumes containing balansa clover (Trifolium michelianum Savi), hairy vetch (Vicia villosa Roth), and crimson clover], and rye + blend mixture cover crops on soil C fractions at the 0-150 mm depth from 2001 to 2003. Active fractions of soil C included potential C mineralization (PCM) and microbial biomass C (MBC) and slow fraction as soil organic C (SOC). Experiments were conducted in Dothan sandy loam (fine-loamy, kaolinitic, thermic, Plinthic Kandiudults) under dryland cotton (Gossypium hirsutum L.) in central Georgia and in Tifton loamy sand (fine-loamy, siliceous, thermic, Plinthic Kandiudults) under irrigated cotton in southern Georgia, USA. Both dryland and irrigated cotton were planted in strip tillage system where planting rows were tilled, thereby leaving the areas between rows untilled. Total aboveground cover crop and cotton C in dryland and irrigated conditions were 0.72-2.90 Mg C ha-1 greater in rye + blend than in other cover crops in 2001 but was 1.15-2.24 Mg C ha-1 greater in rye than in blend and rye + blend in 2002. In dryland cotton, PCM at 50-150 mm was greater in June 2001 and 2002 than in January 2003 but MBC at 0-150 mm was greater in January 2003 than in June 2001. In irrigated cotton, SOC at 0-150 mm was greater with rye + blend than with crimson clover and at 0-50 mm was greater in March than in December 2002. The PCM at 0-50 and 0-150 mm was greater with blend and crimson clover than with rye in April 2001 and was greater with crimson clover than with rye and rye + blend in March 2002. The MBC at 0-50 mm was greater with rye than with blend and crimson clover in April 2001 and was greater with rye, blend, and rye + blend than with crimson clover in March 2002. As a result, PCM decreased by 21-24 g CO2-C ha-1 d-1 but MBC increased by 90-224 g CO2-C ha-1 d-1 from June 2001 to

January 2003 in dryland cotton. In irrigated cotton, SOC decreased by 0.1-1.1 kg C ha-1 d-1, and PCM decreased by 10 g CO2-C ha-1 d-1 with rye to 79 g CO2-C ha-1 d-1 with blend, but MBC increased by 13 g CO2-C ha-1 d-1 with blend to 120 g CO2-C ha-1 d-1 with crimson clover from April 2001 to December 2002. Soil active C fractions varied between seasons due to differences in temperature, water content, and substrate availability in dryland cotton, regardless of cover crops. In irrigated cotton, increase in crop C input with legume + nonlegume treatment increased soil C storage and microbial biomass but lower C/N ratio of legume cover crops increased C mineralization and microbial activities in the spring.

Keywords: Cover crop; Organic carbon; Microbial carbon; Carbon mineralization; On-farm study; Soil quality; Cropping system

Hezhong Dong, Weijiang Li, Wei Tang, Zhenhuai Li, Dongmei Zhang, Enhanced plant growth, development and fiber yield of Bt transgenic cotton by an integration of plastic mulching and seedling transplanting,

Industrial Crops and Products, Volume 26, Issue 3, October 2007, Pages 298-306, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2007.03.008.
(http://www.sciencedirect.com/science/article/B6T77-4NP9KCM-2/2/4c56a5efdab63aea5136feb5f0756db3)

Abstract:

Plastic mulching and seedling transplanting are widely adopted intensive planting systems for cotton production in China. Previous studies have demonstrated considerable yield increases by individual use of mulching or transplanting compared with conventional planting. In the present study, two experiments were conducted to test if an integration of transplanting and plastic mulching is more beneficial than individual use of transplanting for enhancing cotton production, in northern Shandong, Yellow River Valley of China from 2003 to 2005. In the first experiment in 2003 and 2004, a hybrid Bt cotton cultivar SCRC 15 was planted in a greenhouse-like hut in early April, and the raised seedlings were transplanted to mulched or non-mulched field plots in early May. Plant growth and development, yield and yield components, and earliness of cotton were evaluated. In the second experiment in 2004 and 2005, three hybrid and three non-hybrid Bt cotton cultivars were managed with the integrated system or with transplanting alone, and yields of each cultivar were examined. Results from the first experiment showed that plant growth and development, yield and yield components, and earliness of cotton were significantly enhanced by an integration of mulching and transplanting compared with individual use of transplanting in either 2003 or 2004. Lint yields and the number of bolls per unit ground area were increased by 17.4% and 14.6% in 2003, and 17.1% and 15.3% in 2004 with plastic mulching in comparison with non-mulching, respectively. Such enhancement was mainly attributed to significantly increased soil temperature during early season after transplanting. The size of soil blocks for seedling nursing had significant and non-significant enhancement on final lint yield in 2003 and 2004, respectively. In the second experiment, average lint yields of hybrid cotton were increased by 17.8% in 2003 and 16.9% in 2004, and those of non-hybrid cotton were 13.3% in 2003 and 13.5% in 2004 with mulching in comparison with non-mulching (individual use of transplanting). It was concluded that an integration of

plastic mulching and seedling transplanting can be more effective than individual use of transplanting to enhance cotton production in northern Shandong and other heat-limited areas.

Keywords: Bt transgenic cotton; Fiber yield; Plant growth; Plastic mulching; Seedling transplanting

S.S. Reddy, E.Z. Nyakatawa, K.C. Reddy, R.L. Raper, D.W. Reeves, J.L. Lemunyon, Long-term effects of poultry litter and conservation tillage on crop yields and soil phosphorus in cotton-cotton-corn rotation,
Field Crops Research, Volume 114, Issue 2, 10 November 2009, Pages 311-319, ISSN 0378-4290, DOI: 10.1016/j.fcr.2009.09.001.
(http://www.sciencedirect.com/science/article/B6T6M-4X8YMH3-2/2/cd54772f76b20103385b25929cc42369)

Abstract:

Long-term field experiments are needed to fully realize positive and negative impacts of conservation tillage and poultry litter application. A study was initiated on a Decatur silt loam soil at the Tennessee Valley Research and Extension Center, Belle Mina, AL, USA in 1996 to evaluate cotton (Gossypium hirsutum L.) performance with long-term poultry litter (PL) application under different tillages and to study the build up of phosphorus (P) with application of PL. Treatments include incomplete factorial combinations of three tillage systems [conventional till (CT), mulch till (MT), and no-till (NT)], two cropping systems [cotton-fallow and cotton-winter rye (Secale cereale L.)], and two nitrogen sources and rates [100 kg N ha-1 from ammonium nitrate (AN), and 100 and 200 kg N ha-1 from poultry litter (PL)]. Cotton was rotated with corn (Zea mays L.) every third year. Results from 2003 to 2008 showed that all tillages gave similar cotton lint yields with AN at 100 kg N ha-1. Application of PL at 100 kg N ha-1 in NT plots resulted in 12 and 11% yield reductions compared to that of CT and MT, respectively. However, NT plots with higher quantity of PL (200 kg N ha-1) gave similar yields to CT and MT at 100 kg N ha-1. During corn years, higher residual fertility of PL, in terms of grain yields, was observed in NT plots compared to CT and MT. Long-term PL application (100 kg N ha-1 year-1) helped to maintain original soil pH in CT and MT while AN application decreased soil pH. In NT plots, PL at 100 kg N ha-1 was not sufficient to maintain original soil pH, but 200 kg N ha-1 maintained original pH. Although not-significant, elevated P levels were observed in all tillages compared to original P levels which indicates possibility of P build up in future with further application of PL. Application of PL at double rate (200 kg N ha-1) in NT plots resulted in significant build up of P. Results indicate that NT gives similar yields to CT when received AN, but needs higher rate of PL application to achieve similar yields to CT.

Keywords: Poultry litter; Conventional tillage; Cover crop; Mulch tillage; No-tillage; Phosphorus

S. Gursoy, A. Sessiz, S.S. Malhi, Short-term effects of tillage and residue management following cotton on grain yield and quality of wheat,
Field Crops Research, Volume 119, Issues 2-3, November-December 2010, Pages 260-268, ISSN 0378-4290, DOI: 10.1016/j.fcr.2010.07.016.
(http://www.sciencedirect.com/science/article/B6T6M-50TYH1R-1/2/1a8394d3584bb69ee4a25ea613747d6e)

Abstract:

Grain yield and quality of winter wheat (Triticum durum L.) are affected by several factors, and crop management has a very important role among them. A 3-year (from 2003-04 to 2005-06) field experiment under irrigation was carried out at Diyabakir in the South East Anatolia Region of Turkey to evaluate immediate effects of tillage and residue management systems after cotton (Gossypium hirsutum L.) on grain yield and quality [thousand grain weight (TGW), test weight (TW), protein content (PC) and mini sedimentation (mini SDS)] of durum wheat, and correlations among these parameters. A split plot design with three replications was used, in which two residue management treatments [collecting and removing cotton stalks from plots (SRem), and chopping and leaving of cotton stalks in plots (SLev)] were main plots, and six tillage and/or wheat planting method combination treatments [moldboard plough + cultivator + broadcast seeding + cultivator as conventional tillage-I (CT-I), moldboard plough + cultivator + drill as conventional tillage-II (CT-II), chisel plough + cultivator + drill as vertical tillage (VT), two passes of disk harrow + drill as reduced tillage-I (RT-I), rotary tiller + drill as reduced tillage-II (RT-II), and no-till ridge planting (RP)] were sub-plots. The effect of cotton residue management on grain yield, TW, PC, mini SDS was not significant, but SRem (51.21 g) gave significantly higher TGW than SLev (50.63 g). Tillage and/or wheat planting method combination treatments had a significant effect on grain yield, TGW and TW, but did not significantly influence PC and mini SDS. Conventional tillage with broadcast seeding (CT-I) treatment produced the lowest wheat grain yield (5.395 Mg ha-1), while there were no significant differences in grain yield among the other five tillage treatments (yields ranged from 5.671 to 5.819 Mg ha-1). In spite of supplemental irrigations, the variability of weather conditions, particularly the amount and distribution of rainfall during the growing season, had a significant influence on wheat grain yield and quality parameters (TGW, TW, PC, mini SDS). Grain yield had a significant positive correlation with TGW, but it did not show any relationship with other grain quality parameters. In conclusion, the findings suggest that conventional tillage with broadcast seeding would be less effective in producing grain yield of wheat compared to other five tillage treatments with row planting, while management of the previous cotton stalks may not have any effect on yield and quality of wheat except TGW.

Keywords: Tillage; Residue management; Wheat; Grain quality; Yield

R.F. Cullum, G.V. Wilson, K.C. McGregor, J.R. Johnson, Runoff and soil loss from ultra-narrow row cotton plots with and without stiff-grass hedges,
Soil and Tillage Research, Volume 93, Issue 1, March 2007, Pages 56-63, ISSN 0167-1987, DOI: 10.1016/j.still.2006.03.010.
(http://www.sciencedirect.com/science/article/B6TC6-4JWFGPF-1/2/09f92ec333bf48b429afaf91ac36b241)

Abstract:

Grass hedges and no-till cropping systems reduced soil losses on standard erosion plots in ultra-narrow row (20 cm) cotton during a 4-year study (1999-2002). No-till cotton with grass hedges, no-till cotton without grass hedges, conventional-till cotton with grass hedges, and conventional-till cotton without grass hedges produced 4-year average annual soil losses of 1.8, 2.9, 4.0, and 30.8 t ha-1, respectively, and produced 4-year average runoff amounts of 267, 245, 353, and 585 mm, respectively. The annual ratio of soil loss for no-till ultra-narrow row cotton plots with grass hedges to those without hedges averaged 0.62. The annual ratio of soil loss for conventional-till plots with grass hedges to without hedges was 0.13. Averaged over all plots (with and without grass hedges), no-till plots had 86% less soil loss than conventional-till plots. No-till plots without grass hedges had 90% less soil loss than conventional-till plots without grass hedges. Grass hedges effectively reduced soil loss on erosion plots with similar cropping practices as compared to plots without hedges. Along with the reduced soil losses from no-till system as compared to conventional-till system, the no-till ultra-narrow row cotton system resulted in an average 0.2 t ha-1 yield increase as compared to the conventional-till system. Reduced soil loss and increased crop yield are both positive factors that the user should consider when adopting this cotton system. Other studies of contoured grass hedges on field-sized areas are being conducted to determine their applicability on larger areas with greater concentrations of runoff.

Keywords: Runoff; Soil loss; Ultra-narrow row cotton; Soil loss ratios; Cropping and management factor (C-factor); Erosion control practice factor (P-factor)

Giora J. Kidron, Arnon Karnieli, Itzhak Benenson, Degradation of soil fertility following cycles of cotton-cereal cultivation in Mali, West Africa: A first approximation to the problem,

Soil and Tillage Research, Volume 106, Issue 2, January 2010, Pages 254-262, ISSN 0167-1987, DOI: 10.1016/j.still.2009.11.004.
(http://www.sciencedirect.com/science/article/B6TC6-4XY4S9X-1/2/171e73ea4342243ee20010cf42b00f59)

Abstract:

Common agricultural practice in West Africa involves alternating crop cultivation for 10-12 years and thereafter leaving the field to rest (fallow) for 10-15 years. With increasing population pressure and growing demand for food on the one hand, and the lack of unexploited lands on the other, soils undergo fast degradation.

In an attempt to predict soil degradation, 12 fields were sampled around Kita, Mali. Seven of these fields were under cultivation whereas the remaining fields were fallow or virgin soils. The soil pH, electrical conductivity, N-NO3, N-NH4, P, K, and the soil organic matter (SOM) were determined. Of all variables, only nitrogen and SOM showed significant linear relationship with cotton lint at the cultivated fields, with SOM being the only variable showing a clear threshold (of 18 t/ha) that distinguishes between fertile and infertile fields.

Based on field observations a simple model of the family agricultural land use is presented, aiming to provide a link between agriculture practice and soil degradation. The model demonstrates that the current practices of cultivation and fertilization will

result in a slow but inevitable decrease of SOM, with SOM reaching, in 25-35 years, a critical level, below which cotton growth will no longer be economical. We thus conclude that the current practice of cultivation is inefficient and a new cultivation practice, which accounts for the cardinal role of SOM should be adopted.

Keywords: Cotton; Soil cultivation; Nutrients; Nitrogen; Organic matter; Mali

K. Naudin, E. Goze, O. Balarabe, K.E. Giller, E. Scopel, Impact of no tillage and mulching practices on cotton production in North Cameroon: A multi-locational on-farm assessment,
Soil and Tillage Research, Volume 108, Issues 1-2, May-June 2010, Pages 68-76, ISSN 0167-1987, DOI: 10.1016/j.still.2010.03.002.
(http://www.sciencedirect.com/science/article/B6TC6-4YV7PRH-1/2/6b4495ab3e1044fe06f8f94b65e88b7d)

Abstract:

The applicability of conservation agriculture (CA) in sub-Saharan Africa (SSA) is poorly documented. In the 'Nord' and 'Extreme-Nord' provinces of Cameroon, in a 2-year rotation between a cereal (maize or sorghum) and cotton, conventional techniques were compared with CA. The study was conducted from 2001 to 2006 in 662 plots in 243 farmers' fields. Cereal treatments compared were conventional management techniques and CA consisting in the production of mulch using cover crops (Brachiaria ruziziensis, Crotalaria retusa, Dolichos lablab, Mucuna pruriens, Vigna unguiculata) intercropped within the cereal. In the 'Extreme-Nord' province up to 9.7 t ha-1 of vegetative biomass was produced in the CA plots with sorghum and cover crops against up to 4.8 t ha-1 for sorghum alone in conventional plots. In the 'Nord' province maize + cover crops produced up to 5.2 t ha-1 of biomass against up to 2.5 t ha-1 for maize alone. In both provinces, the cereal grain yields were equivalent or higher in CA compared to conventional plots. In 18 fields of the 'Extreme-Nord' province the mulch remaining the year after sorghum + B. ruziziensis is mainly comprised between 3 t ha-1 and 5 t ha-1. Cotton treatments compared were T (tillage), NT (no tillage), and NTM (no tillage with mulch). In both provinces these treatments differed in soil cover, number of localized herbicide sprays used, ridging, and amount of nitrogen fertilizer used. In the 'Extreme-Nord' province treatments differed also for the number of weeding and the date of the first weeding. In the 'Extreme-Nord' province cotton yields were 12% lower for T and 24% lower for NT than for NTM. Cotton yields were regressed on crop husbandry indicators and used inputs. After a manual backward removal in a multiple linear regression respectively no parameters were found to significantly influence yield for T, only one parameter for NT, the number of herbicide sprays used at sowing, and three parameters for NTM: difference between heavy clay and silty loam, application of NPK fertilizer, sowing date. In the 'Nord' province no difference in cotton yield was observed between T, NT and NTM. The flowering period was longer for NTM vs NT in the 'Extreme-Nord' and the 'Nord' provinces and NTM vs T in the 'Nord' province, respectively 13, 9 and 8 days. Although we show that CA techniques can have benefits at field level, further studies are needed to assess their suitability at farm and village levels.

Keywords: Sorghum; Maize; Cover crops; Conservation agriculture; Africa

E.Z. Nyakatawa, V. Jakkula, K.C. Reddy, J.L. Lemunyon, B.E. Norris Jr., Soil erosion estimation in conservation tillage systems with poultry litter application using RUSLE 2.0 model,

Soil and Tillage Research, Volume 94, Issue 2, June 2007, Pages 410-419, ISSN 0167-1987, DOI: 10.1016/j.still.2006.09.003.
(http://www.sciencedirect.com/science/article/B6TC6-4M4KK0Y-2/2/d1341a8b4a90dd21f4c68689dcaf6c9d)

Abstract:

Soil erosion is a major threat to global economic and environmental sustainability. This study evaluated long-term effects of conservation tillage with poultry litter application on soil erosion estimates in cotton (Gossypium hirsutum L.) plots using RUSLE 2.0 computer model. Treatments consisting of no-till, mulch-till, and conventional tillage systems, winter rye (Secale cereale L.) cover cropping and poultry litter, and ammonium nitrate sources of nitrogen were established at the Alabama Agricultural Experiment Station, Belle Mina, AL (34[degree sign]41'N, 86[degree sign]52'W), beginning fall 1996. Soil erosion estimates in cotton plots under conventional tillage system with winter rye cover cropping declined by 36% from 8.0 Mg ha-1 year-1 in 1997 to 5.1 Mg ha-1 year-1 in 2004. This result was largely attributed to cumulative effect of surface residue cover which increased by 17%, from 20% in 1997 to 37% in 2004. In conventional tillage without winter rye cover cropping, soil erosion estimates were 11.0 Mg ha-1 year-1 in 1997 and increased to 12.0 Mg ha-1 year-1 in 2004. In no-till system, soil erosion estimates generally remained stable over the study period, averaging 0.5 and 1.3 Mg ha-1 year-1with and without winter rye cover cropping, respectively. This study shows that cover cropping is critical to reduce soil erosion and to increase the sustainability of cotton production in the southeast U.S. Application of N in the form of ammonium nitrate or poultry litter significantly increased cotton canopy cover and surface root biomass, which are desirable attributes for soil erosion reduction in cotton plots.

Keywords: RUSLE 2.0; Conservation tillage; Cover crop; Soil erosion; C-factor

P.J. Wiatrak, D.L. Wright, J.J. Marois, The impact of tillage and residual nitrogen on wheat,

Soil and Tillage Research, Volume 91, Issues 1-2, December 2006, Pages 150-156, ISSN 0167-1987, DOI: 10.1016/j.still.2005.11.015.
(http://www.sciencedirect.com/science/article/B6TC6-4J2M457-1/2/7676d2a625f121d6fee1a9c850c06bef)

Abstract:

Wheat (Triticum aestivum L.) yield and quality is influenced by management of the previous crop but is highly dependent on current year management. The objective of this study was to evaluate the response of winter wheat seeded in two tillage systems [conventional tillage (CT) and no-till (NT)] to four N rates applied to a previous cotton (Gossypium hirsutum L.) crop (0, 67, 134, and 202 kg ha-1). The experiment with wheat was conducted on a Dothan sandy loam (fine, loamy siliceous, thermic Plinthic Kandiudults) at the University of Florida North Florida Research and Education Center near Quincy, FL from 1995 to 1997. For most plant characteristics, there was a tillage x N x year interaction. Greater plant emergence (79.4 vs. 65.3%) and grain N (23.5 vs.

21.5 g kg-1), and lower grain moisture (139 vs. 142 g kg-1) were obtained under NT than CT, respectively, in one out of two years. Nitrogen applied to a previous cotton crop increased wheat grain yields, plant height and seed number under NT in 1995-1996 and CT in 1996-1997, head density under NT in both years, harvest index under CT in 1996-1997, and grain N concentration in 1995-1996 and 1996-1997 due to residual plant and soil N. With every 1 kg N applied to a previous cotton crop, wheat grain yields increased by 5.38 kg ha-1 under NT, whereas grain yield under CT was not influenced by N application to cotton in 1995-1996. In 1996-1997, grain yields increased by 4.96 and 4.23 kg ha-1 for wheat grown in NT and CT, respectively. Generally, wheat seeded in NT following cotton did not decrease stand or yields compared to CT and wheat grain yields and grain N content increased with N fertilization of the previous crop. However, we would have to apply about 134 kg N ha-1 to a previous cotton crop to maximize wheat production under NT and CT.

Keywords: Double-crop; No-till; Conventional tillage

W. McNair Bostick, Vincent B. Bado, Andre Bationo, Cecilia Tojo Soler, Gerrit Hoogenboom, James W. Jones, Soil carbon dynamics and crop residue yields of cropping systems in the Northern Guinea Savanna of Burkina Faso,
Soil and Tillage Research, Volume 93, Issue 1, March 2007, Pages 138-151, ISSN 0167-1987, DOI: 10.1016/j.still.2006.03.020.
(http://www.sciencedirect.com/science/article/B6TC6-4JW7WMB-1/2/3eef4647d5393dca7d035cd3fba4e411)

Abstract:

Concerns about effects of increasing atmospheric concentration of carbon dioxide (CO2) on climate has given rise to the possibility of emission credits for soil organic carbon (SOC) sequestration. The goal of this study was to analyze SOC sequestration options in cropping systems of the Northern Guinea Savanna of West Africa. An 11-year experiment from the region, which consisted of 56 cropping system treatments that combined various crop rotation sequences with various input levels and an additional treatment of native grass fallow, was analyzed. Rotations included one or more of: sorghum (Sorghum bicolor (L.) Moench), cotton (Gossypium hirsutum L.), groundnut (Arachis hypogaea L.), maize (Zea mays L.) and native grass fallow. Inputs were defined by whether or not the plots were plowed and the addition of soil amendments (N, nitrogen; P, phosphorous; K, potassium; D, dolomite; CR, crop residues; CP, compost and ME, manure). Plots were moldboard plowed before seeding, except fallows, which were not plowed. Soil organic carbon in select treatments and residue yields from all cropped treatments were analyzed. The slope parameters from the regression analysis of SOC in the continuous fallow treatment were not significantly different from zero ($P > 0.05$), suggesting SOC (0.53% after 11 years) was at steady state in this treatment. Rotation and input significantly affected SOC ($P < 0.05$), but interaction effects were not significant. After 11 years, the cropped rotation with the greatest SOC was sorghum-fallow (0.46%), which was significantly greater ($P < 0.05$) than SOC in other the rotations measured: continuous cotton (0.36%), continuous sorghum (0.35%), and cotton-maize-sorghum (0.33%). For the input levels, addition of P, K, and ME gave the greatest SOC (0.44%) after 11 years of cropping, which was significantly greater ($P < 0.05$) than SOC from the N, P, K and D (0.37%), no input

(0.32%) and N, P and K (0.34%) treatments. In addition, SOC with inputs of N, P, K and D (0.37%) was significantly greater than SOC with no input (0.32%). Three management practices, which had significantly greater SOC than others and were among the best for yields, were identified as sequestering management options for the region. These were rotating sorghum and fallow, and amending the soil with mineral P, K, and ME or N, P, K and D. However, potential drawbacks, such as a risk of reduced production with increased fallows, must be identified and addressed if the options are to be adopted.

Keywords: Burkina Faso; Soil carbon; Soil carbon model; West Africa; Crop residue

A.J. Franzluebbers, H.H. Schomberg, D.M. Endale, Surface-soil responses to paraplowing of long-term no-tillage cropland in the Southern Piedmont USA,
Soil and Tillage Research, Volume 96, Issues 1-2, October 2007, Pages 303-315, ISSN 0167-1987, DOI: 10.1016/j.still.2007.07.001.
(http://www.sciencedirect.com/science/article/B6TC6-4PFFCXR-1/2/a8dc1e1a913ef0217497486462620254)

Abstract:

The type of conservation-tillage management employed could impact surface-soil properties, which could subsequently affect relationships between soil and water quality, as well as with soil C sequestration and greenhouse gas emissions. We determined soil bulk density, organic C and N fractions, plant-available N, and extractable P on Typic Kanhapludults throughout a 7-year period, in which four long-term (>10 years), no-tillage (NT) water catchments (1.3-2.7 ha each) were divided into two treatments: (1) continuation of NT and (2) paraplowing (PP) in autumn (a form of non-inversion deep ripping) with NT planting. Both summer [cotton (Gossypium hirsutum L.), maize (Zea mays L.), sorghum (Sorghum bicolor L. Moench), soybean (Glycine max L. Merr.)] and winter [wheat (Triticum aestivum L.), barley (Hordeum vulgare L.), rye (Secale cereale L.), crimson clover (Trifolium incarnatum L.)] crops were NT planted throughout the study under each management system. Soil bulk density was reduced with PP compared with NT by as much as 0.15 Mg m-3, but the extent of reduction was inversely related to the time lag between PP operation and sampling event. Soil organic C became significantly enriched with time during this study under NT (0.49 Mg C ha-1 year-1), but not under PP, in which poultry litter was applied equivalent to 5.7 Mg ha-1 year-1 to all water catchments. Soil maintained a highly stratified depth distribution of organic C and N fractions and extractable P under both NT and PP. Inability to perform the PP operation in the last year of this study resulted in rapid convergence of soil bulk density between tillage systems, suggesting that PP had <1-year effectiveness on soil loosening. The high energy cost of PP (ca. 30 kW shank-1) and the lack of sustained improvement in surface-soil properties put into question the value of PP for improving upon long-term NT management in sandy loam and sandy clay loam Ultisols of the Southern Piedmont USA, unless large effects on crop yield, water quality, or other ecosystem processes warrant its use.

Keywords: Bulk density; Conservation tillage; Organic carbon; Soil nitrogen; Soil quality

Marcio dos Reis Martins, Jose Eduardo Cora, Ricardo Falqueto Jorge, Adolfo Valente Marcelo, Crop type influences soil aggregation and organic matter under no-tillage,
Soil and Tillage Research, Volume 104, Issue 1, June 2009, Pages 22-29, ISSN 0167-1987, DOI: 10.1016/j.still.2008.11.003.
(http://www.sciencedirect.com/science/article/B6TC6-4V8FF96-1/2/97b4f1b1abc4116d6f91b299777a3dab)

Abstract:

The adaptation of no-tillage system in tropical regions depends on the suitable choice of summer and winter crops which should contribute to improvement of soil properties. The aim of the present study was to determine the effect of crop sequences on soil aggregation and contents of organic C and polysaccharides in aggregates of a Rhodic Eutrudox under no-tillage. The treatments consisted of the combination of four summer crop sequences and seven winter crop sequences. The summer crop sequences were: maize monocrop (Zea mays L.) (MM); soybean monocrop (Glycine max (L.) Merrill) (SS); crop sequence of soybean/maize/soybean/maize (SM); crop sequence of rice (Oryza sativa L.)/bean (Phaseolus vulgaris L.)/cotton (Gossypium hirsutum L.)/bean (RB). The winter crops were: maize, sunflower (Helianthus annuus L.), radish (Raphanus sativus L.), pearl millet (Pennisetum americanum (L.) Leeke), pigeon pea (Cajanus cajan (L.) Millsp), grain sorghum (Sorghum bicolor (L.) Moench) and sunn hemp (Crotalaria juncea L.). The highest total organic C, total polysaccharides and dilute acid-extracted polysaccharides contents were found in 2.00-1.00 mm water-stable aggregates and the lowest contents were found in <0.25 mm aggregates. The maize monocrop provided the highest water-stability of soil aggregates. This crop sequence provided the highest content of total organic C and dilute acid-extracted polysaccharides in aggregates with diameter of 6.30-2.00 mm. This indicates that the influence of crops on the stability of aggregates is mediated by total organic C and easily hydrolysable polysaccharides (polysaccharides other than cellulose) in the soil. There were no differences among effects of the winter crops (maize, sunflower, oilseed radish, pearl millet, pigeon pea, grain sorghum and sunn hemp) on the soil aggregation.

Keywords: Soil aggregation; Soil carbohydrates; Soil structure; Crop rotation; Cover crops

M. Tejada, J.L. Gonzalez, The relationships between erodibility and erosion in a soil treated with two organic amendments,
Soil and Tillage Research, Volume 91, Issues 1-2, December 2006, Pages 186-198, ISSN 0167-1987, DOI: 10.1016/j.still.2005.12.003.
(http://www.sciencedirect.com/science/article/B6TC6-4J90VTM-1/2/46b346ed868ded16345cde2bdfc7fafc)

Abstract:

The influence of two organic wastes, cotton gin crushed compost (CC) and beet vinasse (BV) applied for 5 years on a Typic Xerofluvent under dryland conditions near to Sevilla city (Guadalquivir River Valley, Andalusia, Spain) on soil erodibility (K factor of the USLE and RUSLE) and soil loss was studied. CC and BV were applied at rates of 1780, 5340, and 10,680 kg ha-1 (expressed as organic matter content). When CC was applied to the soil, erodibility factor (K) is correlated with soil loss, highlighting a

decrease in K and soil loss when increased the dose of CC applied to the soil. In this respect, K decreased 17% in CC-amended soils respect to control soil at the end of the experiment, and soil loss decreased 36% in CC-amended soils respect to control soil at the end of the experiment and for 45 min and 60 mm h-1. However, when BV was applied, soil physical and biological properties decreased. K decreased 6.4% in BV-amended soils respect to control soil at the end of the experiment, and soil loss increased 59.7% in BV-amended soils respect to control soil at the end of the experimental period and for 45 min and 60 mm h-1. We think that this is because the higher level of Na+ (and possibly of fulvic acids) in BV increased the exchangeable sodium percentage (ESP) and reduced structural stability of BV-amended soil, leading to higher soil loss. This explains the relatively higher soil loss in BV-amended soils. These results contradict many previous reports in which soil organic matter prevented soil loss. For this reason, the equation of soil erodibility (K factor of USLE and RUSLE) must have in consideration other aspects such as the chemical composition of the soil organic matter as well as the soil structural stability.

Keywords: Cotton gin crushed compost; Beet vinasse; Soil erodibility factor (K); Rainfall simulator

Steven W. Martin, James Hanks, Economic analysis of no tillage and minimum tillage cotton-corn rotations in the Mississippi Delta,

Soil and Tillage Research, Volume 102, Issue 1, January 2009, Pages 135-137, ISSN 0167-1987, DOI: 10.1016/j.still.2008.08.009.
(http://www.sciencedirect.com/science/article/B6TC6-4TKXD46-1/2/9f88684fd257f792214c35c6c4ab39cb)

Abstract:

Crop rotations have been shown to have agronomic benefits. An increasingly common crop rotation in the Mid-South is cotton rotated with corn. Many previous studies have focused on tillage systems or crop rotations. Few have evaluated a combination of the two (crop rotations and tillage) especially from an economics perspective. Field studies were conducted at Stoneville, MS for the period 2001-2006. Treatments included no till continuous cotton, minimum till continuous cotton, one year corn followed by two years cotton no till, one year corn followed by two years cotton minimum till, one year corn-one year cotton no till and one year corn-one year cotton minimum till. Results revealed that cotton yields were increased in all four systems rotated with corn. Lower risk was associated with minimum till cotton. Gross returns were higher in a monoculture minimum till cotton system. Net returns were larger in a system that included minimum tillage and a corn rotation. The highest net returns and lowest risk were obtained from a minimum till system of cotton rotated with corn every other year. For those producers required to use a no till system, a one year corn-two year cotton rotation provided the highest net returns and least risk.

Keywords: No till; Minimum till; Rotations; Cotton; Corn; Net returns

CROPPING PATTERNS (5 Jdl)

N.R. Hulugalle, T.B. Weaver, L.A. Finlay, J. Hare, P.C. Entwistle, Soil properties and crop yields in a dryland Vertisol sown with cotton-based crop rotations,
Soil and Tillage Research, Volume 93, Issue 2, April 2007, Pages 356-369, ISSN 0167-1987, DOI: 10.1016/j.still.2006.05.008.
(http://www.sciencedirect.com/science/article/B6TC6-4K8S5GN-2/2/d2be2a62545e002a6c70d2dc23dff2b4)

Abstract:

Information on the effects of growing cotton (Gossypium hirsutum L.)-based crop rotations on soil quality of dryland Vertisols is sparse. The objective of this study was to quantify the effects of growing cereal and leguminous crops in rotation with dryland cotton on physical and chemical properties of a grey Vertisol near Warra, SE Queensland, Australia. The experimental treatments, selected after consultations with local cotton growers, were continuous cotton (T1), cotton-sorghum (Sorghum bicolor (L.) Moench.) (T2), cotton-wheat (Triticum aestivum L.) double cropped (T3), cotton-chickpea (Cicer arietinum L.) double cropped followed by wheat (T4) and cotton-wheat (T5). From 1993 to 1996 land preparation was by chisel ploughing to about 0.2 m followed by two to four cultivations with a Gyral tyne cultivator. Thereafter all crops were sown with zero tillage except for cultivation with a chisel plough to about 0.07-0.1 m after cotton picking to control heliothis moth pupae. Soil was sampled from 1996 to 2004 and physical (air-filled porosity of oven-dried soil, an indicator of soil compaction; plastic limit; linear shrinkage; dispersion index) and chemical (pH in 0.01 M CaCl2, organic carbon, exchangeable Ca, Mg, K and Na contents) properties measured. Crop rotation affected soil properties only with respect to exchangeable Na content and air-filled porosity. In the surface 0.15 m during 2000 and 2001 lowest air-filled porosity occurred with T1 (average of 34.6 m3/100 m3) and the highest with T3 (average of 38.9 m3/100 m3). Air-filled porosity decreased in the same depth between 1997 and 1998 from 45.0 to 36.1 m3/100 m3, presumably due to smearing and compaction caused by shallow cultivation in wet soil. In the subsoil, T1 and T2 frequently had lower air-filled porosity values in comparison with T3, T4 and T5, particularly during the early stages of the experiment, although values under T1 increased subsequently. In general, compaction was less under rotations which included a wheat crop (T3, T4, T5). For example, average air-filled porosity (in m3/100 m3) in the 0.15-0.30 m depth from 1996 to 1999 was 19.8 with both T1 and T2, and 21.2 with T3, 21.1 with T4 and 21.5 with T5. From 2000 to 2004, average air-filled porosity (in m3/100 m3) in the same depth was 21.3 with T1, 19.0 with T2, 19.8 with T3, 20.0 with T4 and 20.5 with T5. The rotation which included chickpea (T4) resulted in the lowest exchangeable Na content, although differences among rotations were small. Where only a cereal crop with a fibrous root system was sown in rotation with cotton (T2, T3, T5) linear shrinkage in the 0.45-0.60 m depth was lower than in rotations, which included tap-rooted crops such as chickpea (T4) or continuous cotton (T1). Dispersion index and organic carbon decreased, and plastic limit increased with time. Soil organic carbon stocks decreased at a rate of 1.2 Mg/ha/year. Lowest average cotton lint yield occurred with T2 (0.54 Mg/ha) and highest wheat yield with T3 (2.8 Mg/ha). Rotations which include a wheat crop are more likely to

result in better soil structure and cotton lint yield than cotton-sorghum or continuous cotton.

Keywords: Farming system; Cropping system; Soil quality; Clay; Dryland; Wheat; Sorghum; Chickpea; Halpustert; Compaction

L. Zhang, W. van der Werf, S. Zhang, B. Li, J.H.J. Spiertz, Temperature-mediated developmental delay may limit yield of cotton in relay intercrops with wheat,
Field Crops Research, Volume 106, Issue 3, 20 March 2008, Pages 258-268, ISSN 0378-4290, DOI: 10.1016/j.fcr.2007.12.010.
(http://www.sciencedirect.com/science/article/B6T6M-4RW4JMT-2/2/88df977da52c03e730762e5a93ff4270)

Abstract:

In the Yellow River valley of China, more then 1.4 million ha of cotton are grown as relay intercrops with wheat. Cotton is sown in April when winter wheat is already in the reproductive phase; thus, a wheat crop with a fully developed canopy will compete for resources with cotton plants in the seedling stage. Yields of cotton are lower in relay intercropping systems than in a monocrop, but the aggregate yield of the cotton-wheat system is greater than of monocultures of the component crops. We study the hypothesis that the lower yield of intercropped cotton is a consequence of delayed development and fruit formation of the cotton as a result of a lowered temperature experienced by seedlings in the intercrop, compared to monoculture, due to shading by wheat.Field experiments were conducted in 3 subsequent years in Anyang, Henan, China. Wheat and cotton were grown as monocrops and as strip intercrops. Four intercrop layouts were investigated, differing in number of wheat and cotton rows in a strip: 3:1, 3:2, 4:2 and 6:2. Developmental stage of the cotton was recorded at regular intervals during the growing cycle while air and soil temperatures were measured with thermocouples at several soil depths and cross-row positions in the canopy.

Temperatures at and near the soil surface were substantially (on average 3 [degree sign]C) lower in intercrops than in monoculture, especially on sunny days, thus lowering the rate of temperature accumulation of cotton seedlings in intercrops, compared to those in monocultures. Cotton in intercrops showed a pronounced delay in early development, e.g. attainment of the squaring stage, compared to monocrops. The period from planting to first square, expressed in thermal time (TT), lasted 531 [degree sign]C d in cotton monoculture and 638-670 [degree sign]C d in intercrops. There were no significant differences in developmental delay between different intercropping patterns. The formation of fruits in intercrops lagged behind by 9-15 d, compared to monoculture, while the number of fruit nodes per plant, averaged over 3 years, was reduced from 30.3 in monocrops to 19.9 in intercrops. The later formation of fruits thus results in a reduction in fruit number and also in a reduction in average age of the fruits, limiting their growth and the sink capacity of the plant as a whole.A plastic film cover increased temperatures in a 3:2 intercrop at the soil surface by 1.9 [degree sign]C and at 5 cm soil depth by 2.7 [degree sign]C, thus restoring the thermal conditions to levels common in monoculture. A cover with straw, however, decreased the temperature at the soil surface by 2.9 [degree sign]C and at 5 cm depth by 1.3 [degree sign]C.

We conclude that the thermal climate in wheat-cotton intercrops is suboptimal for the cotton seedlings. The resulting delay in development of cotton culminates in a lower reproductive capacity and sink capacity. In combination with a reduced source strength, due to later and reduced canopy development in intercropped cotton, these effects result in a lint yield that is substantially lower than in monoculture cotton. This constraint can be ameliorated by measures that improve light capture and heat loading by the cotton, e.g. planting a semi-dwarf wheat or cultivation of cotton on ridges, or application of a plastic film mulch in the cotton seed bed. Early maturing cotton cultivars are at an advantage in intercropping systems.

Keywords: Air temperature; Soil temperature; Soil cover; Thermal time; Physiological time; Phenology

L. Zhang, W. Van Der Werf, W. Cao, B. Li, X. Pan, J.H.J. Spiertz, Development and validation of SUCROS-Cotton: a potential crop growth simulation model for cotton, ***NJAS - Wageningen Journal of Life Sciences***, Volume 56, Issues 1-2, October 2008, Pages 59-83, ISSN 1573-5214, DOI: 10.1016/S1573-5214(08)80017-6.
(http://www.sciencedirect.com/science/article/B94T2-4WJRNXP-6/2/33c5d5d569b50e4cc1f1d97543498639)

Abstract:

A model for the development, growth and potential production of cotton (SUCROS-Cotton) was developed. Particular attention was given to the phenological development of the plant and the plasticity of fruit growth in response to temperature, radiation, daylength, variety traits, and management. The model is characterized by a comparatively simple code and transparent algorithms. The model was parameterized for Chinese cotton varieties and validated with extensive independent datasets on cotton growth and production from the Yellow River region and Xinjiang Province. The model validation showed that the phenology, growth and yield were simulated satisfactorily. The root mean square error (RMSE) for date of emergence, date of flowering, date of open boll stage and duration from sowing to boll opening was less than four calendar days, both for cotton grown in monoculture and cotton grown in a relay intercropping system with wheat. The RMSE of predicted total dry matter compared with observations was at most 6.6%, of lint yield 6.6%, and for number of harvestable bolls 10.0%. SUCROS-Cotton provides a tool to (1) assess production opportunities of cotton in various ecological zones in response to temperature, incoming radiation and management, (2) identify optimal cotton ideotypes for different agro-ecological conditions and for guiding breeding efforts, and (3) explore resource-use-efficient cropping systems, including intercropping options, and crop management practices such as plastic film mulching and sowing date.

Keywords: development; development time; growth; intercropping; lint yield physiological day

L. Zhang, W. van der Werf, S. Zhang, B. Li, J.H.J. Spiertz, Growth, yield and quality of wheat and cotton in relay strip intercropping systems,
Field Crops Research, Volume 103, Issue 3, 13 September 2007, Pages 178-188, ISSN 0378-4290, DOI: 10.1016/j.fcr.2007.06.002.
(http://www.sciencedirect.com/science/article/B6T6M-4P903BM-1/2/41c10e86963207c7aa4cc9e0c7ea8a4b)

Abstract:

Intercropping of wheat and cotton is practiced at a large scale in northern China, but the productivity of intercrops, compared to monoculture, and the productivity and growth patterns of different alternative intercropping patterns have not been quantitatively documented. In this study, four typical wheat-cotton intercropping patterns were examined as to their growth and productivity in field experiments over three growing seasons in Anyang, Henan Province, China. The systems varied in the number of wheat and cotton rows in the alternating strips of either crop, and were labeled accordingly as 3:1, 3:2, 4:2 and 6:2. Dry matter accumulation, yield, land equivalence ratio (LER) and lint quality were determined.

Grain yield of wheat, averaged over three seasons, ranged from 4600 to 5200 kg ha-1 in intercropping, corresponding to 70-79% of the yield in the monoculture (6550 kg ha-1). The 3:1 system gave the highest wheat yield (79% of monoculture), followed by the 6:2 (73%), 3:2 (70%) and 4:2 (70%) systems. Cotton lint yield, averaged over three seasons, ranged from 590 to 740 kg ha-1 in intercropping, corresponding to 54-69% of the yield in cotton monoculture (1085 kg ha-1). The 3:2 and 4:2 systems gave the highest lint yields (69% and 68% of monoculture, respectively), which was significantly lower than in monoculture but significantly higher than in the 3:1 (58%) and 6:2 (54%) systems. The land equivalent ratio was 1.39 in the 3:1, 3:2 and 4:2 systems, and significantly lower, 1.28, in the 6:2 system. All systems provide a substantial land use advantage.Cotton growth patterns in monocultures and intercrops were characterized by fitting expolinear growth equations to periodic harvest data. Fitted parameters indicate a growth delay, compared to cotton monoculture, of 11.8 d in the 3:1 system, 6.3 d in the 3:2 system, 6.9 d in the 4:2 system and 5.6 d in the 6:2 system. Estimated growth rate during the linear growth phase was lowest in the 6:2 system (5.9 g m-2 d-1), significantly greater in the 3:1 (7.0 g m-2 d-1), 4:2 (7.7 g m-2 d-1) and 3:2 (8.4 g m-2 d-1) systems, and greatest, but not significantly different from 3:2 and 4:2 systems, in the monoculture (8.9 g m-2 d-1). These results are interpreted in terms of the competitive effect of wheat during the seedling phase of cotton, which is strongest in the 3:1 system, causing a comparatively long growth delay, and the ability of the cotton leaf canopy to intercept radiation after wheat harvest, which is diminished in the 6:2 system due to the large distance between cotton rows, resulting in a comparatively low rate of linear growth.Effects of intercropping on the quality of cotton were minor and mostly below detection threshold.

Keywords: Crop growth analysis; Grain yield; Lint yield; Land equivalence ratio; Fiber quality; Expolinear growth equation; Competition; Growth delay

L. Zhang, W. van der Werf, L. Bastiaans, S. Zhang, B. Li, J.H.J. Spiertz, Light interception and utilization in relay intercrops of wheat and cotton,
Field Crops Research, Volume 107, Issue 1, 11 April 2008, Pages 29-42, ISSN 0378-4290, DOI: 10.1016/j.fcr.2007.12.014.
(http://www.sciencedirect.com/science/article/B6T6M-4RW4S09-2/2/2b5ad97d33c31c6e7a6304279e3f1fe3)

Abstract:

In China, a large acreage of cultivated land is devoted to relay intercropping of winter wheat and cotton. Wheat is sown in strips with interspersed bare soil in October and harvested in June of the next year, while cotton is sown in the interspersed paths in the wheat crop in April and harvested before the next wheat sowing in October. This paper addresses the question how strip width and number of plant rows per strip of wheat or cotton affect light interception (LI) and light use efficiency (LUE) of both component crops.

Field experiments were carried out in three consecutive years: 2002, 2003 and 2004. Light interception and productivity were estimated in monocultures of wheat and cotton and four intercropping designs differing in strip and path width as well as number of rows per strip. The intercrop systems were identified by the number of rows per strip of wheat and cotton, respectively, as 3:1, 3:2, 4:2 and 6:2. Total light interception over a season was calculated from LAI measurements, using a model for light interception in a row crop. The spatial distribution and diurnal course of light in intercrops were also measured with sensors.Wheat monocrops intercepted 618 MJ m-2 photosynthetically active radiation (PAR) from 18 March to harvest in 2002, 337 MJ m-2 from 29 April to harvest in 2003, and 457 MJ m-2 from 13 April to harvest in 2004. Averaged over 3 years, wheat in the four intercrops (3:1, 3:2, 4:2 and 6:2, respectively) intercepted 83, 71, 73 and 75% as much PAR as the sole wheat. From sowing to harvest, cotton monocrops intercepted 491 MJ m-2 PAR in 2002, 426 MJ m-2 in 2003, and 415 MJ m-2 in 2004. Cotton in the four intercrops (3:1, 3:2, 4:2 and 6:2, respectively) intercepted 73, 93, 86 and 67% as much PAR as the sole cotton. LUE of wheat was 2.12 +/- 0.14 g total dry matter MJ-1 PAR during the reproductive period, while that of cotton was 1.33 +/- 0.02 g dry matter MJ-1 PAR over the whole growing period. No differences in LUE of wheat or cotton were found between systems.The analysis indicates that the high productivity of intercrops, compared to monocultures, can be fully explained by an increase in accumulated light interception per unit cultivated area. The component crops are thus complementary in their interception of light over space and time. The model results indicate that light interception can be modified by choice of the number of crop rows per strip and strip width. The best distribution of light is attained in systems with narrow strips, a high proportion of border rows, and high planting densities of cotton. Suggestions for system improvement are given.

Keywords: Leaf are index (LAI); Light use efficiency (LUE); Photosynthetic active radiation (PAR); Intercropping; Competition

PLANT GENETICS AND BREEDING (15 jdl)

Yan-xia Wang, Xing-fen Wang, Zhi-ying MA, Gui-yin Zhang, Gai-ying HAN, Somatic Embryogenesis and Plant Regeneration from Two Recalcitrant Genotypes of Gossypium hirsutum L.,
Agricultural Sciences in China, Volume 5, Issue 5, May 2006, Pages 323-329, ISSN 1671-2927, DOI: 10.1016/S1671-2927(06)60057-6.
(http://www.sciencedirect.com/science/article/B82XG-4K30SB2-1/2/636469e79143db5b70269a9f7752a6ab)
Abstract:

An improved protocol has been developed for somatic embryogenesis and plant regeneration of recalcitrant cotton cultivars. High callus frequencies and embryogenic tissue were developed in MSB medium supplemented with gradient concentrations of KT and 2,4-D, their concentration decreasing from 0.1 to 0.01 mg L-1. Somatic embryos were successfully incubated in 1/2 macronutrient MSB suspension supplemented with 0.5 g L-1 glutamine and 0.5 g L-1 asparagine. Decrease in macronutrient concentration of MSB significantly alleviated browning and was beneficial to suspension cells. Transformation of somatic embryos into plants was induced in MSB medium supplemented with 3% sucrose, 0.5 g L-1 glutamine, 0.5 g L-1 asparagine, and 6.0 g L-1 agar. The effect of sucrose as carbohydrate was better than that of glucose for plant germination. Using this protocol, regenerated plantlets from the CCRI521 and Zhongzhi86-6 reached to as much as 19.6 and 18.5% somatic embryos, respectively.
Keywords: Gossypium hirsutum L.; recalcitrant genotypes; plant regeneration;

Xiao-Li TIAN, Gang-Wei WANG, Rui ZHU, Pei-Zhu YANG, Liu-Sheng DUAN, Zhao-HuLI, Conditions and Indicators for Screening Cotton (Gossypium hirsutum L.)Varieties Tolerant to Low Potassium,
Acta Agronomica Sinica, Volume 34, Issue 8, August 2008, Pages 1435-1443, ISSN 1875-2780, DOI: 10.1016/S1875-2780(08)60050-4.
(http://www.sciencedirect.com/science/article/B94TW-4V2FYB4-7/2/d6b8130f240ede966338b8fe284bcdcf)
Abstract:

To establish a screening system for evaluating the tolerance of cotton (Gossy pium hirsutum L.) varieties to low potassium (K), 50 cotton varieties that coveredmorethan 80% planting area in China in 2004 were used in a hydroponicsculture and a field experiment in 2006. The K concentrations were 0.02 (low K stress) and 2.50 mmol L-1 (high K), respectively, in the hydroponic culture, and the available K in soil was 59.88 mg kg-1 (K deficient). At 5-leaf stage, the total plant dry weight (DW) varied larger among cotton varieties than that at 3-leaf stage; thus, seedlings at 5-leaf stage were adapted in the comparison of tolerance to low K. Under the low K condition, DW was significantly correlated with the relative dry weight (RDW) ($r = 0.7690$, $P < 0.01$), K accumulation amount (KAA) ($r = 0.9522$, $P < 0.01$), and K utilization index (KUI) ($r = 0.9791$, $P < 0.01$). The KAA of whole plant that grew in low K solution significantly correlated with root length ($r = 0.5201$, $P < 0.01$) and root surface

area (r = 0.3325, P < 0.05). The ratio of spotted area resulting from potassium deficiency to total cotyledon area (defined as S value) was determined as an indicator for screening low K tolerance due to its high variation among varieties with the coefficient of variation of 44.46% and significant correlation with DW (r = -0.4455, P < 0.01) in addition to its normal distribution characteristic. No significant correlations were observed between the K content in seeds and the S value, DW, KAA, and KUI. There was significant correlation between the DW of whole plant at 5-leaf stage under hydroponic culture and the dry weight of reproductive organs (RODW) in field (r = 0.5091, P < 0.01). Therefore, hydroponic culture is feasible for primary screening cotton varieties tolerant to low K stress, but some important varieties should be further identified in field experiment.

Keywords: cotton (Gossypium hirsutum L.); tolerance to low potassium; variety screening; hydroponic culture; indicator of tolerance

Zi-hong YE, Yong-jun MEI, Ke-qin ZOU, Xian-shu FU, Lin-shu JIANG, Genetic Dissection of Net Effects Between Yield and Its Components in Sea Island Cotton (Gossypium barbadense L.),
Agricultural Sciences in China, Volume 7, Issue 9, September 2008, Pages 1052-1060, ISSN 1671-2927, DOI: 10.1016/S1671-2927(08)60146-7.
(http://www.sciencedirect.com/science/article/B82XG-4THKV6G-4/2/4ecd9a152b7f0dc67f09cb614da17871)

Abstract:

The number of bolls, individual boll weight, and lint percentage are three important yield components of lint yield of cotton. In the present study, nine parents, twenty F1, and twenty F2 crosses of intraspecific hybrids of sea island cotton (Gossypium barbadense L.) were grown at Tarim University, Alar, Xinjiang, China, in 2000 and 2001. Lint yield and its three component traits were measured and analyzed by an extended conditional mixed linear model approach. Lint percentage made the largest contribution to additive, additive x environment, and dominance x environment variations for lint yield. The contribution ratios of number of bolls, individual boll weight, and combined contribution of these two traits to additive x environment and dominance x environment variations for lint yield were not statistically significant. Lint yield of different parents could be affected differently by lint percentage. Lint yield of some parents was closely correlated with lint percentage, whereas for other parents, the behavior of individual boll weight and number of bolls played much more important roles on lint yield than that of lint percentage. It was shown by the conditional and conventional predicted additive x environment interaction effects of parents that the environment condition could influence different parents with varied effects.

Keywords: yield; yield components; Gossypium barbadense L.; conditional analysis

A. Aguado, B. De Los Santos, D. Gamane, L.F. Garcia del Moral, F. Romero, Gene effects for cotton-fiber traits in cotton plant (Gossypium hirsutum L.) under Verticillium conditions,

Field Crops Research, Volume 116, Issue 3, 3 April 2010, Pages 209-217, ISSN 0378-4290, DOI: 10.1016/j.fcr.2009.12.011.
(http://www.sciencedirect.com/science/article/B6T6M-4Y9C181-1/2/d3ca54ca979b7d74914b63a1327f5eed)

Abstract:

Verticillium wilt (VW), caused by Verticillium dahliae Kleb., has become one of the most serious problems in cotton (Gossypium hirsutum L.). The use of resistant cultivars has long been considered the most practical and effective means of control. The objective of this work was to study the quantitative genetic basis of fiber traits under Verticillium conditions in upland cotton by using five genotypes and their possible crosses without reciprocals, selecting simultaneously for quality fiber, resistance, and agronomic characteristics. Five cotton cultivars and 10 F1s from half diallel crosses were analyzed for quality fiber under VW conditions. The fiber length, uniformity, strength, elongation, and micronaire were measured during two crop seasons at two different sites each year, consistently in plots with soil naturally infested with Verticillium. Genetic components of variance were analyzed using the Hayman model. Analysis of variance for all traits showed significant differences between genotypes, with the genotype-site interaction in most of the studied traits except for fiber length and micronaire. Both the additive genetic variance component (D) and dominance genetic variance components (H1 and H2) were present in all traits. D was the most important component for uniformity, strength, elongation, and micronaire. Elongation was the trait most correlated with seed-cotton yield. Strength and micronaire were the traits most correlated with VWI. Broad-sense heritability was high for all the traits studied. Narrow-sense heritability was high for uniformity, strength and elongation, and moderate for length and micronaire.

`Acala Prema' and `Acala Germain-510' were identified as the best parent cultivars to breed for uniformity and strength. `Acala Prema', `Acala Germain-510', and `Deltapine Acala 90' were the best to improve elongation and micronaire characters.

Keywords: Cotton; Breeding; Hayman analysis; Path analysis

Naqib Ullah Khan, Gul Hassan, Moula Bux Kumbhar, Khan Bahadar Marwat, Muhammad Azim Khan, Aisha Parveen, Umm-e-Aiman, Muhammad Saeed, Combining ability analysis to identify suitable parents for heterosis in seed cotton yield, its components and lint % in upland cotton,

Industrial Crops and Products, Volume 29, Issue 1, January 2009, Pages 108-115, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2008.04.009.
(http://www.sciencedirect.com/science/article/B6T77-4SRM85K-1/2/117c35cfa5509506741a3c436a0a58cc)

Abstract:

Combining ability and heterosis were studied in a 6 x 6 diallel cross to see the nature of gene action in Upland cotton (Gossypium hirsutum L.) during 2002 to 2004. Analysis of variance revealed highly significant differences among all the F1 and F2

hybrid means and their respective six parental values for all the traits examined. In both generations, the mean squares due to general combining ability (GCA) and specific combining ability (SCA) were also highly significant. SCA genetic variances were greater than GCA and more important for the traits, i.e. boll weight, boll number and seed cotton yield per plant, showing the predominance of non-additive gene action. Lint % in both generations and boll weight in F2s only were controlled by additive type of gene action due to maximum GCA variances. Cultivar CIM-1100 was found to be the best general combiner and its utilization produced valuable hybrids with desirable SCA in both generations. F1 and F2 hybrids, viz., CIM-1100 x CRIS-9, CIM-1100 x FH-682, CIM-1100 x BH-36 and CIM-109 x CIM-1100 as high x low and low x high parents performed well in SCA determination, outstanding mean performance and heterosis. Better SCA effects associated with useful heterosis were more pronounced for yield traits. In F1 hybrids, maximum heterosis was observed for seed cotton yield followed by boll number, boll weight and lint %. The heterosis over better parent was +3.13 to +65.63% for bolls per plant, +0.75 to +24.40% for boll weight, +0.82 to +115.22% for seed cotton yield and +0.27 to +3.88% for lint %. Involvement of CIM-1100 in most of the F1 and F2 hybrids resulted in the synthesis of superior genotypes for most of the traits studied. Inbreeding depression was elevated in good performing hybrids and was the highest for seed cotton yield. Highest yielding F1 hybrids yielded lesser in the subsequent generation due to over-dominance and inbreeding depression, whereas moderate yielding F1 hybrids were found more stable even passing through process of segregation due to additive gene action. The combined performance of F1 and F2 hybrids could be a good indicator to identify the most promising populations to be utilized either as F2 hybrids or as a resource population for further selection.

Keywords: F1 and F2 hybrids; Gene action; General and specific combining Ability; Hybrid vigour; Inbreeding depression; Gossypium hirsutum

Jing ZHENG, Zheng-sheng ZHANG, Li CHEN, Qun WAN, Mei-chun HU, Wei WANG, Ke ZHANG, Da-jun LIU, Xiao CHEN, Xin-qi WEI, Intron-Targeted Intron-Exon Splice Conjunction (IT-ISJ) Marker and Its Application in Construction of Upland Cotton Linkage Map,

Agricultural Sciences in China, Volume 7, Issue 10, October 2008, Pages 1172-1180, ISSN 1671-2927, DOI: 10.1016/S1671-2927(08)60161-3.
(http://www.sciencedirect.com/science/article/B82XG-4TSKFY5-2/2/ed77574280b0b23baed04e4cd449d600)

Abstract:

To develop a new DNA maker, which could be used in genetic diversity analysis and genetic map construction in plants, IT-ISJ (intron targeted intron-exon splice junction) primer combinations, which were designed according to the intronexon splice junction conserved sequences, were used to construct cotton genetic linkage map in the present study. 49 out of 704 IT-ISJ primer combinations showed polymorphism between upland cotton high quality cultivar Yumian 1 and multiple dominant gene line T586, and the polymorphic primer combinations accounted for 7.0% of total primer combinations. 49 IT-ISJ primer combinations were used to genotype 270 F2:7 recombinant inbred

lines developed from (Yumian 1 x T586) F2, and 58 IT-ISJ loci were obtained. 58 IT-ISJ, together with 150 SSR and 8 morphological loci, were used to conduct linkage analysis, and a linkage map including 22 linkage groups and 113 loci (49 IT-ISJ, 62 SSR, and 2 morphological loci) was constructed. The linkage map covered 714.5 cM with an average interval of 6.3 cM between two markers, accounting for 16.1% of cotton genome. The present study demonstrated that the polymorphism of IT-ISJ marker is high, and it could be effectively applied in plant genetic map construction.

Keywords: IT-ISJ (intron targeted intron-exon splice junction); linkage map; upland cotton (Gossypium hirsutum L.)

Tian-Zi CHEN, Shen-Jie WU, Fei-Fei LI, Wang-Zhen GUO, Tian-Zhen ZHANG, In Vitro Regeneration of Four Commercial Cotton Cultivars (Gossypium hirsutum L.) Grown in Xinjiang, China,

Acta Agronomica Sinica, Volume 34, Issue 8, August 2008, Pages 1374-1380, ISSN 1875-2780, DOI: 10.1016/S1875-2780(08)60047-4.
(http://www.sciencedirect.com/science/article/B94TW-4V2FYB4-4/2/2dc08dbdb195e3e09165de69c3443b5b)

Abstract:

Genetic improvement of cotton through biotechnology has been limited by lack of an efficient regeneration system. An efficient somatic embryo production and maturation procedure was thus developed to regenerate plantlets from hypocotyls of cotton cultivars Xinluzhong 20, Xinluzao 24, Xinluzao 33, and 03298 grown in Xinjiang. Calli were effectively produced by 0.01 to 0.10 mg L-1 kinetin (KT) and 0.10 mg L-1 2,4-dichlorophenoxyacetic acid (2,4-D), with a better result by 0.02 or 0.10 mg L-1 KT and 0.10 mg L-1 2,4-D. Split hypocotyl segments and double amounts of KNO3 during induction of calli were beneficial to the emerge of embryogenic calli. Embryogenic calli and globular-stage somatic embryos were effectively initiated with high concentration of KT and low concentration of 2,4-D in ECM media (0.05 or 0.10 mg L-1 KT and 0.01 mg L-1 2,4-D). Embryos were further developed into plantlets in MSBF medium under the conditions of dehydration and ventilation, which were achieved using filter paper on medium and cotton tampon sealing flask. Using this protocol, normal plantlets with strong roots were developed from these cotton cultivars in 6 to 8 months. The successful regeneration protocol established in this study can be used to improve cotton cultivars by genetic engineering.

Keywords: Gossypium hirsutum L.; regeneration; somatic embryogenesis

Jing-Lin CAO, Xian-Long ZHANG, Shuang-Xia JIN, Xi-Yan YANG, Hua-Guo ZHU, Li-Li FU, An Efficient Culture System for Synchronization Control of Somatic Embryogenesis in Cotton (Gossypium hirsutum L.),

Acta Agronomica Sinica, Volume 34, Issue 2, February 2008, Pages 224-231, ISSN 1875-2780, DOI: 10.1016/S1875-2780(08)60010-3.
(http://www.sciencedirect.com/science/article/B94TW-4T5JDPK-5/2/e1b684821290ef231c5c089039a4ef4e)

Abstract:

Low efficiency of somatic embryogenesis and asynchronous embryo development results in a lot of difficulties to physiological, biochemical, and molecular biological studies of the embryogenesis processes in cotton (Gossypium hirsutum L.). A simple and efficient method was developed to improve somatic embryogenesis frequency and synchronous development of mass somatic embryos from cultured cells of the cotton cultivar Coker 201. The embryonic calli obtained after several rounds of subculture were scattered in a liquid medium by shaking for 2 d and then resuspended in the same liquid medium after discarding the larger callus aggregates over a 30 mesh-size-sieve. The suspensions cultured for 14 d were filtered through a 50 mesh-size-sieve and the aggregates over the sieve were incubated for 21 d onto the surface of a Whatman filter paper that was placed on the solid medium containing 2.46 [mu]mol L-1 indole-3-butyric acid (IBA) and 0.70 [mu]mol L-1 kinetin. The amount of somatic embryos obtained by this system was 15.5-fold and 3-fold higher than that of suspension culture and solid culture without filter papers, respectively. About 70.2% for globular, 52.3% for torpedo-shaped, and 73.0% for cotyledonary embryos were obtained during the culture. The method combining suspension culture and solid culture (with filter paper) proved to be efficient for synchrony of somatic embryogenesis and mass embryo development.

Keywords: cotton; somatic embryogenesis; synchronization control; culture system

Ming LUO, Zhong-yi XIAO, Yue-hua XIAO, Xian-bi LI, Lei HOU, Jian-ping ZHOU, Ming-yu HU, Yan PEI, Cloning and Expression Analysis of a Brassinosteroid Biosynthetic Enzyme Gene, GhDWF1, from Cotton (Gossypium hirsuturm L.),
Agricultural Sciences in China, Volume 6, Issue 11, November 2007, Pages 1297-1305, ISSN 1671-2927, DOI: 10.1016/S1671-2927(07)60176-X.
(http://www.sciencedirect.com/science/article/B82XG-4R9B4F5-3/2/fb3bb5808d373b70b2e65e233c3ca825)

Abstract:

Brassinosteroids (BRs) are an important class of plant steroidal hormones that are essential in a wide variety of physiological processes. To determine the effects of BRs on the development of cotton fibers, through screening cotton fiber EST database and contigging the candidate ESTs, a key gene (GhDWF1) involved in the upstream biosynthetic pathway of BRs was cloned from developing fibers of upland cotton (Gossypium hirsutum L.) cv. Xuzhou 142. The full length of the cloned cDNA is 1849 bp, including a 37 bp 5'-untranslated region, an ORF of 1692 bp, and a 120 bp 3'-untranslated region. The cDNA encodes a polypeptide of 563 amino acid residues with a predicted molecular mass of 65 kD. The deduced amino acid sequence has high homology with the BR biosynthetic enzyme, DWARF1/DIMINUTO, from rice, maize, pea, tomato, and Arabidopsis. Furthermore, the typical conserved structures, such as the transmembrane domain, the FAD-dependent oxidase domain, and the FAD-binding site, are present in the GhDWF1 protein. The Southern blot indicated that the GhDWF1 gene is a single copy in upland cotton genome. RT-PCR analysis revealed that the highest level of GhDWF1 expression was detected in 0 DPA (day post anthesis) ovule

(with fibers) while the lowest level was observed in cotyledon. The GhDWF1 gene presents high expression levels in root, young stem, and fiber, especially, at the fiber developmental stage of secondary cell wall accumulation. Moreover, the expression level was higher in ovules (with fibers) of wildtype (Xuzhou 142) than in ovules of fuzzless-lintless mutant at the same developmental stages (0 and 4 DPA). The results suggest that the GhDWF1 gene plays a crucial role in fiber development.

Keywords: cotton; DWARF1 gene; fiber; brassinosteroids; phytosterol

Yuksel Bolek, Genetic variability among cotton genotypes for cold tolerance,
Field Crops Research, Volume 119, Issue 1, 9 October 2010, Pages 59-67, ISSN 0378-4290, DOI: 10.1016/j.fcr.2010.06.015.
(http://www.sciencedirect.com/science/article/B6T6M-50J9VT3-2/2/abac451e35f079ae9080f4e5edda6deb)

Abstract:

Even though planting cotton early in the season is advantageous, the cold sensitivity of cotton seedlings and low germination rates, especially in the areas experiencing low temperatures, are the main obstacle for the early seasonal planting. A total of 106 genotypes from three different species; Gossypium hirsutum L., G. barbadense L., and G. herbaceum L. were screened for cold tolerance using three different approaches. Furthermore, the best screening method to differentiate between the genotypes for cold tolerance, and to predict their field emergence rates was also determined. In detail, optimal germination percentages were measured at 30 [degree sign]C with the results ranging from 61% to 99%. On the other hand, cold temperature germination rates and emergence percentages ranged from 8% to 82% in paper test and from 8% to 88% (the 7th day after planting) in sand test at 18 [degree sign]C, and field emergence percentages ranged from 44% to 77% at 28 days after planting. A significant difference between cotton species in terms of their tolerance to cold was observed. That is, G. barbadense genotypes had higher germination rates than the other two species in the three methods used. There was no correlation between optimal germination rates and field emergence percentages. Among cold temperature germination methods, the 18 [degree sign]C paper test was better in predicting of field emergence percentage, in differentiating between genotypes in terms of their cold tolerance and in determining seed vigor. G. hirsutum cultivars; 8106-2, AYDIN-110, CORINA, DP-388, DPL-50, DPL-5614, NAZILLI-342 and one G. barbadense cultivar, GIZA 70 were more cold tolerant among all the cotton cultivars screened in this study.

Keywords: Cotton; Gossypium; Genotype; Cold tolerance; Germination; Screening

Muhammad Younas Khan Barozai, Muhammad Irfan, Rizwan Yousaf, Imran Ali, Uzma Qaisar, Asma Maqbool, Muzna Zahoor, Bushra Rashid, Tayyab Hussnain, Sheikh Riazuddin, Identification of micro-RNAs in cotton,
Plant Physiology and Biochemistry, Volume 46, Issues 8-9, August-September 2008, Pages 739-751, ISSN 0981-9428, DOI: 10.1016/j.plaphy.2008.05.009.
(http://www.sciencedirect.com/science/article/B6VRD-4SM62CN-1/2/bc3e45c44aa2606705a7cec6c3160f42)

Abstract:

The plant genome has conserved small non-coding microRNAs (miRNAs) genes about 20-24 nucleotides long. They play a vital role in the gene regulation at various stages of plant life. Their conserved nature among the various organisms not only suggests their early evolution in eukaryotes but also makes them a good source of new miRNA discovery by homology search using bioinformatics tools. A systematic search approach was used for interspecies orthologues of miRNA precursors, from known sequences of Gossypium in GenBank. The study resulted in 22 miRNAs belonging to 13 families. We found 7 miRNA families (miR160, 164, 827, 829, 836, 845 and 865) for the first time in cotton. All 22 miRNA precursors form stable minimum free energy (mfe) stem loop structure as their orthologues form in Arabidopsis and the mature miRNAs reside in the stem portion of the stem loop structure. Fifteen miRNAs belong to the world's most commercial fiber producing upland cotton (Gossypium hirsutum), five are from Gossypium raimondii and one each is from Gossypium herbaceum and Gossypium arboreum. Their targets consist of transcription factors, cell division regulating proteins and virus response gene. The discovery of 22 miRNAs will be helpful in future for detection of precise function of each miRNA at a particular stage in life cycle of cotton.

Keywords: Cotton; Micro RNAs; Post-transcriptional gene silencing; Homology search;somatic embryogenesis; effect of macronutrients; suspension culture

A. Aguado, B. De Los Santos, C. Blanco, F. Romero, Study of gene effects for cotton yield and Verticillium wilt tolerance in cotton plant (Gossypium hirsutum L.),
Field Crops Research, Volume 107, Issue 1, 11 April 2008, Pages 78-86, ISSN 0378-4290, DOI: 10.1016/j.fcr.2007.12.018.
(http://www.sciencedirect.com/science/article/B6T6M-4RWB0W7-2/2/95bcb723cbdf5be80090835fde034995)

Abstract:

Verticillium wilt (VW), caused by Verticillium dahliae Kleb., is a destructive disease of cotton (Gossypium hirsutum L.). The use of resistant cultivars has long been considered the most practical and effective mean of control. The aim of this work was to study the quantitative genetic basis of Verticillium wilt resistance in Upland cotton by using five genotypes and their possible crosses without reciprocals selecting simultaneously for resistance and desirable agronomic characteristics. Five cotton cultivars and 10 F1s from half-diallel crosses were analyzed for VW resistance. The seed cotton yield, the number of bolls/ plant, and boll weight were measured and Verticillium wilt index (VWI) was estimated during two crop seasons in two different sites

each year always on plots with naturally infested soil. Genetic components of variance were analyzed using the Hayman model. Analysis of variance for all characters showed significant differences between genotypes, without genotype-site interaction in most cases. Both, additive genetic variance component (D) and dominance genetic variance components (H1 and H2) were presented in all characters, except for VWI. D was the most important component for boll weight and VWI. Boll weight was the most correlated character with seed cotton yield and VWI. Broad sense heritability was high for boll weight and VWI, moderate for seed cotton yield and low for bolls per plant. Narrow sense heritability was moderate for boll weight, and high for VWI.
`Victoria', `Acala Prema', `Acala Germain 510' and `Deltapine 90' were identified as the best parents to increase boll weight. `Acala Prema', `Acala Germain 510' and `Deltapine 90' were the best parents to improve breeding to reduce symptoms disease.
Keywords: Breeding; Hayman analysis

LUAN Ming-bao, GUO Xiang-mo, ZHANG Yong-shan, YAO Jin-bo, Genetic Effect on Yield and Fiber Quality Traits of 16 Chromosome Substitution Lines in Upland Cotton, ***Agricultural Sciences in China***, Volume 7, Issue 11, November 2008, Pages 1290-1297, ISSN 1671-2927, DOI: 10.1016/S1671-2927(08)60177-7.
(http://www.sciencedirect.com/science/article/B82XG-4V0M7MN-2/2/9c995b9f0f87bf6748cf3b4ba21a0819)
Abstract:
Evaluation of the genetic effect on yield and fiber quality can provide useful information on cotton breeding. Sixteen CSB lines and TM-1 introduced from USDA/ARS were used as male and top-crossed with three elite cultivars and the 51 F1 hybrids, 16 CSB lines, TM-1, and 3 elite cultivars were planted at the Cotton Research Institute of CAAS, Anyang, Henan Province and Xiajin, Shandong Province, China. The yield traits and fiber quality data were obtained and additive and dominance effect on each trait were measured by AD model. Boll weight takes the largest additive proration, whereas boll number takes the least additive proration. The largest and the least dominant proration for lint yield and boll weight were measured, respectively. Fiber length has the additive and dominance effect, and dominance effect was slightly more than additive effect. Larger additive and no dominance effect on uniformity, micronaire, and fiber strength were measured. Significantly, positive additive effect on boll weight of CSB06 and CSB12Sh was observed. CSB14Sh and CSB01 have significantly positive additive effect on 4 and 3 traits of fiber quality, respectively. CSB01 has the greatest dominant effect on lint yield among CSB lines. The dominant effect on fiber length of CSB lines showed positive. It is beneficial to use CSB06 and CSB12Sh as parents to improve boll size, to use CSB14Sh and CSB01 as parents to improve fiber quality. As for hybrid cotton breeding, it is reasonable using CSB01 to improve lint yield traits, and using CSB01, CSB11Sh, and CSB06 to improve fiber length.
Keywords: chromosome substitution lines in upland cotton; additive genetic effect; dominance genetic effect; AD model

Yun-lei ZHAO, Shu-xun YU, Chao-zhu XING, Shu-li FAN, Mei-zhen SONG, Wu-wei YE, Differential Gene Expression Between Hybrids and Their Parents During the Four Crucial Stages of Cotton Growth and Development,
Agricultural Sciences in China, Volume 8, Issue 2, February 2009, Pages 144-153, ISSN 1671-2927, DOI: 10.1016/S1671-2927(09)60021-3.
(http://www.sciencedirect.com/science/article/B82XG-4VP7XPF-4/2/f530b2d4496e86c05e21f53a8a763d44)

Abstract:

The study aims to clarify the differential gene expression between cotton hybrids and their parents in order to better understand the molecular basis of cotton heterosis. The research focused on cotton heterotic and lower heterotic hybrids and their parents during the four crucial stages, which were analyzed using a differential display technique. The results indicated that there were both quantitative and qualitative differences in gene expression amongst them. The quantitative differences include over- and under-expression of parental genes and the dominant expression of highly-expressed parental genes in hybrids. In contrast, the qualitative differences are the following: (i) Bands were observed in both parents but not in the F1 hybrid (BPnF1); (ii) bands occurred in either of the parents but not in the F1 hybrid (UPnF1); (iii) bands presented only in the F1 hybrid but not in either of the parents (UF1nP); and (iv) bands were detected in either of the parents and the F1 hybrid (UPF1). Overall, the major differences of gene expression occurred in the qualitative level and four related differential patterns were observed. Furthermore, the amount of differential patterns during the flowering stage was relatively higher than those of other stages. At this juncture, both the amount of hybrid-specific expression patterns at flowering stage and the silenced expression patterns at boll-forming stage in highly heterotic hybrids were found higher than those in the lower heterotic ones. It was concluded that significant differences of gene expression in leaves were present between cotton hybrid and its parents during the whole growing stages. Hence, these differences might be responsible for the observed cotton heterosis.

Keywords: cotton; heterosis; molecular mechanism; gene expression; differential display

J.L. Hofs, B. Hau, D. Marais, Boll distribution patterns in Bt and non-Bt cotton cultivars: I. Study on commercial irrigated farming systems in South Africa,
Field Crops Research, Volume 98, Issues 2-3, August-September 2006, Pages 203-209, ISSN 0378-4290, DOI: 10.1016/j.fcr.2006.01.006.
(http://www.sciencedirect.com/science/article/B6T6M-4JBGJ3P-2/2/3858093f4360767fff095bfa26fbbd3b)

Abstract:

Cotton (Gossypium hirsutum L.) cultivars containing the cryIAc gene accounted for 81% of South Africa's cotton production in 2004. Current research on Bt cotton in developed countries has revealed that this transgenic crop provides a key means for enhancing yields and boosting profits. Our study was designed to assess the agronomic efficiency of Bt cotton particularly in South African commercial (Paper 1) and small-scale (Paper 2) farming systems. Over several consecutive years, we compared yield

boll distribution patterns (using a plant mapping analysis) of a Bt cultivar (NuOpal) with a conventional nearly isogenic line (DeltaOpal). Compared with the non-Bt cultivar, Bt cotton had better early boll retention rates at the first and second positions on the fruiting branches. Beyond the third position this trend was reversed, indicating that non-Bt cotton varieties offset losses occurring at the first two positions by producing fruits at further positions. Bt cotton thus had a higher average boll weight, shorter vegetative cycle, earlier boll opening, and 13% higher yield potential on average than the conventional control. These results indicate that using the transgenic variety provided better protection against bollworm as compared to chemical treatments--which are likely not effective at the onset of bollworm infestation and do not protect the first bolls. These observations demonstrate the advantage of transgenic Bt cotton when grown under near optimal conditions.
Keywords: Cotton; South Africa; Bt cotton; Plant mapping; Earliness; Transgenic varieties

J.L. Hofs, B. Hau, D. Marais, M. Fok, Boll distribution patterns in Bt and non-Bt cotton cultivars: II. Study on small-scale farming systems in South Africa,
Field Crops Research, Volume 98, Issues 2-3, August-September 2006, Pages 210-215, ISSN 0378-4290, DOI: 10.1016/j.fcr.2006.01.007.
(http://www.sciencedirect.com/science/article/B6T6M-4JD0H3M-2/2/ff25bbe76f180830242fa2a5133ce4bd)
Abstract:
The introduction of Bt cotton in small-scale African farming systems raises the question of the technological efficacy of such cultivars in low-input rainfed agriculture conditions. Current surveys on Bt cotton in small-scale farming systems in South Africa suggest this transgenic crop is a key factor for increasing yields and farm income. This study was designed to assess the efficacy of the Bt cultivar under non-optimal conditions that prevail on small-scale farms. We thus carried out a 2-year comparative study on yield performances and boll distribution patterns of Bt and non-Bt cotton in 20 small-scale fields around Makhathini Flats (KwaZulu Natal, South Africa). A survey was also conducted on 86 farms to obtain yield results in a broader sample. In small-scale, low-input rainfed farming systems, productivity is extremely variable and the advantage of transgenic cotton over conventional varieties is not as easy to demonstrate as it is in large-scale, high-input irrigated farming systems. Given the high technological cost, adoption of transgenic crops may sometimes have a negative economic impact for farmers. Nevertheless, the use of transgenic varieties may be effective within the framework of an overall cropping intensification strategy, i.e. as an integrated pest management component and accompanied by fertilizer application and weed management recommendations.
Keywords: Cotton; South Africa; Bt cotton; Plant mapping; Earliness; Transgenic varieties

PLANT PHYSIOLOGY-BIOCHEMISTRY (12 jdl)

Yun-lei ZHAO, Shu-xun YU, Wu-wei YE, Hong-mei WANG, Jun-juan WANG, Bao-xing FANG, Study on DNA Cytosine Methylation of Cotton (Gossypium hirsutum L.) Genome and Its Implication for Salt Tolerance,
Agricultural Sciences in China, Volume 9, Issue 6, June 2010, Pages 783-791, ISSN 1671-2927, DOI: 10.1016/S1671-2927(09)60155-3.
(http://www.sciencedirect.com/science/article/B82XG-50BCK6C-2/2/0a10b3489e5d415789c8e241c1f06f81)
Abstract:
To study the relations between DNA methylation and abiotic stress responses in cotton (Gossypium hirsutum L.), the methylation-sensitive amplified polymorphism (MSAP) method was used to investigate the differences in methylation level and the change of cytosine methylation patterns under salt (NaCl) stress in two different salt-tolerant cotton lines. The results showed that the number of the cytosine methylation of CCGG sites in high salt-tolerant cotton line was less than that in low salt-tolerant line. Under salt stress, extensive cytosine methylation alterations including hypermethylation and demethylation as well as the potential conversion of methylation types occurred in the salt-treated cotton line compared with the corresponding control. Interestingly, salt stress-induced demethylation loci that occurred in high salt-tolerant cotton line were greater than those in low salt-tolerant cotton line, however, salt stress-induced hypermethylation loci in the high salt-tolerant cotton line were less than those in low salt-tolerant cotton line. It suggested that the demethylation positively contributed to salt tolerance and the hypermethylation had negative effect on salt tolerance in cotton.
Keywords: cotton; DNA methylation; salt stress; MSAP; methylation polymorphism

Kun-Ling TAN, Ming-Yu HU, Xian-Bi LI, Shan QIN, De-Mou LI, Xiao-Ying LUO, Juan ZHAO, Zhen-Le ZANG, Bao-Li LI, Yan PEI, Ming LUO, Molecular Identification and Expression Analysis of GhCYP51G1 Gene, a Homologue of Obtusifoliol-14Alpha-Demethylase Gene, from Upland Cotton,
Acta Agronomica Sinica, Volume 35, Issue 7, July 2009, Pages 1194-1201, ISSN 1875-2780, DOI: 10.1016/S1875-2780(08)60091-7.
(http://www.sciencedirect.com/science/article/B94TW-4XY3SPM-3/2/993677225df94d806c68402e5be304cf)
Abstract:
For understanding the effects of phytosterols on the development of cotton (Gossypium hirsutum L.) fibers and the molecular basic of sterol signaling in cotton fiber growth, a gene encoding a homologue of obtusifoliol 14[alpha]-demethylase from developing fibers of upland cotton cultivar Xuzhou 142 was cloned through screening cotton fiber express sequence tag (EST) database and contigging the candidate ESTs. The full length of GhCYP51G1 (GenBank accession number EU727154) was 1710 bp, including a 160 bp 5'-untranslated region (UTR), a 1461 bp open reading frame (ORF), and an 89 bp 3'-UTR. The GhCYP51G1 encoded a polypeptide of 486 amino acid residues with a predicted molecular mass of 55.2 kD. The deduced amino acid

sequences had high homology with the members of CYP51 family in plant kingdom. Moreover, many typical conserved regions were characterized as the obtusifoliol 14[alpha]-demethylase, such as substrate recognition sites and heme-binding region presented in the deduced protein. Quantitative real-time reverse transcript PCR analysis revealed that the higher expression levels of GhCYP51G1 gene were detected in fibers that were 8, 12, and 18 d post anthesis (DPA), and the 12-DPA ovules. These results indicate that GhCYP51G1 gene plays an important role in fiber elongation. Furthermore, auxin significantly down regulates the expression level of GhCYP51G1 in cotton fiber growth, suggesting that phytosterols play a role in the interaction of plant hormones, especially in the interaction of brassinosteroids and auxin.

Keywords: cotton fiber; phytosterols; obtusifoliol 14[alpha]-demethylase; GhCYP51G1; brassinosteroids

W. Ray Edwards, Judy A. Hall, Alan R. Rowlan, Tama Schneider-Barfield, Tzeli Julia Sun, Mohini A. Patil, Margaret L. Pierce, R. Gary Fulcher, Alois A. Bell, Margaret Essenberg, Light filtering by epidermal flavonoids during the resistant response of cotton to Xanthomonas protects leaf tissue from light-dependent phytoalexin toxicity, ***Phytochemistry***, Volume 69, Issue 12, September 2008, Pages 2320-2328, ISSN 0031-9422, DOI: 10.1016/j.phytochem.2008.05.021.
(http://www.sciencedirect.com/science/article/B6TH7-4SY693F-2/2/27c09a5c67885c50070478556de12b2d)

Abstract:

2,7-Dihydroxycadalene and lacinilene C, sesquiterpenoid phytoalexins that accumulate at infection sites during the hypersensitive resistant response of cotton foliage to Xanthomonas campestris pv. malvacearum, have light-dependent toxicity toward host cells, as well as toward the bacterial pathogen. Adaxial epidermal cells surrounding and sometimes covering infection sites turn red. The red cells exhibited 3-4-fold higher absorption at the photoactivating wavelengths of sunlight than nearby colorless epidermal cells. Red epidermal cells protected underlying palisade mesophyll cells from the toxic effects of 2,7-dihydroxycadalene plus sunlight, indicating a role for epidermal pigments in protecting living cells that surround infection sites from toxic effects of the plant's own phytoalexins. A semi-quantitative survey of UV-absorbing substances extracted from epidermal strips from inoculated and mock-inoculated cotyledons indicated that the principal increase in capacity to absorb the photoactivating wavelengths was due to a red anthocyanin and a yellow flavonol, which were identified as cyanidin-3-O-[beta]-glucoside and quercetin-3-O-[beta]-glucoside, respectively.

Keywords: Gossypium hirsutum L.; Malvaceae; Upland cotton; Xanthomonas campestris pv. malvacearum; Ecological biochemistry; Anthocyanin; Flavonol glycoside; Phytoalexin; Sesquiterpene; Cyanidin-3-O-[beta]-glucoside; Chrysanthemin; 2,7-Dihydroxycadalene; Isoquercitrin; Lacinilene C; Quercetin-3-O-[beta]-glucoside; UV damage; UV protection

Hong-Mei SHU, You-Hua WANG, Wen-Jing ZHANG, ZHi-Guo ZHOU, Activity Changes of Enzymes Associated with Fiber Development and Relationship with Fiber Specific Strength in Two Cotton Cultivars,
Acta Agronomica Sinica, Volume 34, Issue 3, March 2008, Pages 437-446, ISSN 1875-2780, DOI: 10.1016/S1875-2780(08)60018-8.
(http://www.sciencedirect.com/science/article/B94TW-4T5JDPF-5/2/b2d8b77cc1a836965561fd57223edc1e)

Abstract:

Sucrose synthase (SuSy) and [beta]-1,3-glucanase play very important roles in developing cotton (Gossypium hirsutum L.) fiber. To investigate the characteristics of Susy and [beta]-1,3-glucanase, as well as the expressions of related genes, 2 cotton cultivars, Kemian 1 with high strength fiber of 35 cN tex-1 and Dexiamian 1 with low strength fiber of 26 cN tex-1, were used. The differences of the cellulose deposition and fiber specific strength in the 2 cultivars were related to the levels of key enzyme activities and the gene expression. The activity and gene expression of sucrose synthase and [beta]-1,3-glucanase were higher in Kemian 1 than those in Dexiamian 1. The expression of SuSy gene was obviously higher in Kemian 1 than that in Dexiamian 1 at 25 days post anthesis (DPA), whereas the expression of [beta]-1,3-glucanase was obviously different at 10-25 DPA between the 2 cultivars. During the accumulation of cellulose, Kemian 1 had a longer period and a gentler speed accumulation than Dexiamian 1. The position of fruiting branch also affected the accumulation of cellulose. Genes for Expansin, [beta]-1,4-glucanase expressed lower when the boll age increased, and showed significant decrease at 20 DPA. This was in agreement with the dynamic change during the cotton fiber development that is the fiber length elongated rapidly before 25 DPA, and slowed down until it almost stopped thereafter. From the results, it is suggested that the different characteristics of key enzymes activity in fibers may cause the differences in the cellulose accumulation and fiber-specific strength.

Keywords: cotton cultivar; enzyme activity; gene expression; cellulose accumulation; fiber specific strength

Amita Mishra, Smriti Khare, Prabodh Kumar Trivedi, Pravendra Nath, Ethylene induced cotton leaf abscission is associated with higher expression of cellulase (GhCel1) and increased activities of ethylene biosynthesis enzymes in abscission zone,
Plant Physiology and Biochemistry, Volume 46, Issue 1, January 2008, Pages 54-63, ISSN 0981-9428, DOI: 10.1016/j.plaphy.2007.09.002.
(http://www.sciencedirect.com/science/article/B6VRD-4PPMXM7-1/2/dd3f1bc04e00b45302196782c1585056)

Abstract:

Ethylene induced cotton (Gossypium hirusutum var RST-39) leaf abscission has been characterized by measuring the activities of ACC synthase (ACS, E.C. 4.4.1.14), ACC oxidase (ACO, E.C. 1.14.17.4) and cellulase (E.C. 3.2.1.4). In addition, a leaf abscission specific cDNA (GhCel1) has been cloned from cotton, which belongs to the [alpha]2 subgroup of cellulases that possess a C-terminus carbohydrate-binding domain. Measurement of enzyme activity in the abscission zones of cotton leaf explants exposed to ethylene for 48 h compared to non-treated controls indicated a more than 5-

fold increase in the activity of ACS, 1.2-fold increase in the activity of ACO and about 2.7-fold increase in the activity of cellulase in the ethylene treated explants. This increase was accompanied by a substantial decrease in the force required to separate the petiole from the stem (break strength) and an increased accumulation of cellulase transcript in the abscission zone. Treatment of explants with 1-Methylcyclopropene (1-MCP) prior to ethylene resulted in significant inhibition of enzyme activities and transcript accumulation. It is concluded that ethylene response of cotton leaf abscission leads to higher cellulase expression and increased activities of ethylene biosynthesis enzymes in the abscission zone.

Keywords: 1-Methylcyclopropene; ACC oxidase; ACC synthase; Cellulase; Ethylene; Gossypium hirusutum; Leaf abscission

Philippe Marmey, Aida Jalloul, Majd Alhamdia, Komi Assigbetse, Jean-Luc Cacas, Andreas E. Voloudakis, Antony Champion, Alain Clerivet, Jean-Luc Montillet, Michel Nicole, The 9-lipoxygenase GhLOX1 gene is associated with the hypersensitive reaction of cotton Gossypium hirsutum to Xanthomonas campestris pv malvacearum, ***Plant Physiology and Biochemistry,*** Volume 45, Issue 8, August 2007, Pages 596-606, ISSN 0981-9428, DOI: 10.1016/j.plaphy.2007.05.002.
(http://www.sciencedirect.com/science/article/B6VRD-4NS2GDM-1/2/d24030f96e1ec1cfa4c341b94c87e337)

Abstract:

Hypersensitive reaction (HR) cell death of cotton to the incompatible race 18 from Xanthomonas campestris pathovar malvacearum (Xcm) is associated with 9S-lipoxygenase activity (LOX) responsible for lipid peroxidation. Here, we report the cloning of cotton (Gossypium hirsutum L.) LOX gene (GhLOX1) and the sequencing of its promoter. GhLOX1 was found to be highly expressed during Xcm induced HR. Sequence analysis showed that GhLOX1 is a putative 9-LOX, and GhLOX1 promoter contains SA and JA responsive elements. Investigation on LOX signalisation on cotyledons infiltrated with salicylic acid (SA), or incubated with methyl-jasmonate (MeJA) revealed that both treatments induced LOX activity and GhLOX1 gene expression. HR-like symptoms were observed when LOX substrates were then injected in treated (MeJA and SA) cotyledons or when Xcm compatible race 20 was inoculated on MeJA treated cotyledons. Together these results support the fact that GhLOX1 encodes a 9 LOX whose activity would be involved in cell death during cotton HR.

Keywords: Lipoxygenase; Hypersensitive reaction; Xanthomonas campestris; Gossypium hirsutum; Methyl jasmonate; Salicylic acid

Chun-yan WANG, Akihiro Isoda, Mao-song LI, Dao-long WANG, Growth and Eco-Physiological Performance of Cotton Under Water Stress Conditions,
Agricultural Sciences in China, Volume 6, Issue 8, August 2007, Pages 949-955, ISSN 1671-2927, DOI: 10.1016/S1671-2927(07)60133-3.
(http://www.sciencedirect.com/science/article/B82XG-4PM8WN0-6/2/2358cb6dd2bb7ed618c1e344b31db78a)

Abstract:

A cotton cultivar Xinluzao 8 was grown under four levels of water stress treatments (normal irrigation, slight, mild and severe water stress) from the initial reproductive growth stage in Shihezi, Xinjiang, China, in 2002, to evaluate the growth and eco-physiological performances. Under water stress conditions, the transpiration ability decreased while the leaf temperature increased. Although the relative leaf water content decreased as water stress increased, the differences among the treatments were small, indicating that cotton has high ability in maintaining water in leaf. The stomatal density increased as water stress increased, while the maximum stomatal aperture reduced only in the severest stressed plants. The time of the maximum stomatal aperture was delayed in the mild and severe stressed plants. When severe stress occurred, the stomata were kept open until the transpiration decreased to nearly zero, suggesting that the stomata might not be the main factor in adjusting transpiration in cotton. Cotton plant has high adaptation ability to water stress conditions because of decrease in both stomatal conductance and hydraulic conductance from soil-to-leaf pathway. The actual quantum yield of photosystem II (PS II) decreased under water stress conditions, while the maximum quantum yield of PS II did not vary among treatments, suggesting that PS II would not be damaged by water stress. The total dry weight reduced as water stress increased.

Keywords: cotton; eco-physiological performance; water stress; transpiration; stomatal aperture

Liliana Brankova, Sergei Ivanov, Vera Alexieva, The induction of microsomal NADPH:cytochrome P450 and NADH:cytochrome b5 reductases by long-term salt treatment of cotton (Gossypium hirsutum L.) and bean (Phaseolus vulgaris L.) plants, ***Plant Physiology and Biochemistry***, Volume 45, Issue 9, September 2007, Pages 691-695, ISSN 0981-9428, DOI: 10.1016/j.plaphy.2007.07.005.
(http://www.sciencedirect.com/science/article/B6VRD-4P7X4N5-2/2/4edcf3919e2c45e3290fb7ef7526642d)

Abstract:

We studied the effect of salinity on the activity of microsomal NADPH:cytochrome P450 reductase (CPR, EC 1.6.2.4) and NADH:ferricytochrome b5 oxidoreductase (B5R, EC 1.6.2.2) in two dicotyledonous plant species differing in their sensitivity to salt, cotton (Gossypium hirsutum L. cv Ogosta) and common bean (Phaseolus vulgaris L. cv Dobrujanski 7). A significant inhibition of fresh weight of salt-treated bean plants was observed, while cotton was affected to a much lesser degree. NaCl application resulted in a significant increase in the activity of both reductases, but was more pronounced in salt-tolerant cotton. We suppose that alterations in B5R and CPR activities may be targeted to the maintenance of membrane lipids. Most probably, plants use both enzymes (B5R and CPR) and their respective electron donors (NADH and NADPH) to reduce cytochrome b5, which can donate reducing equivalents to a series of lipid-modification reactions such as desaturation and hydroxylation.

Keywords: Common bean; Cotton; NADH:ferricytochrome b5 reductase; NADPH:cytochrome P450 reductase; Salt stress

Sangeeta Agarwal, Avnish Kapoor, O. Satya Lakshmi, Anil Grover, Production and phenotypic analysis of rice transgenics with altered levels of pyruvate decarboxylase and alcohol dehydrogenase proteins,
Plant Physiology and Biochemistry, Volume 45, Issue 9, September 2007, Pages 637-646, ISSN 0981-9428, DOI: 10.1016/j.plaphy.2007.07.008.
(http://www.sciencedirect.com/science/article/B6VRD-4P8GWVS-1/2/0c645fd1bcba975737393ac7894cccd3)

Abstract:

Pyruvate decarboxylase (Pdc) and alcohol dehydrogenase (Adh) enzymes are responsible for the operation of ethanolic fermentation pathway that appears to correlate to an extent with anoxia tolerance in plants. This study was undertaken with the objective of (a) analysing the rice pdc gene family and (b) altering the efficacy of the ethanolic fermentation process, through production of transgenic rice plants over- and under-expressing pyruvate decarboxylase (employing Ospdc1 gene from rice) as well as over-expressing alcohol dehydrogenase (employing Ghadh2 gene from cotton) proteins. Correlations noted in this study between the pattern of expression of the Pdc [alpha]-subunit and Ospdc2 transcript as well as between the Pdc [beta]-subunit and Ospdc1 transcript suggest the possibility that [alpha]-subunit is encoded by Ospdc2 and that [beta]-subunit is encoded by Ospdc1. The fact that levels of Pdc [beta]-subunit were particularly high in pUH-sPdc1 (plasmid construct designed for over-expression of Ospdc1) seedlings while levels of [beta]-subunit levels were negligible or lower in pUH-asPdc1 (plasmid construct designed for under-expression of Ospdc1) seedlings also support these observations. Transgenics raised for over-expression of Pdc and Adh and under-expression of Pdc were confirmed for the transgene presence and effects by PCR, Southern blotting, Northern blotting, Western blotting and isozyme assays. Pdc and Adh over-expressing rice transgenics at early seedling stage under unstressed control growth conditions showed slight, consistent advantage in root vigour as compared to that of wild-type seedlings.

Keywords: Alcohol dehydrogenase; Low O2 stress; Pyruvate decarboxylase; Rice; Transgenics

Robert D. Stipanovic, Lorraine S. Puckhaber, Joseph H. Reibenspies, Howard J. Williams, The absolute configuration of (-)-3-hydroxy-[alpha]-calacorene,
Phytochemistry, Volume 67, Issue 13, Reports on Structure Elucidation, July 2006, Pages 1304-1308, ISSN 0031-9422, DOI: 10.1016/j.phytochem.2006.05.019.
(http://www.sciencedirect.com/science/article/B6TH7-4K8SC2W-4/2/7cb127395237b1c76810f835461834e9)

Abstract:

3-Hydroxy-[alpha]-calacorene was identified in extracts from cold-shocked seedlings of cotton (Gossypium hirsutum L.) and kenaf (Hibiscus cannabinus L.), both of which are members of the Malvaceae family. (-)-3-Hydroxy-[alpha]-calacorene was isolated from Heterotheca inuloides Cass. (Asteraceae). HPLC on a chiral stationary phase column showed that the 3-hydroxy-[alpha]- calacorene from cotton and kenaf had the same relative configuration, while that from H. inuloides was of the opposite

configuration. X-ray crystallographic analysis established the absolute configuration of the compound in H. inuloides as (8R)-(-)-3-hydroxy-[alpha]-calacorene.

Keywords: Heterotheca inuloides; Gossypium hirsutum; Hibiscus cannabinus; Malvaceae; Cotton; Kenaf; Biosynthesis; Sesquiterpene; (-)-3- Hydroxy-[alpha]-calacorene

Wei-wei FAN, Li-an WANG, Chun-hong MA, Wen-qi DONG, Yun-chao LI, Zi-hui LIU, Yin-suo JIA, Jun-yi GENG, Xiang-yun ZHANG, The Influence of the Verticillium dahliae Kleb Infection on the Anti-Enzyme Inside the Body of the Cotton with Different Root Injured Degree,

Agricultural Sciences in China, Volume 6, Issue 7, July 2007, Pages 816-824, ISSN 1671-2927, DOI: 10.1016/S1671-2927(07)60117-5.
(http://www.sciencedirect.com/science/article/B82XG-4P9F020-7/2/9c140db3073ca24227328832e46c5a71)

Abstract:

This study was to explore the influence of the Verticillium dahliae Kleb inflection on the anti-enzyme inside the body of the cotton with a different root injured degree. When the cotton seedling was long, with four leaves, it was flushed with water carefully, and then the following were obtained: (1) complete root seedling; (2) cut root seedling - by cutting off the lower part, 3-5 cm of the root, with a disinfected knife; (3) injured root seedling - by cutting off most of the side roots, but keeping the main root. Three kinds of cotton seedlings with different roots were immersed separately in different concentrations of the germ liquid (V. dahliae) of 20 mL each. Through 0-48 h, the wilt degree of the seedling was recorded, and the related anti-enzyme of the variety was measured. After being immersed in the germ liquid, there was a significant difference in the wilt degree of the three kinds of injured root. When the germ liquid was in the ratio of 1:10, the complete root seedling was the lightest with no wilt; the injured root seedling was the second with a 2-degree wilt; but the cut root seedling was the most serious with a 3-degree wilt. At the same time, the changes in the peroxidase and malondialdehvde activities were determined. Peroxidase (POD) activities in the cut root seedling were 38.2 U mg-1 min-1, in the injured root seedling were 42.96 U mg-1 min-1, and in the complete root seedling were the highest at 49.2 U mg-1 min-1. The malondialdenvde (MDA) content in cut root seedling was 39.483 mmol g-1, injured root seedling was 27.12 mmol g-1, and the complete root seedling was only 3.845 mmol g-1. The activity of the related anti-enzymes, such as POD was high or low, the quantity of the MDA was more or less, which they met the order of the harm of the seedlings. The change of SOD activities in cut root seedling was the most obvious as well. After injuring and inflecting the young roots, the exterior pathological reaction of the seedling and the dynamic state biochemical reaction of the related enzymes inside the plant body were studied. It showed that the plant exterior pathology responded to the test, with the internal biochemical reaction fitting together mutually.

Keywords: cotton; Verticillium dahliae Kleb; injury of root; POD; SOD; MDA

Olga Veshkurova, Zamira Golubenko, Egor Pshenichnov, Irina Arzanova, Vyacheslav Uzbekov, Elvira Sultanova, Shavkat Salikhov, Howard J. Williams, Joseph H. Reibenspies, Lorraine S. Puckhaber, Robert D. Stipanovic, Malvone A, a phytoalexin found in Malva sylvestris (family Malvaceae),
Phytochemistry, Volume 67, Issue 21, November 2006, Pages 2376-2379, ISSN 0031-9422, DOI: 10.1016/j.phytochem.2006.08.010.
(http://www.sciencedirect.com/science/article/B6TH7-4KY88R1-1/2/d7551a9a222df353eaa4405b0477a19f)

Abstract:

The isolation and structure of a phytoalexin, malvone A (2-methyl-3-methoxy-5,6-dihydroxy-1,4-naphthoquinone) is reported. Malvone A formation is induced in Malva sylvestris L. by the plant pathogen Verticillium dahliae. In a turbimetric assay for toxicity to V. dahliae, it had an ED50 value of 24 [mu]g/ml. The structure of malvone A was determined by MS and NMR spectroscopy, and by X-ray crystallographic analysis. The X-ray analysis showed water molecules were located in channels that run along the a-axis.

Keywords: Malva sylvestris; Malvaceae; Gossypium; Cotton; Verticillium dahliae, Phytoalexin, Tetra-nor-sesquiterpene; 2-Methyl-3-methoxy-5,6-dihydroxy-1,4-naphthoquinone; Malvone A

PLANT PHYSIOLOGY-NUTRITION (22 jdl)

Chang-Qing Yang, Shan Lu, Ying-Bo Mao, Ling-Jian Wang, Xiao-Ya Chen, Characterization of two NADPH: Cytochrome P450 reductases from cotton (Gossypium hirsutum),
Phytochemistry, Volume 71, Issue 1, January 2010, Pages 27-35, ISSN 0031-9422, DOI: 10.1016/j.phytochem.2009.09.026.
(http://www.sciencedirect.com/science/article/B6TH7-4XKF9BJ-1/2/02fdd81a8658272f1e624d50bfeb9ca2)

Abstract:

Cytochrome P450 monooxygenases (P450s) are commonly involved in biosynthesis of endogenous compounds and catabolism of xenobiotics, and their activities rely on a partner enzyme, cytochrome P450 reductase (CPR, E.C.1.6.2.4). Two CPR cDNAs, GhCPR1 and GhCPR2, were isolated from cotton (Gossypium hirsutum). They are 71% identical to each other at the amino acid sequence level and belong to the Class I and II of dicotyledonous CPRs, respectively. The recombinant enzymes reduced cytochrome c, ferricyanide and dichlorophenolindophenol (DCPIP) in an NADPH-dependent manner, and supported the activity of CYP73A25, a cinnamate 4-hydroxylase of cotton. Both GhCPR genes were widely expressed in cotton tissues, with a reduced expression level of GhCPR2 in the glandless cotton cultivar. Expression of GhCPR2, but not GhCPR1, was inducible by mechanical wounding and elicitation, indicating that the GhCPR2 is more related to defense reactions, including biosynthesis of secondary metabolites.

Keywords: Gossypium hirsutum; P450 reductase; Secondary metabolism; Gossypol

Stephen P. Milroy, Michael P. Bange, Pongmanee Thongbai, Cotton leaf nutrient concentrations in response to waterlogging under field conditions,
Field Crops Research, Volume 113, Issue 3, 4 September 2009, Pages 246-255, ISSN 0378-4290, DOI: 10.1016/j.fcr.2009.05.012.
(http://www.sciencedirect.com/science/article/B6T6M-4WSR0R6-1/2/35ca94c011da409f1ac0613d6e07ba65)

Abstract:

Cotton is known to be poorly adapted to waterlogged conditions. When grown on soils with inherently low drainage rates, combined with the use of furrow irrigation and with summer dominant rainfall patterns, there is a significant risk of intermittent waterlogging. Good surface drainage is the most effective management option but when land-forming is poor or when substantial rain occurs soon after an irrigation application, significant yield loss can occur. Two field experiments were conducted in which cotton was subjected to waterlogging by extending the duration of furrow irrigation events. In order to assess the impact of waterlogging on plant nutrition, mineral nutrient concentrations in the youngest fully expanded leaves were measured repeatedly during the imposition of waterlogging, during recovery and through to the end of the growing season. Almost all nutrient concentrations were reduced by waterlogging but the extent and timing of recovery varied. A single early waterlogging event had a much greater impact (especially on N, P and K) than a single event late in development. Recovery from waterlogging appears to have been impaired during the period of rapid boll growth. During this period also, normal irrigation events caused transient reductions in some nutrients if the crop had been previously waterlogged. As with other studies on waterlogging, there was evidence that sodium concentration in leaves increased. While P and K concentrations were negatively associated with leaf sodium, there was no evidence that this relationship was altered by waterlogging.

Management of nutrition after waterlogging has previously focused on the correction of leaf N and Fe concentrations. The wide range of nutrients that was affected in our experiments suggests that the value of correcting nutrients other than N needs to be explored. In addition, the results suggest that there is also a need to promote growth after waterlogging, rather than only correcting the nutrient concentration, to provide a larger reserve of key nutrients to meet reproductive demand.

Keywords: Cotton; Gossypium hirsutum; Mineral nutrition; Nitrogen; Phosphorus; Potassium; Sodium; Waterlogging

Daiyuan Zhang, Irma L. Pirtle, Stacy J. Park, Mongkol Nampaisansuk, Purnima Neogi, Sylvia W. Wanjie, Robert M. Pirtle, Kent D. Chapman, Identification and expression of a new delta-12 fatty acid desaturase (FAD2-4) gene in upland cotton and its functional expression in yeast and Arabidopsis thaliana plants,
Plant Physiology and Biochemistry, Volume 47, Issue 6, Plant Lipids, June 2009, Pages 462-471, ISSN 0981-9428, DOI: 10.1016/j.plaphy.2008.12.024.
(http://www.sciencedirect.com/science/article/B6VRD-4VD9X1N-1/2/6489944b45e055f979bb886c099fe728)

Abstract:

A cotton (Gossypium hirsutum L.) genomic clone encompassing a 17.9-kb DNA fragment was found to contain a delta-12 fatty acid desaturase gene (designated FAD2-4). The FAD2-4 open reading frame has 1,155 bp and is uninterrupted, encoding a conceptual FAD2-4 polypeptide of 384 amino acids that has 98% identity with the cotton FAD2-3 polypeptide. The FAD2-4 gene has a single intron of 2,780 bp in its 5'-untranslated region (5'-UTR). The 3'-flanking regions and 5'-UTR introns in the FAD2-4 and FAD2-3 genes are quite different, indicating that the genes might be paralogs in the cotton genome. Reverse transcriptase (RT)-PCR analysis indicated that the FAD2-4 and FAD2-3 genes were expressed in all tissues examined, including seeds, seedling tissues, young and mature leaves, roots, stems, developing flower buds, and ovule fibers. These constitutive patterns of expression were notably different from that of the FAD2-1 gene, which was restricted to seeds and developing flower buds, or to the expression of a newly-identified FAD2-2 gene isoform, which was barely detectable in roots, hypocotyls, stems, and fibers, but was expressed in all other tissues. The FAD2-4 coding region was expressed in yeast and shown to encode a functional delta-12 desaturase, converting oleic acid (C18:1) to linoleic acid (C18:2) in recombinant yeast cells. In addition, both the FAD2-4 and the FAD2-3 genes were transferred into the Arabidopsis thaliana fad2-1 mutant background where they effectively restored wild type fatty acid composition and growth characteristics. Finally, the cotton FAD2-4 green fluorescent protein (GFP) fusion polypeptide appeared to be localized in the endomembrane system of transgenic Arabidopsis plants in the complemented fad2-1 mutant background, supporting a functional ER location for the cotton FAD2-4 polypeptide in this heterologous plant system. Thus, a new functional member of the FAD2 gene family in cotton has been characterized, indicating a complex regulation of membrane lipid desaturation in this important fiber/oilseed crop.

Keywords: Delta-12 fatty acid desaturase 2; Gossypium hirsutum L.; Linoleic acid; Oleic acid; Polyunsaturated fatty acid metabolism

Jonghan Ko, Giovanni Piccinni, Characterizing leaf gas exchange responses of cotton to full and limited irrigation conditions,
Field Crops Research, Volume 112, Issue 1, 30 April 2009, Pages 77-89, ISSN 0378-4290, DOI: 10.1016/j.fcr.2009.02.007.
(http://www.sciencedirect.com/science/article/B6T6M-4VVRCNP-1/2/9eb9f2e55e28cf5512ca107b2e7ce7a5)

Abstract:

Plant responses to water deficit need to be monitored for producing a profitable crop as water deficit is a major constraint on crop yield. The objective of this study was to evaluate physiological responses of cotton (Gossypium hirsutum) to various environmental conditions under limited water availability using commercially available varieties grown in South Texas. Soil moisture and variables of leaf gas exchange were measured to monitor water deficit for various varieties under different irrigation treatments. Lint yield and growth variables were also measured and correlations among growth parameters of interest were investigated. Significant differences were found in soil moisture, leaf net assimilation (An), stomatal conductance (g), transpiration rate

(Tr), and instantaneous water use efficiency (WUEi) among irrigation treatments in 2006 while no significant differences were found in these parameters in 2007. Some leaf gas exchange parameters, e.g., Tr, and leaf temperature (TL) have strong correlations with An and g. An and WUE were increased by 30-35% and 30-40%, respectively, at 600 [mu]mol (CO2) m-2 s-1 in comparison with 400 [mu]mol (CO2) m-2 s-1. Lint yield was strongly correlated with g, Tr, WUE, and soil moisture at 60 cm depth. Relative An, Tr, and TL started to decrease from FTSW 0.3 at 60 cm and FTSW 0.2 at 40 cm. The results demonstrate that plant water status under limited irrigation management can be qualitatively monitored using the measures of soil moisture as well as leaf gas exchange, which in turn can be useful for describing yield reduction due to water deficit. We found that using normalized An, Tr, and TL is feasible to quantify plant water deficit.
Keywords: Photosynthesis; Water use efficiency; Yield

Vijaya Singh, Charles K. Pallaghy, Dhananjay Singh, Phosphorus nutrition and tolerance of cotton to water stress: II. Water relations, free and bound water and leaf expansion rate,
Field Crops Research, Volume 96, Issues 2-3, 30 April 2006, Pages 199-206, ISSN 0378-4290, DOI: 10.1016/j.fcr.2005.06.011.
(http://www.sciencedirect.com/science/article/B6T6M-4GWC0W0-7/2/87a27969a61b154d9eb065fcc5ea2639)
Abstract:

In previous experiments, increased leaf-Phosphorus (P) content with increasing P supply enhanced the individual leaf expansion and water content of fresh cotton leaves in a severely drying soil. In this paper, we report on the bulk water content of leaves and its components, free and bound water, along with other measures of plant water status, in expanding cotton leaves of various ages in a drying soil with different P concentrations. The bound water in living tissue is more likely to play a major role in tolerance to abiotic stresses by maintaining the structural integrity and/or cell wall extensibility of the leaves, whilst an increased amount of free water might be able to enhance solute accumulation, leading to better osmotic adjustment and tolerance to water stress, and maintenance of the volumes of sub-cellular compartments for expansive leaf growth. There were strong correlations between leaf-P%, leaf water (total, free and bound water) and leaf expansion rate (LER) under water stress conditions in a severely drying soil. Increased soil-P enhanced the uptake of P from a drying soil, leading to increased supply of osmotically active inorganic solutes to the cells in growing leaves. This appears to have led to the accumulation of free water and more bound water, ultimately leading to increased leaf expansion rates as compared to plants in low P soil under similar water stress conditions. The greater amount of bound and free water in the high-P plants was not necessarily associated with changes in cell turgor, and appears to have maintained the cell-wall properties and extensibility under water stressed conditions in soils that are nutritionally P-deficient.
Keywords: Water content; Free and bound water; Leaf expansion rate; Cotton; Phosphorus; Water stress; Cell turgor

Xue-Lin LI, Zhong-Xu LIN, Yi-Chun NIE, Xiao-Ping GUO, Xian-Long ZHANG, Methylation-Sensitive Amplification Polymorphism of Epigenetic Changes in Cotton Under Salt Stress,

Acta Agronomica Sinica, Volume 35, Issue 4, April 2009, Pages 588-596, ISSN 1875-2780, DOI: 10.1016/S1875-2780(08)60073-5.
(http://www.sciencedirect.com/science/article/B94TW-4XDMBNT-2/2/721ff49f7fdd4f32d84b31eaf18de256)

Abstract:

The objective of the study was to dissect the cytosine methylation in cotton (Gossypium hirsutum L.) genome and the changes in pattern of cytosine methylation under salt stress. Germinated seeds of an inbred cotton line YZ1 were treated with 100 to 200 mmol L-1 of NaCl solution for 3 weeks, and the growth of plantlets were measured. The results showed that 100 mmol L-1 NaCl obviously promoted plant height and root length of cotton seedlings, but 200 mmol L-1 NaCl significantly inhibited plant growth. When the NaCl concentration was ranging from 100 to 200 mmol L-1, the number of lateral root was considerably inhibited by the salt stress. The genomic DNA and total RNA were extracted 3 weeks after NaCl treatment. According to the analysis of methylation-sensitive amplified polymorphism (MSAP), the level of global DNA methylation showed a decreas from 41.2% to 34.5% as the salt concentration increased. There was a significantly negative correlation ($r = -0.986$, $P < 0.05$) between the NaCl concentration and the level of DNA methylation in cotton roots. Under the treatments with 100, 150, and 200 mmol L-1 NaCl, the ratios of DNA methylation were 6.4%, 7.6%, and 11.3% based on the control (0 mmol L-1 NaCl), and the percentages of DNA demethylation were 12.7%, 11.1%, and 8.2%, respectively. The results of reverse transcription PCR (RT-PCR) showed that the highly homologous fragments from the control and the salt treatment expressed in different patterns, suggesting that these genes probably play an important role in cotton adaptation to salt stress.

Keywords: cotton; salt stress; DNA methylation; methylation-sensitive amplified polymorphism; RT-PCR

Rong-Hui MA, Nai-Yin XU, Chuan-Xi ZHANG, Wen-Feng LI, Ying FENG, Lei QU, You-Hua WANG, Zhi-Guo ZHOU, Physiological Mechanism of Sucrose Metabolism in Cotton Fiber and Fiber Strength Regulated by Nitrogen,

Acta Agronomica Sinica, Volume 34, Issue 12, December 2008, Pages 2143-2151, ISSN 1875-2780, DOI: 10.1016/S1875-2780(09)60023-7.
(http://www.sciencedirect.com/science/article/B94TW-4WBT18W-6/2/99f57b8183652d487c3a928a3b2f6786)

Abstract:

Two cotton (Gossypium hirsutum L.) cultivars, KC-1 with average fiber strength of 35 cN tex -1 and AC-33B with average fiber strength of 32 cN tex-1 were used to study effectiveness of nitrogen on fiber strength. Three nitrogen application rates (0, 240, and 480 kg ha-1), standing for low, moderate, and high nitrogen levels, respectively, were applied in field experiments in Nanjing (118[degree sign]50'E, 32[degree sign]02'N, middle lower reaches of Yangtze River Valley) and Xuzhou (117[degree sign]11'E, 34[degree sign]15'N, Yellow River Valley). The changes of

nitrogen concentration in the subtending leaf of cotton boll followed the equation YN = at-b, where YN is nitrogen concentration in the subtending leaf of cotton boll (%); t is boll age (d); a and b are parameters. Parameter awas the highest under the high-nitrogen level in both cultivars, explaining the decreases of sucrose inversion amount and enzymes (invertase, sucrose synthetase, and sucrose phosphate synthetase) activities before boll age of 24 d as well as the maximal speed of cellulose accumulation in cotton fiber and fiber strength since the boll age of 24 d. Parameter b was the highest under the low-nitrogen level in both cultivars, indicating negative effects on sucrose metabolism after boll age of 24 d, the shortened duration of cellulose rapid accumulation in cotton fiber, and the reduced increment of fiber strength from boll age of 24 d to boll opening. These changes were important physiological responses to nitrogen concentration in the subtending leaf of cotton boll during cotton fiber development, and ultimately resulted in lower final fiber strength under both high- and low-nitrogen level. In the subtending leaf of cotton boll, boll age of 24 d was a transition point of sucrose metabolism in cotton fiber and fiber strength regulated by nitrogen.
Keywords: cotton; subtending leaf of cotton boll; leaf nitrogen concentration; cotton fiber; sucrose metabolism; fiber strength

Hong-Biao HU, Wen-Jing ZHANG, Bing-Lin CHEN, You-Hua WANG, Hong-Mei SHU, Zhi-Guo ZHOU, Changes in C/N Ratio of Subtending Leaf of Cotton Boll and Its Relationship with Cotton Boll Dry Matter Accumulation and Distribution,
Acta Agronomica Sinica, Volume 34, Issue 2, February 2008, Pages 254-260, ISSN 1875-2780, DOI: 10.1016/S1875-2780(08)60012-7.
(http://www.sciencedirect.com/science/article/B94TW-4T5JDPK-7/2/2b95b0e3f3ad9de1686d9f7784dc863a)
Abstract:

Fourteen cotton (Gossypium hirsutum L.) cultivars differing in yield were used to study the C/N ratio in the subtending leaf of cotton boll and its effect on boll dry matter accumulation and distribution. The 14 cultivars were clustered into 3 groups according to different changing patterns of C/N ratio in the subtending leaf of cotton boll. There were significant differences in dynamic changes of the C/N ratio and dry weight per boll among the 3 groups. Group III show much higher C/N ratio than Groups I and II from 10 to 17 d of boll age, and it maintained the C/N ratio of approximately 2.5 after 24 d of boll age. Group III also showed the widest changing range and the highest average values during the whole boll development. The boll dry matter accumulation of Group III took the longest time period and the lowest accumulating rate, which resulted in the highest final dry weight per boll and boll weight. The distributions of dry matter in cotton boll (percentages of boll-shell, seed, and lint) were not significantly different among the 3 groups. The C/N ratio in the subtending leaf of boll had no correlation to lint percentage and lint yield. The results indicated that the dynamics of the C/N ratio in the subtending leaf of cotton boll are significantly different among genotypes. A favorable pattern for dry matter accumulation in cotton boll is the sharp decrease in C/N ratio from 10 to 17 d of boll age, which is maintained at a relatively higher level after 24 d of boll age.
Keywords: subtending leaf of cotton boll; C/N ratio; dry matter accumulation and distribution

Yu YU, Zhi-Wei WANG, Chang-Hui FENG, Yan-Xin ZHANG, Zhong-Xu LIN, Xian-Long ZHANG, Genetic Evaluation of EST-SSRs Derived from Gossypium herbaceum,
Acta Agronomica Sinica, Volume 34, Issue 12, December 2008, Pages 2085-2091, ISSN 1875-2780, DOI: 10.1016/S1875-2780(09)60020-1.
(http://www.sciencedirect.com/science/article/B94TW-4WBT18W-3/2/cd539962ed56db2211adfc880e84e24e)

Abstract:

To investigate contribution of Gossypium herbaceum to the tetraploid genome, expressed sequence tag (EST)-simple sequence repeats (SSRs) were isolated from 247 EST sequences of G. herbaceum documented in GenBank. Twenty-seven perfect SSRs were identified from 25 unique ESTs. These SSRs contained 1 to 6 bp nucleotide motifs with high frequency for 2 bp and 3 bp nucleotide motifs. A total of 25 primers were developed and 22 of them amplified clear bands in 24 cotton accessions (7 diploids of A genome, 11 diploids of D genome, and 6 allotetraploids of AD genome). These primers generated 92 polymorphic bands with an average of 3.64 per primer. The polymorphism information content (PIC) ranged from 0.49 to 0.91 with an average of 0.81. Among the 25 EST-SSR primers, 6 primers revealed polymorphism between Emian 22 and Pima 3-79, and yielded 7 polymorphic loci (5 codominant and 2 dominant) in the BC1 population (Emian 22/Pima 3-79//Emian 22). Only HAU230b showed distorted segregation in the BC1 population. The 6 polymorphic loci were integrated into 6 chromosomes of the interspecific linkage map with BC1 genetic. Among them, 4 loci were mapped on chromosomes 6, 10, 11, and 12 of A subgenome, and 2 loci on chromosomes 19 and 20 of D subgenome.

Keywords: Gossypium herbaceum; EST; SSR; polymorphism information content (PIC); genetic map

Jinggao Liu, Robert D. Stipanovic, Alois A. Bell, Lorraine S. Puckhaber, Clint W. Magill, Stereoselective coupling of hemigossypol to form (+)-gossypol in moco cotton is mediated by a dirigent protein,
Phytochemistry, Volume 69, Issue 18, Tannin/Polyphenol Special Issue, December 2008, Pages 3038-3042, ISSN 0031-9422, DOI: 10.1016/j.phytochem.2008.06.007.
(http://www.sciencedirect.com/science/article/B6TH7-4T118N6-2/2/acf9282958f1e23b7e04466d37253bfe)

Abstract:

The terpenoid gossypol, a secondary metabolite found in the cotton plant, is synthesized by a free radical dimerization of hemigossypol. Gossypol exists as an atropisomeric mixture because of restricted rotation around the central binaphthyl bond. The dimerization of hemigossypol is regiospecific in cotton. In the case of some moco cotton, the dimerization also exhibits a high level of stereoselectivity. The mechanism that controls this stereoselective dimerization is poorly understood. In this paper, we demonstrate that a dirigent protein controls this stereoselective dimerization process. A partially purified protein preparation from cotton flower petals, which by itself is unable to convert hemigossypol to gossypol, converts hemigossypol with a 30% atropisomeric excess into (+)-gossypol when combined with an exogenous laccase, which by itself produces racemic gossypol.

Keywords: Dirigent protein; Moco cotton; Gossypium hirsutum; Malvaceae; (+)-Gossypol; Gossypol biosynthesis; Hemigossypol; Oxidative coupling; Peroxidase; Stereoselectivity

Cun-cang JIANG, Fang CHEN, Xiang-zhao GAO, Jian-wei LU, Kai-yuan WAN, Fu-zhao NIAN, Yun-hua WANG, Study on the Nutrition Characteristics of Different K Use Efficiency Cotton Genotypes to K Deficiency Stress,
Agricultural Sciences in China, Volume 7, Issue 6, June 2008, Pages 740-745, ISSN 1671-2927, DOI: 10.1016/S1671-2927(08)60109-1.
(http://www.sciencedirect.com/science/article/B82XG-4SWFK1G-F/2/847e6061c5be6973439b4424cdbcc0cc)

Abstract:

To study the mechanism of plant K use efficiency, both K high and low use efficiency cotton genotypes, 103 and 122, respectively, were selected from 86 cotton cultivars (Gossypium hirsutum L.). The research was conducted using pot experiment for planting cotton on without K (0.0 g kg-1 soil) and with K (0.4 g kg-1 soil) treatments in 2005. Experimental result showed that, with K deficiency stress, genotype 103 grew much better than genotype 122 except that its lower leaves showed the symptoms of K deficiency, whereas all the leaves of genotype 122 showed the symptoms of K deficiency. Root dry matter weights of treatments for genotype 103 with and without K application were 1.07 and 1.25 times of genotype 122. It indicated that the root system of genotype 103 was well developed and has better nutrition uptake capability than that of genotype 122. The result also showed that the cotton shoots of genotype 103 were 1.07 and 1.13 times over genotype 122 on treatments of with and without K application. It indicated that genotype 103 has stronger transport organs. In genotype 103, plants, dry matter, and potassium were mainly transported to cotton bolls. The boll dry weight of genotype 103 was 2.58 times in without K treatment and 1.90 times in with K treatment over genotype 122. The potassium accumulation in bolls of genotype 122 was only 49.3% of that in genotype 103. Potassium accumulation in the other organs of genotype 103 was relatively low compared with in bolls. This indicated that the distribution of K and organic matter in genotype 103 was more efficient than genotype 122. The main differences between high K efficiency cotton genotype 103 and low K efficiency genotype 122 lie in their potassium nutrition and organic matter using efficiency on uptake, transportation, accumulation, distribution, and utilization.

Keywords: cotton (Gossypium hirsutum L.); potassium use efficiency; genotype; uptake capability; distribution ability

A. Mishra, S. Khare, P.K. Trivedi, P. Nath, Effect of ethylene, 1-MCP, ABA and IAA on break strength, cellulase and polygalacturonase activities during cotton leaf abscission,
South African Journal of Botany, Volume 74, Issue 2, April 2008, Pages 282-287, ISSN 0254-6299, DOI: 10.1016/j.sajb.2007.12.001.
(http://www.sciencedirect.com/science/article/B7XN9-4RJSJ8G-1/2/4895f626f04fbf8cf0aef7cfed676a74)

Abstract:

Organ abscission in higher plants has invariably been characterized by higher activities of cell wall hydrolases in the abscission zone of the abscising organ, which facilitates degradation of middle lamella and loosening of cell wall of separation layers. The plant hormone ethylene has been implicated in the induction and progression of the abscission process. In the present study, we have measured activities of cellulase and polygalacturonase (PG) in the abscission zone of cotton (Gossypium hirusutum var RST-39) leaf explants in the presence of ethylene. The effects of abscisic acid (ABA) and indole acetic acid (IAA) were monitored to elucidate the role of other phytohormones in the process of abscission. A several fold increase in cellulase and PG activities and decrease in break strength were observed in the LAZ of ethylene-treated explants. The increase in enzyme activities and decrease in break strength were strongly suppressed in the presence of 1-methylcyclopropene (1-MCP) and IAA. ABA alone was found to stimulate enzyme activities and decrease the break strength though not to the extent of ethylene. 1-MCP pretreatment of ABA and ethylene-treated explants showed significant inhibition in enzyme activities. It is concluded that cotton leaf abscission is ethylene regulated and characterized by increased activities of cellulase and PG in its abscission zone. ABA can induce abscission. However, it appears that ABA induced abscission may be mediated through ethylene.

Keywords: 1-MCP; Breakstrength; Cell wall hydrolases; Ethylene; Gossypium hirusutumn; Leaf abscission

A. Massacci, S.M. Nabiev, L. Pietrosanti, S.K. Nematov, T.N. Chernikova, K. Thor, J. Leipner, Response of the photosynthetic apparatus of cotton (Gossypium hirsutum) to the onset of drought stress under field conditions studied by gas-exchange analysis and chlorophyll fluorescence imaging,

Plant Physiology and Biochemistry, Volume 46, Issue 2, February 2008, Pages 189-195, ISSN 0981-9428, DOI: 10.1016/j.plaphy.2007.10.006.

(http://www.sciencedirect.com/science/article/B6VRD-4PWF0HX-4/2/e1cd8d6e76ae57e5338159eeee9ea319)

Abstract:

The functioning of the photosynthetic apparatus of cotton (Gossypium hirsutum) grown during the onset of water limitation was studied by gas-exchange and chlorophyll fluorescence to better understand the adaptation mechanisms of the photosynthetic apparatus to drought conditions. For this, cotton was grown in the field in Central Asia under well-irrigated and moderately drought-stressed conditions. The light and CO2 responses of photosynthesis (AG), stomatal conductance (gs) and various chlorophyll fluorescence parameters were determined simultaneously. Furthermore, chlorophyll fluorescence images were taken from leaves to study the spatial pattern of photosystem II (PSII) efficiency and non-photochemical quenching parameters. Under low and moderate light intensity, the onset of drought stress caused an increase in the operating quantum efficiency of PSII photochemistry ([phi]PSII) which indicated increased photorespiration since photosynthesis was hardly affected by water limitation. The increase in [phi]PSII was caused by an increase of the efficiency of open PSII reaction

centers (Fv'/Fm') and by a decrease of the basal non-photochemical quenching ([phi]NO). Using a chlorophyll fluorescence imaging system a low spatial heterogeneity of [phi]PSII was revealed under both irrigation treatments. The increased rate of photorespiration in plants during the onset of drought stress can be seen as an acclimation process to avoid an over-excitation of PSII under more severe drought conditions.

Keywords: Chlorophyll fluorescence imaging; Drought acclimation; Gossypium hirsutum; Photorespiration; Photosynthesis; Stomatal conductance

He-zhong DONG, Wei TANG, Wei-jiang LI, Zhen-huai LI, Yue-hua NIU, Dong-mei ZHANG, Yield, Leaf Senescence, and Cry1Ac Expression in Response to Removal of Early Fruiting Branches in Transgenic Bt Cotton,
Agricultural Sciences in China, Volume 7, Issue 6, June 2008, Pages 692-702, ISSN 1671-2927, DOI: 10.1016/S1671-2927(08)60104-2.
(http://www.sciencedirect.com/science/article/B82XG-4SWFK1G-8/2/6aad70e2d066a6ca51dd7d3f0d6f24d7)

Abstract:

Two-year field experiments were conducted at Linqing, Yellow River valley of China, to study the plant response to the removal of early fruiting branches in transgenic Bt (Bacillus thuringiensis) cotton (Gossypium hirsutum L.) from 2003 to 2004. Plants were undamaged and treated by removing two basal fruiting branches (FB) at squaring to form the control and the removal treatment, respectively. The plant height, leaf area (LA), dry weight of fruiting forms (DWFF), the number of fruiting nodes (NFN), photosynthetic (Pn) rate, and levels of leaf chlorophyll (Chl), N, P, K, and Cry1Ac protein in main-stem leaves were measured at a 10- or 20-d interval after FB removal, and the sink/source ratio as indicated by NFN/LA and DWFF/LA was determined. FB removal significantly increased the plant height, LA, and plant biomass in both years. Lint yields were increased 7.5 and 5.2% by removal compared with their controls in 2003 and 2004, respectively. Significant increases in boll size (5.7 and 5.1%) were also observed in removal than in control for both years. Either NFN/LA or DWFF/LA was significantly reduced by removal before 40 d after removal; however, both NFN/LA and DWFF/LA were significantly enhanced by FB removal at 80 d after removal compared to the untreated control. There was no significant difference in fiber quality in the first two harvests between removal and control, but fiber strength and micronarie in the third harvest were significantly improved by FB removal. In terms of leaf Chl, Pn rate, levels of total N, P, and K in late season, leaf senescence was considerably delayed by FB removal. Levels of Cry1Ac protein in the fully expanded young leaves were considerably higher in FB-excised plants than in control, indicating FB removal enhanced Cry1Ac expression. It is suggested that the yield and quality improvement with FB removal may be attributed to the increased NFN/LA or DWFF/LA in late season and delayed leaf senescence, respectively. FB removal can be a potential practice incorporated into the intensive cultivation system for enhancing transgenic Bt cotton production.

Keywords: branch removal; Bt cotton; Cry1Ac protein; leaf senescence; photosynthetic rate; sink/source ratio

Vijaya Singh, Charles K Pallaghy, Dhananjay Singh, Phosphorus nutrition and tolerance of cotton to water stress: I. Seed cotton yield and leaf morphology,
Field Crops Research, Volume 96, Issues 2-3, 30 April 2006, Pages 191-198, ISSN 0378-4290, DOI: 10.1016/j.fcr.2005.06.009.
(http://www.sciencedirect.com/science/article/B6T6M-4H0BSXP-1/2/a345c3f0fc8aec58d98df799388d890a)

Abstract:

Seed cotton yield and morphological changes in leaf growth were examined under drying soil with different phosphorus (P) concentrations in a tropical climate. Frequent soil drying is likely to induce a decrease in nutrients particularly P due to reduced diffusion and poor uptake, in addition to restrictions in available water, with strong interactive effects on plant growth and functioning. Increased soil P in field and in-ground soil core studies increased the seed cotton yield and related morphological growth parameters in a drying soil, with hot (daily maximum temperature >33 [degree sign]C) and dry conditions (relative humidity, 25% to 35%), particularly during peak boll formation and filling stage. The soil water content in the effective rooting zone (top 0.4 m) decreased to -1.5 MPa by day 5 of the soil drying cycle. However, the increased seed cotton yield for the high-P plants was closely related to increasing leaf area with increased P supply. Plant height, leaf fresh mass and leaf area per plant were positively related to the leaf P%, which increased with increasing P supply. Low P plants were lower in plant height, leaf area, and leaf tissue water in the drying soil. Individual leaf area and the water content of the fresh leaf (ratio of dry mass to fresh mass) were significantly dependent on leaf P%.

Keywords: Cotton; Phosphorus; Water stress; Leaf expansion; Leaf water

Chauncey R. Benedict, Jinggao Liu, Robert D. Stipanovic, The peroxidative coupling of hemigossypol to (+)- and (-)-gossypol in cottonseed extracts,
Phytochemistry, Volume 67, Issue 4, February 2006, Pages 356-361, ISSN 0031-9422, DOI: 10.1016/j.phytochem.2005.11.015.
(http://www.sciencedirect.com/science/article/B6TH7-4HYV07Y-1/2/d178b05e133fea6d476f55bf5151d989)

Abstract:

Peroxidase(s) present in embryo extracts of Gossypium hirsutum cv. Texas Marker 1 catalyzed a bimolecular coupling of [4-3H]-hemigossypol to [4,4'-3H2]-gossypol. The reaction was dependent on the addition of H2O2 and was inhibited 71-94% by 1 and 10 mM sodium azide. The phenolic coupling produced 53% (+)-gossypol and 47% (-)-gossypol in close agreement to the 49% (+)-gossypol and 51% (-)-gossypol found in the intact seed. The nearly racemic mixture of (+)-and (-)-gossypol produced in these embryo extracts can be accounted for by non-enzymatic random coupling of the free radicals of hemigossypol produced by the peroxidase. In contrast, peroxidase reaction mixtures containing crude embryo extracts of G. hirsutum var. marie-galante produced 73% (+)-gossypol and 27% (-)-gossypol. These data from the marie-galante extracts and the fact that these intact seed contain 95% (+)-gossypol suggest a regio-stereoselective bimolecular coupling of hemigossypol to gossypol. The development of the peroxidative coupling of hemigossypol to gossypol in maturing seed of G. hirsutum

cv. Texas Marker 1 was correlated to the formation of gossypol and suggests that peroxidative coupling of hemigossypol contributes to gossypol biosynthesis.

Keywords: Gossypium hirsutum; Malvaceae; Cotton; Peroxidative coupling; Gossypol formation; Hemigossypol coupling; Dirigent protein

Peng Gao, Pi-Ming Zhao, Juan Wang, Hai-Yun Wang, Xiong-Ming Du, Gui-Ling Wang, Gui-Xian Xia, Co-expression and preferential interaction between two calcineurin B-like proteins and a CBL-interacting protein kinase from cotton,

Plant Physiology and Biochemistry, Volume 46, Issue 10, October 2008, Pages 935-940, ISSN 0981-9428, DOI: 10.1016/j.plaphy.2008.05.001.
(http://www.sciencedirect.com/science/article/B6VRD-4SK62T7-1/2/9437158e15029ac64778502ac2f12e4d)

Abstract:

The CBL/CIPK signaling system mediates a variety of responses to environmental stimuli in plants. In this work, we identified four CBL genes from Gossypium hirsutum, two of which (designated GhCBL2 and GhCBL3) showed preferential expression in the elongating fiber cells. Moreover, the expression patterns of these two CBL genes coincided with that of a putative CBL-interacting protein kinase gene (GhCIPK1) that we isolated in a previous study. Yeast two-hybrid assay indicated that among the four CBLs, GhCIPK1 interacted selectively with GhCBL2 and GhCBL3. The co-expression and interactions of these proteins suggest that they are components of the same signaling pathway. These findings strengthen our previous prediction that CBL/CIPK signaling plays a critical role in the regulation of cotton fiber elongation.

Keywords: Cotton fiber; Calcineurin B-Like protein; CBL-interacting protein kinase

Walter E. Thomas, Wesley J. Everman, James R. Collins, Clifford H. Koger, John W. Wilcut, Rain-free requirement and physiological properties of cotton plant growth regulators,

Pesticide Biochemistry and Physiology, Volume 88, Issue 3, July 2007, Pages 247-251, ISSN 0048-3575, DOI: 10.1016/j.pestbp.2006.12.002.
(http://www.sciencedirect.com/science/article/B6WP8-4MJSCG3-2/2/3bc472a69379a5fc4648aa360f596c10)

Abstract:

Greenhouse studies were conducted to (1) evaluate the rain-free requirement for mepiquat chloride and mepiquat chloride plus cyclanilide with and without surfactant and to (2) evaluate absorption and translocation of cyclanilide, a component of a new cotton plant growth regulator. No significant differences in the number of nodes, leaf area, and plant organ fresh and dry weight were observed with any PGR treatment and rainfall simulation combination. Both plant growth regulators responded similarly to rainfall interval. As rain-free period increased, cotton height was reduced. Based on these data, a rain-free period of 8 h is needed to maximize efficacy, regardless of the use of surfactant. Absorption of cyclanilide ranged from 11 to 15% at 3 and 48 h after

treatment, respectively. Averaged over harvest intervals, 18% of the applied cyclanilide remained in the treated leaf while 1.7 and 6.5% of the applied cyclanilide was found in the above and below treated leaf tissue, respectively.

Keywords: Plant height; Absorption; Translocation; Rain-free period; Leaf area

M. Zwiegelaar, I.A. Dubery, Early activation of cell wall strengthening-related gene transcription in cotton by a Verticillium dahliae elicitor,

South African Journal of Botany, Volume 72, Issue 3, August 2006, Pages 467-472, ISSN 0254-6299, DOI: 10.1016/j.sajb.2005.12.012.
(http://www.sciencedirect.com/science/article/B7XN9-4JS1TN9-7/2/9a4a76fc6a92a392370edb9141f7b1cc)

Abstract:

Differential expression of genes in cultured cotton cells and leaf disks that have been challenged with a purified elicitor from Verticillium dahliae, was investigated in order to identify genes involved in the early defense response of cotton. The mRNA differential display reverse transcriptase polymerase chain reaction was used to identify differentially expressed genes 5 h after application of 50 [mu]g mL- 1 Verticillium dahliae elicitor. Sequence analysis of selected amplicons revealed homologies with genes involved in metabolism of carbohydrate precursors for cell wall synthesis. cDNAs identified that were up-regulated after elicitor treatment coded for homologs to a UDP-N-acetylglucosamine pyrophosphorylase-like protein, a glucosyltransferase-like protein, a beta-1,4-N-acetylglucosaminyltransferase, a cellulose synthase-like protein, a 3-deoxy-d-manno-octulosonic acid transferase-like protein and a hydroxyproline-rich glycoprotein. In addition, one cell wall-related cDNA that was down-regulated after elicitor treatment, coded for a proline-rich protein family member homolog. The differential expression of the cDNAs up-regulated after the Verticillium dahliae elicitor treatment was confirmed with reverse Northern dot blots. These results indicate that metabolic reprogramming through the enhanced synthesis of carbohydrate precursors accompanies the activation of de novo cell wall synthesis. As such it is important for the understanding of early defense related responses in cotton and for their biotechnological manipulation.

Keywords: Cell wall; Cotton; Differential display; Elicitor; Gene expression; Verticillium

Xing-mei SUO, Ying-tao JIANG, Mei YANG, Shao-kun LI, Ke-rum WANG, Chong-tao WANG, Artificial Neural Network to Predict Leaf Population Chlorophyll Content from Cotton Plant Images,

Agricultural Sciences in China, Volume 9, Issue 1, January 2010, Pages 38-45, ISSN 1671-2927, DOI: 10.1016/S1671-2927(09)60065-1.
(http://www.sciencedirect.com/science/article/B82XG-4YJ4CW6-6/2/480798ff87bd018133ec364857e9cf4b)

Abstract:

Leaf population chlorophyll content in a population of crops, if obtained in a timely manner, served as a key indicator for growth management and diseases

diagnosis. In this paper, a three-layer multilayer perceptron (MLP) artificial neural network (ANN) based prediction system was presented for predicting the leaf population chlorophyll content from the cotton plant images. As the training of this prediction system relied heavily on how well those leaf green pixels were separated from background noises in cotton plant images, a global thresholding algorithm and an omnidirectional scan noise filtering coupled with the hue histogram statistic method were designed for leaf green pixel extraction. With the obtained leaf green pixels, the system training was carried out by applying a back propagation algorithm. The proposed system was tested to predict the chlorophyll content from the cotton plant images. The results using the proposed system were in sound agreement with those obtained by the destructive method. The average prediction relative error for the chlorophyll density ([mu]g cm-2) in the 17 testing images was 8.41%.

Keywords: artificial neural network; image processing; cotton plant; leaf population chlorophyll content; prediction

Wenfeng Li, Zhiguo Zhou, Yali Meng, Naiyin Xu, Michel Fok, Modeling boll maturation period, seed growth, protein, and oil content of cotton (Gossypium hirsutum L.) in China, ***Field Crops Research***, Volume 112, Issues 2-3, 26 June 2009, Pages 131-140, ISSN 0378-4290, DOI: 10.1016/j.fcr.2009.02.009.
(http://www.sciencedirect.com/science/article/B6T6M-4VXT0WC-1/2/5d2161a5ce37b7d2d89c2ada34d85cc5)

Abstract:

The simulation of cottonseed (Gossypium hirsutum L.) growth is still an area of great uncertainty, especially in the process of cottonseed quality formation. A simple process-based model was developed to predict cotton boll maturation period and simulate cottonseed biomass accumulation, protein, and oil content. The cotton boll maturation period module took solar radiation and N nutrition factors into account in addition to temperature and variety maturity profile. Based on the hypothesis that the accumulation of biomass, oil, and protein are mainly sink-determined, the model was developed by considering parameters of cultivar characteristics, weather (temperature and solar radiation), and crop management variables (precisely N supply). The subtending leaf N concentration of cotton boll was simulated by a new semi-empirical model, and worked as the direct indicator of the N nutrition effect on cottonseed growth and development. The model was calibrated using data obtained in experiment conducted in Nanjing (the lower reaches of Yangtze River Valley) in 2005 and 2006. The model was then tested using two field experimental data sets. One was obtained in Nanjing, China in 2007, and the other in the Yellow River Valley (Xuzhou and Anyang) and the lower reaches of Yangtze River Valley (Huaian), China in 2005. The simulated values of boll maturation period by the model were very consistent with the observed values, with root mean square error (RMSE) lower than 3 days. The RMSE of cottonseed dry weight, protein content, and oil content predictions were 8.9 mg seed-1, 2.19%, and 2.71%, respectively. The result showed that the model is sufficiently robust to predict the cotton boll maturation period, cottonseed dry weight, and quality in wide range of conditions. It is not only a necessary component of cotton growth model, but

also provides a good platform for further study in modeling cottonseed protein and oil yield.

Keywords: Cottonseed; Crop model; Boll maturation period; Biomass accumulation; Protein content; Oil content

B.K. Mishra, S. Pathak, A. Sharma, P.K. Trivedi, S. Shukla, Modulated gene expression in newly synthesized auto-tetraploid of Papaver somniferum L.,
South African Journal of Botany, Volume 76, Issue 3, August 2010, Pages 447-452, ISSN 0254-6299, DOI: 10.1016/j.sajb.2010.02.090.
(http://www.sciencedirect.com/science/article/B7XN9-4YPGRY6-1/2/ef5b8605023dbc0acee3ab36975951cb)

Abstract:

Autopolyploidy is advantageous for plant metabolism in terms of elevated rates of synthesis or a higher variability of metabolically relevant compounds. In the present study, successful induction of polyploidy was achieved through applying colchicine soaked cotton on shoot meristem. The ploidy level of the developed tetraploids was confirmed through microscopic observations of stomata and chromosomal studies. Chromosome number in the developed tetraploids were 2x = 2n = 44 as compared to the control having 2x = 2n = 22. Alkaloid profile of both treated and control plants showed a significant enhancement from 25% to 50% in morphine content. Expression analysis through semiquantitative reverse transcription-polymerase chain reaction (RT-PCR) of various known genes involved in the biosynthesis of morphinanes showed increased expression in tetraploids. Gene expression analysis of different polyploidy series can supplement our understanding related to molecular mechanism involved in increased alkaloid biosynthesis during polyploidization.

Keywords: Alkaloids; Autopolyploidy; Colchicine; Diploid; Opium poppy; Polyploidization

PLANT PHYSIOLOGY-GROWTH AND DEVELOPMENT (8 jdl)

Gang Wu, Fa Jun Chen, Feng Ge, Impacts of early-season square abscission on the growth and yield of transgenic Bt cotton under elevated CO2,
Field Crops Research, Volume 102, Issue 3, 20 June 2007, Pages 239-243, ISSN 0378-4290, DOI: 10.1016/j.fcr.2007.03.007.
(http://www.sciencedirect.com/science/article/B6T6M-4NN1TJD-1/2/5b38876b9cacb39529e4fa838378d592)

Abstract:

A field study was carried out to quantify the compensation capacity of Bacillus thuringiensis (Bt)-transgenic cotton to simulated damage by manually removing squares during the early growing season in 2004 and 2005 in combination with CO2 levels (ambient CO2 and elevated CO2). Treatments included: initial squares were wholly (100%) removed manually for 1 week (i.e., SR1 treatment) and for 2 consecutive weeks (i.e., SR2 treatment). Plant leaf area was measured every 2 weeks, and plant root,

stem, leaf, shatters, boll dry weight and lint yield and maturity were measured at harvest. Significantly higher leaf area per plant was observed on each sampling date for SR1 and SR2 treatments compared with control (SR0) treatment in 2004 and 2005 under elevated CO2. Significantly higher lint yield and maturity were observed for SR0, SR1 and SR2 treatments under elevated CO2 in 2004 and 2005. CO2 concentration and square removal significantly affected plant lint yield and maturity. Moreover, the interaction between CO2 concentration x square removal had a significant effect on plant leaf dry weight, lint yield and maturity. Our results indicated that transgenic cotton plants can compensate for the manual removal of 100% of the initial squares for 1 and 2 weeks under ambient and elevated CO2.

Keywords: Elevated CO2; Transgenic Bt cotton; Square removal; Maturity; Lint yield

Yuan Chen, Guoyou Ye, Li Zhang, Yonghui Wang, Xiang Zhang, Dehua Chen, Effect of trans-Bacillus thuringiensis gene on gibberellic acid and zeatin contents and boll development in cotton,

Field Crops Research, Volume 103, Issue 1, 25 July 2007, Pages 5-10, ISSN 0378-4290, DOI: 10.1016/j.fcr.2007.04.003.
(http://www.sciencedirect.com/science/article/B6T6M-4NS36BM-1/2/31137b6eae4e599ee78444b9388a24eb)

Abstract:

Two experiments were conducted to investigate the effect of the Bacillus thuringiensis (Bt) transgene on gibberellic acid and zeatin contents and boll development in cotton using two types of Bt-transformed cultivars. In the 2003 study, boll size and weight, gibberellic acid 3 (GA3) and zeatin (ZR) contents were investigated from 3 to 45 days after flowering (DAF). In 2004, the flowers were sprayed with GA3, 6-benzyl adenine (6-BA) or a combination of both, and responses in boll size and weight, and endogenous GA3 and ZR contents were determined. In comparison to the common parent, Simian 4, overall boll size and weight were lower for the conventional Bt cultivar, Sikang 1, but higher for the hybrid Bt cultivar, Sikang 3. Similarly, the boll GA3 and ZR contents of Sikang 1 were lower than those of Simian 4, while those of Sikang 3 were higher than Simian 4. The largest difference between Sikang 1 and Simian 4 for boll GA3 and ZR contents were 18.5 and 25.5%, respectively, observed at 17 DAF. The largest difference between Sikang 3 and Simian 4 for boll GA3 and ZR contents were 25.5 and 85.7% at 31 DAF respectively. Application of GA3, 6-BA or a combination significantly increased boll size and weight for the conventional Bt cultivar and Simian 4, but did not have a significant effect on these characteristics of the hybrid cultivar Sikang 3. GA3 and ZR contents of the conventional Bt cultivar Sikang 1 were also significantly increased by application of these treatments. The combined application of GA3 and 6-BA tended to have a larger effect than the application of either of them separately, but the differences were statistically not significant. These results suggested that the lower boll GA3 and ZR contents, which could reduce boll nitrogen metabolism intensity, were responsible for the reduced boll development of the conventional Bt cultivar Sikang 1.

Keywords: Bt cotton; Boll development; Endogenous hormone; Gibberellic acid; Zeatin

Zi-hong YE, Jun ZHU, Heterosis Study on Developmental Behavior of Flowering and Boll Setting in Upland Cotton,
Agricultural Sciences in China, Volume 5, Issue 1, January 2006, Pages 23-32, ISSN 1671-2927, DOI: 10.1016/S1671-2927(06)60015-1.
(http://www.sciencedirect.com/science/article/B82XG-4JCC40Y-3/2/1f4eba35b68106fbb1fdb4b66148cdeb)

Abstract:

The developmental behavior was examined for flowering and boll setting in upland cotton (Gossypium hirsutum L.) at different boll-setting sites and blooming periods. Conventional and conditional methods were applied to analyze heterosis by an additive-dominance model with genotype by environment (GE) interaction effects. Positive general heterosis was significantly detected on middle-lower nodes at positions 1 and 2 for a number of flowers and bolls per plant. Deviation between HPBE1 and HPBE2 was relatively large for a number of flowers per plant at positions 3, 4, and 5, but much smaller for number of bolls per plant. There was increase of heterosis before the end of July, and the highest heterosis was observed at 22 DAF (22 days after flowering) for flowers and at 16 DAF for bolls, and then declined. There existed significant diversity of interaction heterosis for flowers as well as for bolls during blooming stages, but deviation between HPBE1 and HPBE2 was smaller for number of bolls per plant than that of flowers per plant. The cross of DP-15 (late-season variety)' HG-H-12 had positive general heterosis since 19 DAF, and negative HPB was observed for the cross of GL-5 (early-season variety)' HG-H-12 after 37 DAF. Interaction heterosis was mostly not significant for cross DP-15' HG-H-12, but the reverse was true for cross GL-5' HG-H-12. Positive conditional HPB was detected since 16 DAF until 43 DAF for cross DP-15' HG-H-12, and before 13 DAF for cross GL-5' HG-H-12.

Keywords: Gossypium hirsutum L.; heterosis; conditional analysis; number of flowers; number of bolls

Zhi-Yong ZHANG, Qing-Lian WANG, Zhao-Hu LI, Liu-Sheng DUAN, Xiao-Li TIAN, Effects of Potassium Deficiency on Root Growth of Cotton Seedlings and Its Physiological Mechanisms,
Acta Agronomica Sinica, Volume 35, Issue 4, April 2009, Pages 718-723, ISSN 1875-2780, DOI: 10.1016/S1875-2780(08)60079-6.
(http://www.sciencedirect.com/science/article/B94TW-4XDMBNT-8/2/018f1c1d6139e4b7d0715ad4b65fe011)

Abstract:

For the purpose of dissecting the mechanism of root growth in response to potassium (K) deficiency in cotton (Gossypium hirsutum L.), young seedlings of NuCOTN99B grown in half-strength modified Hoagland's solution with low K nutrient (0.05 mmol L-1) were investigated for the root configuration, content of endogenous free indole acetic acid (IAA), and amount of ethylene released from the roots 4 d after treatment. Compared with the treatment with moderate K nutrient (0.50 mmol L-1, control), the K deficient treatment significantly inhibited root length and the formation of lateral roots. The reduced lateral roots mainly resulted from the shortened branched root zone, and there was no change in the lateral root density. Under K deficient

condition, the greatest reductions for root length, total root surface area, and root volume occurred in fine roots (0.05 mm <= diameter < 0.20 mm), followed by the coarse roots (diameter [.tau] 0.45 mm) and the middle roots (0.25 mm <= diameter < 0.45 mm). The fine roots were more important in nutrient uptake than the middle and the coarse roots. Thus, the K starving damage was greater in cotton seedlings than the growth inhibition of roots. When the cotton seedlings exposed to K deficient media for 4 d and 10 d, the total root length and the total root surface area were 35.7-38.0% and 47.7-50.6% of the values of the control plants; whereas the K accumulation was approximately 25% and 16% to the control values, respectively. As expected, the endogenous free IAA content in the roots grown in K deficient media reduced by 50%, whereas the amount of ethylene released from roots increased by nearly 6-fold, which partially explained the inhibition of lateral root formation and root elongation by K deficiency.

Keywords: Gossypium hirsutum; potassium; root growth; indole acetic acid; ethylene

Zhiquan Zhang, Margaret L. Pierce, Andrew J. Mort, Changes in homogalacturonans and enzymes degrading them during cotton cotyledon expansion,
Phytochemistry, Volume 68, Issue 8, April 2007, Pages 1094-1103, ISSN 0031-9422, DOI: 10.1016/j.phytochem.2007.02.005.
(http://www.sciencedirect.com/science/article/B6TH7-4NC50RC-1/2/71b6b4dc729784acef9e2483460892c0)

Abstract:

Changes in homogalacturonans (HGs) and enzymes degrading them have been investigated during cotton (Gossypium hirsutum L.) cotyledon expansion. Using an in vivo assay for pectin-degrading enzymes that involves fluorescent labeled oligomers of GalA as substrate and capillary electrophoresis for product analysis, we found that endo- and exo-polygalacturonases are present in the cotyledon extracellular spaces, and there are dramatic changes in the levels of both activities as the cotyledons change their rate of expansion. Capacity for endo-polygalacturonase activity was highest during the initial stages of cotyledon expansion. However, for exo-polygalacturonase activity it was highest in the later stages of expansion. Cell walls were prepared from 3-, 5-, and 7-day-old cotton cotyledons and treated with liquid HF at -23 [degree sign]C. This treatment cleaves the glycosidic linkages of most neutral sugars in the walls without degrading HGs. HGs with a relatively high degree of esterification can then be solubilized with water, and those with low esterification can be solubilized with concentrated imidazole buffer. The majority of HGs were obtained in the water extracts. The degrees of esterification were 57%, 47%, and 47% in water extracts and 34%, 25%, and 27% in imidazole extracts, in 3-, 5-, and 7-day-old cotton cotyledons, respectively. Using a PA100 ion-exchange column, the members of a GalA homologous series up to approximately 70 residues can be separated. The results from HG molecular length distribution analysis indicated that the HG at 3 days was on average shorter than that in the older cotyledons, perhaps reflecting the higher level of endo-polygalacturonase activity at this stage of more rapid growth.

Keywords: Cell walls; Endo-polygalacturonase; Exo-polygalacturonase; Gossypium; Malvaceae; Growth; Pectin

Rickie B. Turley, Earl Taliercio, Cotton benzoquinone reductase: Up-regulation during early fiber development and heterologous expression and characterization in Pichia pastoris,
Plant Physiology and Biochemistry, Volume 46, Issues 8-9, August-September 2008, Pages 780-785, ISSN 0981-9428, DOI: 10.1016/j.plaphy.2008.04.016.
(http://www.sciencedirect.com/science/article/B6VRD-4SCD9YW-2/2/cd3b4dc5faa41d97db455846d647e629)
Abstract:
Benzoquinone reductase (BR; EC 1.6.5.7) is an enzyme which catalyzes the bivalent redox reactions of quinones without the production of free radical intermediates. Using 2D-PAGE comparisons, two proteins were found to be up-regulated in wild-type cotton ovules during the fiber initiation stage but not in the fiberless line SL 1-7-1. These proteins were excised from the gel, partially sequenced and identified to be BR isoforms. PCR was used to amplify both full length coding regions of 609 bp and once cloned, the restriction enzyme HindIII was used to distinguish the clones encoding the BR1 (one site) and BR2 (two sites) isoforms. Both deduced protein sequences had 203 residues which differed at 14 residues. The molecular mass and pIs were similar between the measured protein (2D-PAGE) and the theoretical protein (deduced). Heterologous proteins BR1 and BR2 were produced for further study by ligating the BR1 and BR2 clones in frame into the [alpha]-factor secretion sequence in pPICZ[alpha]A vector and expressed with Pichia pastoris. Both BR1 and BR2 were approximately 26.5 kDa and did enzymatically reduce 2,6-dimethoxybenzoquinone similar to the fungal BR.
Keywords: Benzoquinone reductase; Fiber development; Gossypium hirsutum; Quinones; Pichia pastoris

Han-Bai HUA, Zhao-Hu LI, Xiao-Li TIAN, Mechanism of Tolerance to Potassium Deficiency Between Liaomian 18 and NuCOTN99B at Seedling Stage,
Acta Agronomica Sinica, Volume 35, Issue 3, March 2009, Pages 475-482, ISSN 1875-2780, DOI: 10.1016/S1875-2780(08)60069-3.
(http://www.sciencedirect.com/science/article/B94TW-4X3127B-5/2/d9b326ff3e2a948cfc45d05d5ad428bc)
Abstract:
The objective of the present study was to elucidate the mechanism of tolerance to potassium (K) deficiency in cotton (Gossypium hirsutum L.) through comparing the differences of K uptake, translocation, and utilization in a K-efficient cultivar Liaomian 18 (non-Bt cotton) and a K-inefficient cultivar NuCOTN99B (American Bt cotton). The seedlings of the 2 cultivars were hydroponically cultured in a growth chamber and treated with sufficient K of 2.5 mmol L-1 (control) or deficient K of 0.03 mmol L-1. There was no significant difference in dry matter yield of seedlings between both cultivars under the control condition, whereas Liaomian 18 produced 170% more dry matter than

NuCOTN99B in the K-deficient solution. Under the K-deficient condition, the amounts of K uptake per unit root dry weight, per unit root length, and per unit root surface area in Liaomian 18 were similar to or lower than those in NuCOTN99B, and the ratio of K accumulation in leaf to that in whole plant was 57.7% and 67.6% in Liaomian 18 and NuCOTN99B, respectively. These results indicated that the higher K-efficiency of Liaomian 18, compared with NuCOTN99B, was independent of its capacities for root physiological uptake and translocation of K to leaf. In contrast, Liaomian 18 had larger root system than NuCOTN99B, and its root length, root surface area, and root volume were 3.4, 3.8, and 4.2 folds higher than those of NuCOTN99B, respectively. In addition, the K utilization index (dry matter produced per unit of K concentration) in Liaomian 18 was 147% higher than that in NuCOTN99B. Therefore, the higher tolerance to K deficiency in Liaomian 18 possibly depended on its larger root system and greater internal K utilization efficiency. On account of the insignificant differences in osmotic potential and relative water content in leaf between Liaomian 18 and NuCOTN99B, the higher internal K utilization efficiency of Liaomian 18 was deduced to be associated with the biochemical function of K rather than the biophysical function of K.

Keywords: Gossypium hirsutum L.; tolerance to K deficiency; K uptake; K translocation; K utilization

Zhenlan Liu, Keith L. Adams, Expression Partitioning between Genes Duplicated by Polyploidy under Abiotic Stress and during Organ Development,
Current Biology, Volume 17, Issue 19, 9 October 2007, Pages 1669-1674, ISSN 0960-9822, DOI: 10.1016/j.cub.2007.08.030.
(http://www.sciencedirect.com/science/article/B6VRT-4PKPP89-1/2/f533d5c3b25f122a081cb42dbd8469b3)

Abstract:

Allopolyploidy has been a prominent mode of speciation and a recurrent process during plant evolution and has contributed greatly to the large number of duplicated genes in plant genomes [1], [2], [3] and [4]. Polyploidy often leads to changes in genome organization and gene expression [5], [6], [7], [8] and [9]. The expression of genes that are duplicated by polyploidy (termed homeologs) can be partitioned between the duplicates so that one copy is expressed and functions only in some organs and the other copy is expressed only in other organs, indicative of subfunctionalization [10]. To determine how homeologous-gene expression patterns change during organ development and in response to abiotic stress conditions, we have examined expression of the alcohol dehydrogenase gene AdhA in allopolyploid cotton (Gossypium hirsutum). Expression ratios of the two homeologs vary considerably during the development of organs from seedlings and fruits. Abiotic stress treatments, including cold, dark, and water submersion, altered homeologous-gene expression. Most notably, only one copy is expressed in hypocotyls during a water-submersion treatment, and only the other copy is expressed during cold stress. These results imply that subfunctionalization of genes duplicated by polyploidy has occurred in response to abiotic stress conditions. Partitioning of duplicate gene expression in response to environmental stress may lead to duplicate gene retention during subsequent evolution.

Keywords: EVO_ECOL

PLANT PHYSIOLOGY-REPRODUCTION (6 jdl)

X.H. Tong, M.K. Daud, Y.Q. Sun, S.J. Zhu, Physiological and molecular mechanisms of glyphosate tolerance in an in vitro selected cotton mutant,
Pesticide Biochemistry and Physiology, Volume 94, Issues 2-3, June-July 2009, Pages 100-106, ISSN 0048-3575, DOI: 10.1016/j.pestbp.2009.04.007.
(http://www.sciencedirect.com/science/article/B6WP8-4W26GCV-1/2/631e5814c489b828f066e0dea69bc1b1)

Abstract:

We have selected an upland cotton (Gossypium hirsutum L.) cell line (R1098) that is highly tolerant to glyphosate. This cell line was developed by in vitro selection with gradually increasing glyphosate concentrations, and its mechanisms conferring glyphosate tolerance were studied. Based on a whole-plant dose-response bioassay, R1098 plants were tolerant to glyphosate at a concentration of 1500 g ae ha-1 glyphosate (1.5x the recommended field rate) whereas the control plants (Coker 312) were unable to survive at 150 g ae ha-1 glyphosate. Coker 312 accumulated 13.1 times more shikimate in leaves at 5 days after glyphosate treatment (1500 g ae ha-1) than that of R1098. Two distinct cDNAs for 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS), EPSPS-1 and EPSPS-2, were isolated from R1098. Both cDNAs were 97.7% identical within the common protein-coding region and the predicted sequences of the mature proteins were greater than 83% identical with EPSPS proteins from other known higher plants. In comparison to the glyphosate-susceptible cotton Coker 312, sequence analysis of the EPSPS-1 gene indicated that R1098 has an alanine insertion at nucleotide position 1216 resulting in frameshift. It leads to two copy functional EPSPS genes in R1098. There was no difference between R1098 and Coker 312 in EPSPS mRNA levels before glyphosate treatment. However, its treatment caused a 2-4 times increase in the basal EPSPS mRNA level in R1098.

Keywords: Gossypium hirsutum L.; Cotton; Shikimate; Glyphosate; EPSPS; Real-time PCR

Hagai Yasuor, Joseph Riov, Baruch Rubin, Glyphosate-induced male sterility in glyphosate-resistant cotton (Gossypium hirsutum L.) is associated with inhibition of anther dehiscence and reduced pollen viability,
Crop Protection, Volume 26, Issue 3, Weed Science in Time of Transition, March 2007, Pages 363-369, ISSN 0261-2194, DOI: 10.1016/j.cropro.2005.06.015.
(http://www.sciencedirect.com/science/article/B6T5T-4MBJXVV-1/2/d7143f7aa0bcc6269946fae818ff0a09)

Abstract:

Glyphosate-resistant cotton (GRC) was introduced experimentally to Israel in 1998. Field and laboratory studies were conducted in 1998-2000 to evaluate the effect of the timing and rates of glyphosate application on cotton development and fruit set. No damage to the vegetative parts of cotton plants was observed when glyphosate was applied over-the-top (OTT) at all growth stages examined. However, glyphosate applied OTT, at the 8-10 leaf stage (late OTT), caused severe damage to the reproductive parts. Cotton grown in different climatic regions responded differently to late OTT

application of glyphosate, indicating a strong interaction with environmental conditions. Late OTT application resulted in a development of abnormal flowers, non-dehiscent anthers containing irregularly shaped and less viable pollen grains. In contrast, the stigma and other female organs of treated plants were functional and did not show any injury symptoms. Male-sterile flowers usually produced deformed bolls with one or more degenerated compartments leading to a 'moon' or 'beak' shape bolls. Bolls developed on the early fruiting branches (5th-10th) of late OTT-treated plants were smaller as compared to those developed at the same position on untreated plants. In general, the cotton plants succeeded to compensate for the early damage caused by glyphosate by producing additional bolls on the upper internodes. These additional bolls did not reach maturity until harvest time. In spite of the visible injury to flowers and bolls, late OTT application did not cause significant yield reduction. Combined late and very late (12-13 leaf stage, before cotton canopy closes) glyphosate application resulted in a significant yield reduction. Further studies are in progress to elucidate the mechanism involved in the glyphosate-induced male sterility in transgenic cotton.

Keywords: Glyphosate; Cotton; Gossypium hirsutum L.; Roundup Ready(R); Square; Flower; Stigma; Anther; Pollen grain; Bolls

Xiao-quan ZHANG, Xue-de WANG, Pei-dong JIANG, Wei ZHU, Inheritance of Fertility Restoration for Cytoplasmic Male Sterility in a New Gossypium barbadense Restorer, ***Agricultural Sciences in China***, Volume 9, Issue 4, April 2010, Pages 472-476, ISSN 1671-2927, DOI: 10.1016/S1671-2927(09)60119-X.
(http://www.sciencedirect.com/science/article/B82XG-4YX7DDD-3/2/f23b10fe803e24ae40def01baec76821)

Abstract:

In order to clarify inheritance mechanism of fertility restoration for cytoplasmic male sterility (CMS) in a new Gossypium barbadense restorer line Hai R which was found in the fertility test crossing of G. hirsutum CMS lines with G. barbadense germplasms. 23 fertility segregation populations of F2 and backcross were used to analyze the inheritance of fertility restoring gene(s) of Hai R. The result showed that Hai R had one major dominant gene (RfB) to control the CMS fertility restoration and this fertility restoration gene functioned at the sporophytic level. The sterile cytoplasm background might not only influence the transmission rate of male gamete but also that of female gamete when the restorer gene was recessive. It could be deduced that this fertility restoration gene might come from G. harknessii cotton, Hai R is of value in the application of cotton interspecific hybrid breeding.

Keywords: Gossypium barbadense; cytoplasmic male sterility; fertility restoring gene

Xiao-quan ZHANG, Xue-de WANG, Yun-guo ZHU, Wei ZHU, Pei-dong JIANG, Breeding for Male-Sterility Line with G. barbadense Nuclear Background and Cytological Observation of Its Microsporogenesis,
Agricultural Sciences in China, Volume 6, Issue 5, May 2007, Pages 529-535, ISSN 1671-2927, DOI: 10.1016/S1671-2927(07)60079-0.

(http://www.sciencedirect.com/science/article/B82XG-4NX345H-3/2/0b991e8340feaeae5a501e51a04d6c9a)

Abstract:

To study the feasibility of utilizing the heterosis of interspecific (Gossypium barbadense x G. hirsutum) hybrid cotton based on cytoplasmic male-sterility system, a G. barbadense male-sterility line HaiA with G. harknessii cytoplasm and its maintainer HaiB were developed by replacing nuclear genome from G. hirsutum to G. barbadense in a backcross breeding program. Its male cell abortion was observed using a light microscope through a paraffin slice for H.E staining technique. The results showed that the abortion characteristics in HaiA were not significantly changed at the cytological level, although G. hirsutum nuclear genome of sterile line was replaced by G. barbadense nuclear genome, and its abortion mainly took place at the stage of the microspore mother cell meiosis. HaiA sterility was very stable because of its early abortion and no-poltens in anthers. Hybrids between HaiA and G. hirsutum restorers were high in pollen viability, boll setting rate, boll weight and lint percentage which contributed to high yield heterosis. It is suggested that HaiA is of great value in the application of cotton interspecific hybrid seed production.

Keywords: Gossypium barbadense; cytoplasmic male sterility; interspecific heterosis

G. Basini, S. Bussolati, L. Baioni, F. Grasselli, Gossypol, a polyphenolic aldehyde from cotton plant, interferes with swine granulosa cell function,

Domestic Animal Endocrinology, Volume 37, Issue 1, July 2009, Pages 30-36, ISSN 0739-7240, DOI: 10.1016/j.domaniend.2009.01.005.

(http://www.sciencedirect.com/science/article/B6T62-4VWPSX0-2/2/5d0371755a5c691c46cc7b185b93e7aa)

Abstract:

Gossypol is a polyphenol isolated from the seed, roots and stem of cotton plant (Gossypium sp.) It has been associated with adverse effects on female reproduction, but recently also shown having promising effects against several malignancies. Its mechanisms of action are however still not fully understood. This study was therefore conducted to investigate the effect of 5 or 25 [mu]g/mL gossypol on swine granulosa cell steroidogenic activity, redox status and Vascular Endothelial Growth Factor (VEGF) production. Study demonstrated that gossypol significantly ($P < 0.001$) inhibited granulosa cell estradiol 17[beta] and progesterone production, an effect that could be at least partially mediated by an increase ($P < 0.05$) of nitric oxide and superoxide anion production as a consequence of superoxide dismutase inhibition. Moreover, gossypol stimulates ($P < 0.001$) VEGF production. In conclusion, study has demonstrated effecs of gossypol on swine granulosa cell function in vitro. Effects on female swine fertility can not be excluded.

Keywords: Angiogenesis; Ovary; Free radicals; Steroids; Reproduction

Pei-dong JIANG, Yun-guo ZHU, Xiao-ling WANG, Wei ZHU, Xiao-quan ZHANG, XIE Hai-yan, Xue-de WANG, Metabolism of Reactive Oxygen Species in the Cytoplasmic Male-Sterile Cotton Anther,

Agricultural Sciences in China, Volume 6, Issue 3, March 2007, Pages 275-280, ISSN 1671-2927, DOI: 10.1016/S1671-2927(07)60045-5.
(http://www.sciencedirect.com/science/article/B82XG-4NNP3JJ-3/2/41ba03653953c9ee425b97796ab48031)

Abstract:

Reactive oxygen species (ROS) in plant cell, including superoxide (O2), hydrogen peroxide (H2O2), and malondialdehyde (MDA), are thought to be important inducible factors of cell apoptosis if excessively accumulated in cells. To elucidate the metabolic mechanism of ROS production and scavenging in anthers of the cytoplasmic male-sterile (CMS) cotton. CMS line, maintainer, and hybrid F1 anthers, were employed for studying the relationship between CMS and metabolism of ROS, by comparing ROS changes in the sterile and fertile anthers at different developmental stages. The results showed that during the abortion preliminary stage (sporogenous cell division stage), anthers of CMS line had higher contents of O2, H2O2, and MDA than those of maintainer or hybrid F1. Simultaneously, the higher activities of superoxide dismutase (SOD), catalase (CAT), and peroxidase (POD) in scavenging ROS were measured in the anthers of the CMS line, indicating that an increase of ROS in anthers of abortion preliminary stage had an inducible effect on the antioxidant enzymes. But during the abortion peak of CMS anther (pollen mother cell meiosis stage), on the one hand, contents of O2. H2O2, and MDA were extraordinarily high in CMS anthers, on the other hand, the activities of SOD, CAT, and POD were excessively low, which disrupted the balance between the production and elimination of ROS and led to pollen mother cells apoptosis at this stage. In the following two stages (uninucleate microspore stage and mature pollen stage), the contents of O2 and H2O2 in the aborted anthers were approximated to contents in the fertile anthers of the maintainer and hybrid F1. However, MDA contents were continuously raised and enzymic activities of SOD, CAT, and POD were consistently decreased in sterile anthers, which indicated that ROS still had harmful effects on the anthers after the apoptosis of the male cells. Excessive accumulation of O2, H2O2, and MDA and significant reduction of ROS scavenging-enzyme activities were coinstantaneous with male cells apoptosis in the anthers of the cotton CMS line. But when the restorer gene was transferred into the CMS line, excessive production of ROS could be eliminated in the anthers of hybrid F1.

Keywords: cotton; cytoplasmic male sterility; reactive oxygen species

PEST OF PLANTS (57 jdl)

Guangchao Kong, Muhammad. K. Daud, Shuijin Zhu, Effects of pigment glands and gossypol on growth, development and insecticide-resistance of cotton bollworm (Heliothis armigera (Hubner)),

Crop Protection, Volume 29, Issue 8, August 2010, Pages 813-819, ISSN 0261-2194, DOI: 10.1016/j.cropro.2010.03.016.

(http://www.sciencedirect.com/science/article/B6T5T-4YYWRHR-1/2/907487ded6c315cd29579a34f112870b)

Abstract:
Cotton bollworm (Heliothis armigera) is a major pest of cotton and other crops. It is important to understand the mechanisms of insecticide tolerance of cotton bollworm on cotton cultivars with host plant resistance to this insect pest. The objectives of this study were to investigate the effects of cotton pigment glands and their gossypol on the growth, development and insecticide tolerance of cotton bollworm. Three pairs of cotton isogenic lines with glanded versus glandless leaves, as well as artificial diets with 5 levels of gossypol, were used to raise cotton bollworm larvae for five generations. The growth, development and insecticide tolerance of larvae were studied. The results indicated that the cotton pigment glands and higher levels of gossypol resulted in a significant decrease in larval weights and moth eclosion rates and delayed the development of larvae and pupae. Larvae that fed on glanded cotton leaves were significantly more tolerant to two insecticides, cyhalothin and monocrotophos, than those fed on glandless cotton leaves. LD50 values were only increased where they were in amount per unit body weight, and not where were calculated in amount per individual. Also the insecticide tolerance of cotton bollworm larvae increased as the gossypol content was raised from 0 to 0.225% in artificial diets. Meanwhile, the activities of two detoxifying enzymes, carboxylesterase and glutathione s-transferase, were significantly higher in the larvae fed on glanded cotton leaves than those fed on glandless cotton leaves. The activities of two enzymes also increased greatly with the increase of gossypol content from 0 to 0.225% in artificial diets. Across 5 generations of feeding and investigation, the significant inhibition effect on larval growth and larval tolerance to two pesticides were found to be only associated with the feeding by current generation, but were not related to previous diets. The activities of two detoxifying enzymes in larvae were also not enhanced significantly when they were fed continuously on glanded cotton leaves or artificial diet with high gossypol. These results indicated that pigment glands and higher levels of gossypol not only inhibited the growth of cotton bollworm larvae but also enhanced their insecticide tolerance. However, the inhibition effect and enhanced insecticide tolerance were inducible but could not be accumulated or inherited. These results will help us better understand the interaction and co-evolution of insecticide tolerance in larvae of cotton bollworm and host chemicalcomponents, and also has provided useful information on cotton bollworm management in cotton production, especially in glandless cotton.

Keywords: Cotton (Gossypium hirsutum L.); Host plant resistance; Insecticide tolerance; Mechanisms; Detoxifying enzymes

G.T. Gujar, V. Kalia, G.K. Bunker, S. Dhurua, Impact of different levels of non-Bt cotton refuges on pest populations, bollworm damage, and Bt cotton production,

Journal of Asia-Pacific Entomology, Volume 13, Issue 4, December 2010, Pages 249-253, ISSN 1226-8615, DOI: 10.1016/j.aspen.2010.06.004.
(http://www.sciencedirect.com/science/article/B8JJN-508PR18-2/2/e8f47d87fce36bf0b2bccb78d13958a8)
Abstract:

The impact of structured strip row refugia (varying from 10% to 50%) in the Bt cotton crops JKCH1947Bt (producing one toxin, Cry1Ac) and MRC7017BGII (producing two toxins, Cry1Ac and Cry2Ab) on the pest complex and cotton yield was studied. During the cropping season (June 2008 to November 2008), sucking pest incidence was negligible. However, the incidences of spotted bollworm, Earias vittella, and the leafroller, Sylepta derogata, were high on the non-Bt cotton. The total cotton seed yield of the Bt crop plus the refuge decreased proportionately with respect to the increase in proportion of non-Bt cotton. Total cotton production decreased significantly when 40% non-Bt cotton was planted as refuge. These studies showed that a refuge of up to 30% non-Bt cotton in JKCH1947Bt and up to 20% non-Bt cotton in MRC7017Bt did not affect total seed cotton yield compared to 100% Bt cotton.
Keywords: Refugia; transgenic Bt cotton; bollworms; yield

Swagata 'Ban' Banerjee, Steven W. Martin, An estimation of producer returns from Bt cotton with varying refuge sizes,
Crop Protection, Volume 27, Issue 6, June 2008, Pages 1003-1008, ISSN 0261-2194, DOI: 10.1016/j.cropro.2007.12.008.
(http://www.sciencedirect.com/science/article/B6T5T-4RPD76Y-1/2/dbb69e241647aedeb86c6492240d17c9)
Abstract:

The US Environmental Protection Agency (EPA) has mandated an Insect Resistance Management (IRM) program that attempts to preserve the benefits of insect protection from Bacillus thuringiensis (Bt) cotton. According to that mandate, growers planting Bt cotton are required to follow the IRM practices designed to keep some lepidopteran populations from being exposed to the Bt protein. Thus, a refuge of non-Bt cotton must be planted. Currently, producers may select among different sprayed and unsprayed refuge percentages. Recently, EPA has been petitioned to remove all refuge requirements. In order to compare farm-level returns from various refuge requirements, returns for a cotton farm in the Mississippi Delta were calculated from observed and simulated yields. Results indicate higher mean returns above insecticide costs for Btcotton than for non-Bt (refuge) cotton. For any given non-Bt cotton (refuge) percentage, returns are higher without increased risk when insecticide sprays are applied.
Keywords: Bt cotton; Refuge; Returns; Risk; Simulated yield

H.C. Sharma, G. Pampapathy, Influence of transgenic cotton on the relative abundance and damage by target and non-target insect pests under different protection regimes in India,

Crop Protection, Volume 25, Issue 8, August 2006, Pages 800-813, ISSN 0261-2194, DOI: 10.1016/j.cropro.2005.11.002.
(http://www.sciencedirect.com/science/article/B6T5T-4JF975B-1/2/bc323f509421c37c755bf496bcf8ae0f)

Abstract:

Effectiveness of transgenic cottons with Bacillus thuringiensis (Bt) cry1Ac gene along with non-transgenic commercial cultivars of Gossypium hirsutum and G. arboreum for the management of cotton bollworm, Helicoverpa armigera was evaluated at the research farm, International Crops Research Institute for the Semi-Arid Tropics, Patancheru, Andhra Pradesh, India. In general, there were no significant differences in oviposition between the transgenic and the non-transgenic cultivars under protected and unprotected conditions. The larval numbers were significantly lower on the transgenic hybrids during the 2004 rainy season under high infestation, but the differences in larval density between the transgenic and non-transgenic hybrids during 2002 and 2003 seasons under low levels of infestation were quite small. Bollworm damage in squares and bolls was significantly lower in the transgenic hybrids than in the non-transgenic ones, although there were a few exceptions. Differences in seed cotton yield between the transgenic and the non-transgenic hybrids were not significant under unprotected conditions at moderate levels of infestation during the 2002 and 2003 cropping seasons (except in the case of Mech 184). However, significant differences in seed cotton yield were observed during the 2004 cropping season under heavy bollworm infestation. Seed cotton yield of the first picking in transgenic hybrids was significantly greater than that of the non-transgenic counterparts. Transgenic hybrids suffered low shoot damage by spotted bollworm, Earias vittella. However, there were no differences between the transgenic and non-transgenic hybrids in their relative susceptibility to cotton jassid, Amrasca biguttula biguttula and serpentine leaf miner, Liriomyza trifolii, white fly, Bemisia tabaci, green bug, Nezara viridula, ash weevil, Myllocerus undecimpustulatus, and red cotton bug, Dysdercus koenigii. With a few exceptions, the bollworm damage and seed cotton yield of the G. arboreum varieties Aravinda and MDL 2450, and the G. hirsutum variety L 604 was not significantly different than that of the transgenic hybrids, and these varieties were also resistant to cotton jassid. The results suggested that it would be useful to combine transgenic resistance to H. armigera with plant characteristics conferring resistance to the target or non-target insect pests in the region in order to realize the full potential of transgenic plants for sustainable crop production.

Keywords: Cotton; Gossypium; Helicoverpa armigera; Non-target pests; Pest management

Erik J. Sacks, A. Forest Robinson, Introgression of resistance to reniform nematode (Rotylenchulus reniformis) into upland cotton (Gossypium hirsutum) from Gossypium arboreum and a G. hirsutum/Gossypium aridum bridging line,

Field Crops Research, Volume 112, Issue 1, 30 April 2009, Pages 1-6, ISSN 0378-4290, DOI: 10.1016/j.fcr.2009.01.006.
(http://www.sciencedirect.com/science/article/B6T6M-4VT17R0-1/2/5c64bb897ed3715bff44774ce4f8b10c)
Abstract:

Gossypium hirsutum L. is the predominant cotton of commerce and all cultivars of this species are susceptible to the reniform nematode, Rotylenchulus reniformis. To introgress resistance to R. reniformis into the tetraploid 2(AD1) G. hirsutum, a resistant diploid A2-genome Gossypium arboreum accession (A2-190) was crossed with a hexaploid 2((AD1)D4) bridging line (G 371) to obtain a tetraploid triple-species hybrid. The triple-species hybrid was back-crossed to G. hirsutum and a population of 277 BC1 individuals was produced. The BC1s and controls were assayed in growth chambers for resistance to R. reniformis. Fortuitously, the hexaploid bridging line G 371 was also found to be resistant to R. reniformis. The BC1 segregated 3:1, resistant:susceptible, indicating that resistance was conferred by dominant genes at two different loci, with each originating from a distinct germplasm source. This study demonstrated that it is possible to introgress and pyramid genes for resistance to R. reniformis in G. hirsutum.
Keywords: Cotton; Reniform nematode; Resistance; Inheritance; Introgression; Wide cross

R.S. Mann, R.S. Gill, A.K. Dhawan, P.S. Shera, Relative abundance and damage by target and non-target insects on Bollgard and BollgardII cotton cultivars,
Crop Protection, Volume 29, Issue 8, August 2010, Pages 793-801, ISSN 0261-2194, DOI: 10.1016/j.cropro.2010.04.006.
(http://www.sciencedirect.com/science/article/B6T5T-502NJSW-2/2/7c8383feb4976ef23b465bb58aa99185)
Abstract:

Bollgard(R) and BollgardII(R) cotton cultivars were evaluated for their efficacy for control of bollworms and their effects on sucking insects and the abundance of natural enemies under bollworm insecticide protected and non-insecticide protected field conditions during the 2004 and 2005 cropping seasons. Bollgard cultivars are genetic transforms that produce Cry1Ac toxins from Bacillus thuringiensis (Bt) to control American bollworm, Helicoverpa armigera. Second generation BollgardII cultivars contain 2 toxins, Cry1Ac and Cry2Ab, and are more effective in controlling a broader range of caterpillar species. Bollgard cultivars were free of H. armigera damage until harvest under insecticide protected as well as non-protected conditions. Both BollgardII and Bollgard cultivars were infested with larvae of spotted bollworm, Earias vitella, and spiny bollworm, Earias insulana, at later crop growth stages. Neither BollgardII nor Bollgard cultivars were free of square (fruiting body), open boll and loculi damage. Bollworm damage did not reach economic threshold levels up to harvest. Densities of sucking insects (Amrasca biguttula biguttula, Bemisia tabaci, Aphis gossypi, and Thrips tabaci), of the foliage feeder Myllocerus undecimpustulatus and of predators(Chrysoperla spp., Orius spp., Coccinella spp., Brumus spp., Vespa spp.,

Lycosa spp., and Aranews spp.) were similar on Bollgard, BollgardII and conventional cultivars. The time of the first appearance of bollworms, sucking insects and predators on Bt cotton did not vary from conventional cotton varieties. Insecticidal protection based on economic threshold levels resulted in significant reductions in bollworm damage on conventional cultivars.

Keywords: Bt cotton; Helicoverpa armigera; Earias spp.; Jassid; Whitefly; Predators

Rasoul Marzban, Qian He, Xiaoxia Liu, Qingwen Zhang, Effects of Bacillus thuringiensis toxin Cry1Ac and cytoplasmic polyhedrosis virus of Helicoverpa armigera (Hubner) (HaCPV) on cotton bollworm (Lepidoptera: Noctuidae),
Journal of Invertebrate Pathology, Volume 101, Issue 1, April 2009, Pages 71-76, ISSN 0022-2011, DOI: 10.1016/j.jip.2009.02.008.
(http://www.sciencedirect.com/science/article/B6WJV-4VSB1HB-1/2/82413d45a87fb546cab213feac219014)

Abstract:

In this study, interactions on the mortality and debilitating effects between Cry1Ac, a toxic protein produced by Bacillus thuringiensis (Berliner) and HaCPV (Chinese strain) on first and third instars larvae of Helicoverpa armigera were evaluated in laboratory. When first instar was exposed to combination of Bt cotton leaf discs containing HaCPV (6 x 106, 1 x 107, and 3 x 107 PIB ml-1) the effect on mortality was additive, when such instar larvae exposed to combination of Cry1Ac (0.9, 2.7, or 8.1 [mu]g g-1) and the same concentrations of HaCPV the effect on mortality was additive except for the combination of Cry1Ac (0.3 [mu]g g-1) and HaCPV concentrations that showed synergism. When third instars of H. armigera were infected using a suspension containing both HaCPV and Cry1Ac, most combinations of them showed additive effect except for the combination of Cry1Ac (0.3 [mu]g g-1) and HaCPV (3 x 107 PIB ml-1) that showed synergism. However, when they exposed to Bt cotton leaf discs and HaCPV the effect on mortality was synergism except combination of Bt cotton leaf discs and HaCPV (6 x 106 PIB ml-1) that showed additive. Most of the combinations are showed additive effect in the toxicity and in combinations of Cry1Ac at lowest and HaCPV at highest concentrations synergism is observed. Not only were larval growth and development delayed, but pupation and pupal weight also decreased when larvae were fed on artificial diet containing Cry1Ac and HaCPV or transgenic Bt cotton leaf discs specially in first instar.

Keywords: Bacillus thuringiensis; Cry1Ac; Helicoverpa armigera; Transgenic cotton; HaCPV; Combination; Synergism; Additive

Yonghui Wang, Guoyou Ye, Na Luan, Jian Xiao, Yuan Chen, Dehua Chen, Boll size affects the insecticidal protein content in Bacillus thuringiensis (Bt) cotton,
Field Crops Research, Volume 110, Issue 2, 10 February 2009, Pages 106-110, ISSN 0378-4290, DOI: 10.1016/j.fcr.2008.07.008.
(http://www.sciencedirect.com/science/article/B6T6M-4TC8J34-1/2/7f6a78809ab51b73aa3abc67fe8160d7)

Abstract:

Bacillus thuringiensis (Bt) transgenic cotton has been planting in large-scale for more than 10 years in China. It was observed that resistance to bollworm was reduced with the application of big-boll cultivars in China. The objective of the study was to investigate the effects of boll size on the contents of CryIA insecticidal protein in boll shell and cotton seed during the course of boll development. Two experiments were conducted at the Yangzhou University Farm, Yangzhou, China. In 2004, three cultivars including Sikang 1 (small-boll), Xiangza 3 (medium-boll) and Kemian 3 (big-boll) were compared for boll shell volume and 100-seed weight from 10 to 40 days after flowering (DAF), and insecticidal protein contents in boll shell and cotton seed from 10 to 50 DAF. As expected, the differences between cultivars were significant for all the four characteristics. Cultivars with bigger boll shell volume had higher 100-seed weight but lower insecticidal protein contents in both of the boll shell and cotton seed. The correlation between boll size and boll insecticidal protein content was negative (-0.653). The correlation between 100-seed weight and cotton seed insecticidal protein content was significantly negative (-0.645). In 2005, leaf cut (LC) and square removal (SR) treatments were applied to Sikang 1 and Sikang 3. The boll shell volume and 100-seed weight were decreased by LR, but increased by SR. LC significantly enhanced and SR significantly reduced the insecticidal protein contents of boll shell and cotton seed. The correlation between boll size and boll insecticidal protein content (-0.870) and the correlation between 100-seed weight and cotton seed insecticidal protein content were both highly significant and negative (-0.841). Therefore, the results of the study indicated that the boll insecticidal protein content was significantly affected by boll size. The implications of the observed results in breeding, cultural practices and pest management were discussed.

Keywords: Bt cotton; Boll size; CryIA insecticidal protein

G.T. Gujar, V. Kalia, A. Kumari, B.P. Singh, A. Mittal, R. Nair, M. Mohan, Helicoverpa armigera baseline susceptibility to Bacillus thuringiensis Cry toxins and resistance management for Bt cotton in India,

Journal of Invertebrate Pathology, Volume 95, Issue 3, Special Issue for SIP 2007, SIP 2007, July 2007, Pages 214-219, ISSN 0022-2011, DOI: 10.1016/j.jip.2007.03.011. (http://www.sciencedirect.com/science/article/B6WJV-4NBH239-4/2/42f4babcdae7e2e76afb7a75cd081332)

Abstract:

Transgenic cotton that produces insecticidal proteins from Bacillus thuringiensis (Bt), often referred to as Bt cotton, is widely grown in many countries. Bt cotton with a single cry1A gene and stacked also with cry2A gene has provided satisfactory protection against the damage by the lepidopteran bollworms, especially the cotton bollworm, Helicoverpa armigera (Hubner) which is considered as a key pest. The baseline susceptibility of the larvae of H. armigera to Cry1Ac and other toxins carried out in many countries has provided a basis for monitoring resistance. There is no evidence of development of field-level resistance in H. armigera leading to the failure of Bt cotton crop anywhere in the world, despite the fact that Bt cotton was grown on the largest ever area of 12.1 million hectares in 2006 and its cumulative cultivation over the

last 11 years has surpassed the annual cotton area in the world. Nevertheless, the Bt resistance management has become a necessity to sustain Bt cotton and other transgenic crops in view of potential of the target insects to evolve Cry toxin resistance.

Keywords: Cotton bollworm; Helicoverpa armigera; Bacillus thuringiensis Cry toxins; Bt cotton; Bt resistance management

Sharon Downes, Rod Mahon, Karen Olsen, Monitoring and adaptive resistance management in Australia for Bt-cotton: Current status and future challenges,

Journal of Invertebrate Pathology, Volume 95, Issue 3, Special Issue for SIP 2007, SIP 2007, July 2007, Pages 208-213, ISSN 0022-2011, DOI: 10.1016/j.jip.2007.03.010.
(http://www.sciencedirect.com/science/article/B6WJV-4NBH239-3/2/888c46b11ed586ed4b7b61607042ede1)

Abstract:

In the mid-1990s the Australian Cotton industry adopted an insect-resistant variety of cotton (Ingard(R)) which expresses the Bt toxin Cry1Ac that is specific to a group of insects including the target Helicoverpa armigera. A conservative resistance management plan (RMP), that restricted the area planted to Ingard(R), was implemented to preserve the efficacy of Cry1Ac until two-gene transgenic cotton was available. In 2004/05 Bollgard II(R) replaced Ingard(R) as the transgenic cotton available in Australia. It improves on Ingard(R) by incorporating an additional insecticidal protein (Cry2Ab). If an appropriate refuge is grown, there is no restriction on the area planted to Bollgard II(R). In 2004/05 and 2005/06 the Bollgard II(R) acreage represented approximately 80 of the total area planted to cotton in Australia. The sensitivity of field-collected populations of H. armigera to Bt products was assayed before and subsequent to the widespread deployment of Ingard(R) cotton. In 2002 screens against Cry2Ab were developed in preparation for replacement of Ingard(R) with Bollgard II(R). There have been no reported field failures of Bollgard II(R) due to resistance. However, while alleles that confer resistance to H. armigera in the field are rare for Cry1Ac, they are surprisingly common for Cry2Ab. We present an overview of the current approach adopted in Australia to monitor and adaptively manage resistance to Bt-cotton in field populations of H. armigera and discuss the implications of our findings to date. We also highlight future challenges for resistance management in Australia, many of which extend to other Bt-crop and pest systems.

Keywords: Bacillus thuringiensis; Cotton; Resistance; Helicoverpa armigera; Australia

Samuel Nibouche, Natacha Guerard, Pierre Martin, Maurice Vaissayre, Modelling the role of refuges for sustainable management of dual-gene Bt Cotton in West African smallholder farming systems,

Crop Protection, Volume 26, Issue 6, June 2007, Pages 828-836, ISSN 0261-2194, DOI: 10.1016/j.cropro.2006.05.018.
(http://www.sciencedirect.com/science/article/B6T5T-4M33VPN-1/2/5053df7d3c54c7940ea0d992ecfb7aa5)

Abstract:

Modelling is a common tool for evaluating the sustainability of Bt crops. We previously used modelling to show that, under the agro-ecological conditions of West Africa, non-Bt cotton could be used as a refuge to delay the development of resistance to Bt toxins in Helicoverpa armigera. We concluded that Cry1Ac Bt Cotton should be limited to 20% of the total cotton acreage [Nibouche, S., Martin, P., Vaissayre, M., 2003. A modelling approach of the sustainability of Bt cotton grown by small farmers in West Africa. Res. Pest Manag. Newsl. 13, 55-58]. Here we present results obtained with a cotton cultivar expressing two Bt genes (dual-gene Bt Cotton). Our conclusions are the same as those drawn on the basis of results obtained with one-gene Bt Cotton, i.e. non-Bt cotton refuges are essential for effective prevention of resistance, since wild host plants of the bollworm have not been found to serve as a refuge for this pest during the rainy season. The optimal size of non-Bt cotton refuges depends on bollworm mortality levels on Bt cotton, and on gene flow between rainfed crops and irrigated vegetable crops. Although there is very little data available regarding pest movements and/or migration and crop-pest interactions in the agro-ecological conditions of West Africa, our simulations indicate that Bt cotton should not be grown on more than 20-25% of the total cotton cropping area in order to prevent resistance from developing in the long term.

Keywords: Transgenic crop; Resistance; Model; Helicoverpa armigera; Cotton

Y.H. Lu, F. Qiu, H.Q. Feng, H.B. Li, Z.C. Yang, K.A.G. Wyckhuys, K.M. Wu, Species composition and seasonal abundance of pestiferous plant bugs (Hemiptera: Miridae) on Bt Cotton in China,

Crop Protection, Volume 27, Issues 3-5, March-May 2008, Pages 465-472, ISSN 0261-2194, DOI: 10.1016/j.cropro.2007.07.017.

(http://www.sciencedirect.com/science/article/B6T5T-4PKG5MW-1/2/197da629eda9513d7539ce0840bfad46)

Abstract:

Only recently, due to a major reduction of broad-spectrum insecticide use in transgenic (Bt) cotton in China, plant bugs (Heteroptera: Miridae) have emerged as key pests of this crop. To determine their species composition and seasonal activity at various locations nationwide, field surveys were carried out between 2002 and 2006, using sweep-net samples and visual observation. Surveys were conducted in three major cotton-growing regions: Changjiang River, Yellow River, and Northwestern Region. The mirid complex on Bt cotton basically consisted of five different species, with Lygus lucorum, Lygus pratensis, and Adelphocoris suturalis most commonly encountered. L. lucorum and A. suturalis were the dominant species in the Changjiang River and Yellow River Region, while L. pratensis was the most common species in the Northwestern Region. The various mirid species were found in cotton fields throughout the cotton-growing season, usually with great population densities during the squaring and flowering stages. Peak mirid abundance ranged from 50 to 200 per hundred plants. Given the comparatively low economic thresholds for mirids (approx. 10 individuals/100 plants), these insects constitute serious pests in all cotton-growing regions of China. This paper suggests that L. lucorum, L. pratensis, and A. suturalis should be treated as

the main targets for developing pestiferous mirid forecasting and management strategies, which would be defined at or prior to the flowering and squaring stages of cotton in China.

Keywords: Transgenic Bt cotton; Mirid; Species composition; Seasonal abundance; China

James R. Fuxa, Arthur R. Richter, Maynard L. Milks, Threshold distances and depths of nucleopolyhedrovirus in soil for transport to cotton plants by wind and rain,
Journal of Invertebrate Pathology, Volume 95, Issue 1, May 2007, Pages 60-70, ISSN 0022-2011, DOI: 10.1016/j.jip.2006.11.011.
(http://www.sciencedirect.com/science/article/B6WJV-4MSXTBD-2/2/9108bf3b10d92726c005b76e698fde23)

Abstract:

Two aspects of abiotic transport of nucleopolyhedrovirus from soil to cotton plants were examined in greenhouse experiments: the distance from the plants and depth in soil from which the virus could be transported under controlled conditions of soil type and moisture, wind, and precipitation. Transport distance and depth were tested separately under relatively conducive (precipitation/sandy soil and wind/clay soil) and non-conducive (precipitation/clay soil and wind/sandy soil) conditions, as determined in previous research. The amount of virus transported by precipitation generally decreased as distance from the plant increased, but in wind the amounts of virus transported were best described by polynomial models, with transport efficiency usually peaking at a distance of 60 cm. Depending on plant height and tissue, the farthest distances that virus was transported ranged from 30 to 60 cm by precipitation from clay soil, 60-75 cm in precipitation/sand, 60-80 cm in wind/clay, and 60-80 cm in wind/sand. In the depth experiments, transport by precipitation and wind generally decreased as the depth of virus in soil increased. The greatest depth from which NPV was transported ranged from 0 to 0.5 cm by precipitation from clay soil, 0.5-1.0 cm in precipitation/sand, 1.0-2.0 cm in wind/clay, and 0.5-1.0 cm in wind/sand. All of the experimental parameters (distance or depth, soil type, plant height, plant tissue) and all two-way interactions significantly ($P < 0.05$) affected transport in all four experiments, except for the 'soil x plant tissue' interaction in the depth/wind experiment. In all of the experiments, transport was significantly greater ($P < 0.05$) to lower than to upper portions of plants and to leaves than to buds and squares. Transport was significantly greater from sandy soil than from clay in precipitation, and it was greater from clay than from sandy soil in wind. The results will contribute to NPV epizootiology, microbial control, and risk assessment.

Keywords: Baculoviridae; Heliothis virescens; Nucleopolyhedrovirus, transport; Nucleopolyhedrovirus, epizootiology; Transport, soil-plant; Transport wind; Transport, rain

Naiyin Xu, Michel Fok, Lixin Bai, Zhiguo Zhou, Effectiveness and chemical pest control of Bt-cotton in the Yangtze River Valley, China,
Crop Protection, Volume 27, Issue 9, September 2008, Pages 1269-1276, ISSN 0261-2194, DOI: 10.1016/j.cropro.2008.04.003.
(http://www.sciencedirect.com/science/article/B6T5T-4SPSH95-1/2/0f225ce14852a82ecd2dbbe762a20d1a)

Abstract:

The paper determines what might be the factors beneath the limited or reduced effectiveness being observed in China. The analysis is based on the data collected for several years from many locations in the Yangtze River Valley Varietal Experiment Network. All varieties declared to be Bt-cotton were confirmed to have the Bt-gene, the expression of which was assessed in three ways: through the analysis of Bt-protein production and through indoor and outdoor bioassays. Gene expression varied substantially between varieties and between years for the few varieties which were tested in two subsequent years. The Bt-cotton varieties being sown cannot control bollworms totally and this led to spray chemicals regardless of the real infestation level. Farmers are hence paying high prices for varieties which are not totally resistant to bollworms and pest control costs are not reduced to the extent that they might expect, lowering the profitability of cotton production.

Keywords: China; Bt; Cotton; Variety; Hybrids; Gene expression; Chemical control; Effectiveness

N.M.M. Abdullah, Joginder Singh, B.S. Sohal, Behavioral hormoligosis in oviposition preference of Bemisia tabaci on cotton,
Pesticide Biochemistry and Physiology, Volume 84, Issue 1, January 2006, Pages 10-16, ISSN 0048-3575, DOI: 10.1016/j.pestbp.2005.03.011.
(http://www.sciencedirect.com/science/article/B6WP8-4HH819J-1/2/330805b4752a1ce6313d830aa1bb018c)

Abstract:

The study on behavioral hormoligosis in oviposition preference in Bemisia tabaci (Genn.) on cotton was conducted, at Entomological Research Farm, Punjab Agricultural University (PAU), Punjab, India, during 2001 crop season and repeated in the same season. Multiple-choice test was followed for conducting the experiment. Quinalphos (250, 375, and 500), carbaryl (625, 938, and 1250), acephate (750, 1125, and 1500), endosulfan (438, 656, and 875), and fenvalerate (25, 38, and 50 g ai/ha) were repeatedly sprayed on potted plants of American cotton (var. LH-1556). The impact of these insecticides was evaluated in term of oviposition preference by B. tabaci to treated plants. Also, it investigated changes in biochemical components of treated cotton leaves and the correlation with oviposition preference. The results revealed that, fenvalerate treated plants were more preferred by whitefly for oviposition. Maximum number of eggs was observed on fenvalerate treated plants, 38, 50, and 25 g/ha (39.3, 37.3, and 36.1 eggs/leaf, respectively) followed by acephate 1500 g/ha (26.9 eggs/ leaf) compared with untreated control (14.1 eggs/leaf). Almost similar trend of results was

observed in the repeated experiment. The results obtained from biochemical studies revealed that all the insecticidal treatments caused reduction in total sugars comparedwith untreated control except fenvalerate and low dose of quinalphos. All insecticides caused increase in total free amino acids and brought significant changes in total phenols and pH value of treated plants. These results have confirmed the behavioral hormoligosis in oviposition preference that induced by fenvalerate and acephate in B. tabaci, which may be one of the causes behind its resurgence on plants repeatedly treated with these insecticides.

Keywords: Bemisia tabaci; Insecticides; Hormoligosis; Oviposition; Cotton; Biochemical changes

S. Kranthi, C.S. Dhawad, S. Naidu, A. Bharose, A. Chaudhary, V. Sangode, S.K. Nehare, S.R. Bajaj, K.R. Kranthi, Susceptibility of the cotton bollworm, Helicoverpa armigera (Hubner) (Lepidoptera: Noctuidae) to the Bacillus thuringiensis toxin Cry2Ab before and after the introduction of Bollgard-II,

Crop Protection, Volume 28, Issue 5, May 2009, Pages 371-375, ISSN 0261-2194, DOI: 10.1016/j.cropro.2008.12.001.
(http://www.sciencedirect.com/science/article/B6T5T-4VBM46V-1/2/b6b3513667bc402bd62303c2ec7f9889)

Abstract:

The geographical variability in Helicoverpa armigera susceptibility levels to Cry2Ab toxin expressed by transgenic maize (not currently commercialized in India) was determined through log dose probit assays conducted on populations collected during 2004-05 (from 25 districts) and 2007-08 (from 22 districts) across India. While 2004-05 is the year prior to commercialization of dual gene Bollgard-II-Bt cotton that expresses Cry2Ab in addition to Cry1Ac, 2007-08 is two years after its commercial release. LC50 values ranged from 6.0 to 28.6 [mu]g Cry2Ab/ml of diet in 2004-05 and from 2.46 to 34.7 [mu]g Cry2Ab/ml of diet in 2007-08. The IC50 range in 2004-05 and 2007-08 was from 0.31 to 2.3 [mu]g/ml and 0.10-3.4 [mu]g/ml of diet, respectively. The probit analysis data of 2004-05 can be used as baseline indices to monitor for changes in the H. armigera susceptibility to Cry2Ab, subsequent to the introduction of Bollgard-II cotton in India. The probit analysis data of 2007-08 showed that the baseline has not undergone any significant changes two years after cultivation of Bollgard-II in India. The relatively low toxicity of Cry2Ab and its higher expression late in the cotton season compared with Cry2Ab, compounded with its presence in Bt hybrids on a separate linkage group from Cry1Ac suggest problems of resistance in the future.

Keywords: Helicoverpa armigera; Bt cotton; Bacillus thuringiensis; Resistance; Cry2Ab

Omer Hema, Hugues Ninaon Some, Ouola Traore, John Greenplate, Mourad Abdennadher, Efficacy of transgenic cotton plant containing the Cry1Ac and Cry2Ab genes of Bacillus thuringiensis against Helicoverpa armigera and Syllepte derogata in cotton cultivation in Burkina Faso,

Crop Protection, Volume 28, Issue 3, March 2009, Pages 205-214, ISSN 0261-2194, DOI: 10.1016/j.cropro.2008.09.014.
(http://www.sciencedirect.com/science/article/B6T5T-4TY4MR4-1/2/87e2233c72bb0694d2bf974a5b2e8445)
Abstract:

As part of the research into alternatives to pyrethroids, to which lepidopteran cotton pests have begun to develop resistance, transgenic cotton expressing two endotoxins (Cry1Ac and Cry2Ab) of Bacillus thuringiensis Berliner (Bt), in the U.S. germplasms DP50 and Coker 312, was tested under field conditions in Burkina Faso in two contained areas. An untreated (no lepidopteran insecticidal sprays) conventional (non-transgenic) U.S. variety (Coker 312 in 2003; DP50 in 2004 & 2005) and two conventional local varieties (untreated and treated) were utilized in each test as comparators. The experiments conducted in 2003, 2004 and 2005 showed that the transgenic cotton plant significantly reduced larval populations of the cotton bollworm, Helicoverpa armigera, and the cotton leafroller, Syllepte derogata compared to untreated varieties. Plant damage analyses upon maturity revealed significantly higher levels of sound bolls in transgenic cotton plants. Seed cotton yields and lint quality were also higher for the transgenic cotton than for untreated convention varieties. The transgenic variety was always statistically equivalent or superior to the treated conventional one.The transgenic cotton plant expressing two endotoxins (Cry1Ac and Cry2Ab) of B. thuringiensis Berliner (Bt) can therefore be an alternative to the use of pyrethroids and endosulfan in cotton cultivation in Burkina Faso. This will have dual advantage of significantly reducing the quantities of pesticides sprayed in the cotton fields while protecting yields and quality of lint.
Keywords: Transgenic cotton plant; Bacillus thuringiensis; Helicoverpa armigera; Syllepte derogata; Burkina Faso

Maria A. Ibargutxi, Delia Munoz, Inigo Ruiz de Escudero, Primitivo Caballero, Interactions between Cry1Ac, Cry2Ab, and Cry1Fa Bacillus thuringiensis toxins in the cotton pests Helicoverpa armigera (Hubner) and Earias insulana (Boisduval),
Biological Control, Volume 47, Issue 1, October 2008, Pages 89-96, ISSN 1049-9644, DOI: 10.1016/j.biocontrol.2008.07.003.
(http://www.sciencedirect.com/science/article/B6WBP-4T0MMHV-2/2/01eb5356dbec10152e4a9af93275c277)
Abstract:

One of the most effective strategies recommended to delay insect resistance to Bt-plants is concurrent expression of several toxins in the same plant. A new generation of Bt-cotton, including Bollgard II and WideStrike, has been developed to simultaneously express two different Cry toxins, Cry1Ac and Cry2Ab, and Cry1Ac and Cry1Fa, respectively. The aim of this study was to determine the individual and combined toxic effect of Cry1Ac, Cry2Ab, and Cry1Fa in the cotton pests Helicoverpa armigera and Earias insulana, as well as the nature of the interactions between these toxins, as determined by mean lethal concentration (LC50) values and larval growth inhibition studies. Singly, all three assayed toxins were more toxic against E. insulana

than against H. armigera larvae. Toxin Cry1Ac was significantly more toxic than the other two on H. armigera, while toxin Cry1Fa was the least toxic and caused no significant mortality. When combined, Cry1Ac and Cry1Fa showed an additiveinteraction in all proportions analyzed for both pest species, whereas Cry1Ac and Cry2Ab interacted synergistically in mixtures comprising 1:1 or 1:4 of each toxin against H. armigera. In E. insulana, there was no synergism between Cry1Ac and Cry2Ab but both these toxins showed a high insecticidal activity when administered individually and in mixtures. This study suggest that each particular toxin or toxin combination expressed in transgenic Bt-cotton should be carefully selected depending on the most important pest species present in each geographical area.

Keywords: Earias insulana; Helicoverpa armigera; Bacillus thuringiensis; Bt cotton; Cry toxins; Interaction; Synergy; Pest control

Kanglai He, Zhenying Wang, Shuxiong Bai, Li Zheng, Yubo Wang, Haiying Cui, Efficacy of transgenic Bt cotton for resistance to the Asian corn borer (Lepidoptera: Crambidae), ***Crop Protection,*** Volume 25, Issue 2, February 2006, Pages 167-173, ISSN 0261-2194, DOI: 10.1016/j.cropro.2005.04.003.
(http://www.sciencedirect.com/science/article/B6T5T-4G5BJ8H-4/2/d209e529838186598da0b148c2b56cef)

Abstract:

Transgenic Bt cotton is expected to provide satisfactory control of several lepidopteran species in cotton. The Asian corn borer (ACB), Ostrinia furnacalis (Guenee), is an important component of the lepidopteran pest complex of cotton in China. Monsanto's transgenic Bt cotton NC 33B, expressing Cry1Ac protein, and a Chinese transgenic Bt cotton GK-2, expressing Cry1A protein, were evaluated for resistance to ACB during 2001-2002. Field trials were conducted with an artificial infestation of ACB at different cotton crop stages, which coincided with the generations of natural ACB occurrence. Damage ratings were significantly reduced in transgenic cotton cultivars both NC 33B and GK-2 compared with their parental non-transgenic Bt cotton cultivars DP5415 and Simian 3, and a major conventional cultivar Shiyuan 321, respectively. In addition, percentage of plants stem-bored and mean number of tunnels per plant were significantly higher on GK-2 than on NC 33B in the second generation. Laboratory bioassays were carried out by exposing neonates to plant tissues collected from the field during the season. Tissues assayed included the new leaves, floral buds, match-head squares, and white flowers, which are the tissues initially attacked by the neonates in the field. Low larval survival rates were observed on NC 33B and GK-2, contrasting greatly to the high number of survivors found on equivalent non-Bt cotton tissue isolated throughout the season. However, larval survival was higher on the tissues isolated from late-season Bt cotton plants than on early season. In addition, higher larval survival was observed on GK-2 than NC 33B in assays with the late season tissues. This may be associated with reduced levels of available toxin in plant tissues as they age. Both laboratory and field data indicated that NC 33B and GK-2 were highly resistant to ACB. The high level of efficacy for Bt cotton against ACB offers the potential for season-long control.

Keywords: Bt cotton; Transgenic plant; Host plant resistance; Ostrinia furnacalis

T. Brevault, Y. Oumarou, J. Achaleke, M. Vaissayre, S. Nibouche, Initial activity and persistence of insecticides for the control of bollworms (Lepidoptera: Noctuidae) in cotton crops,
Crop Protection, Volume 28, Issue 5, May 2009, Pages 401-406, ISSN 0261-2194, DOI: 10.1016/j.cropro.2008.12.006.
(http://www.sciencedirect.com/science/article/B6T5T-4VF0XMM-3/2/d0c4fad88933643b7b08eb27bcfe8078)
Abstract:
We evaluated six insecticides for their initial activity against the cotton bollworms Helicoverpa armigera (Hubner), Diparopsis watersi (Rotschild), and Earias spp., in sub-Saharan Africa (Cameroon). Residual activity and effect of simulated rainfall were also assessed in the case of H. armigera. Bioassays were conducted by transferring larvae on leaf discs collected from sprayed plots. Thiodicarb, endosulfan, and to a lesser extent emamectin-benzoate and indoxacarb had high initial activity against H. armigera, regardless of larval instars. Spinosad and cypermethrin-profenofos (CP) mix were effective at controlling larvae of first and second instars but not larvae of third to fifth instars. All tested insecticides effectively controlled Earias larvae (87-98% mortality). Regarding D. watersi, indoxacarb and endosulfan (77 and 82% mortality respectively) were less effective than spinosad and thiodicarb (95-99% mortality). Persistence was quantified by the duration after which an insecticide kills less than 50% of H. armigera neonates. Rain had a significant detrimental effect on insecticide persistence, except in the case of thiodicarb and emamectin-benzoate. In rainy conditions, thiodicarb (17.2 d) was the most persistent insecticide, followed by emamectin-benzoate and spinosad (10.6 and 8.9 d), and endosulfan, indoxacarb, and CP (2.7-5.2 d). Indoxacarb should be recommended for controlling sporadic outbreaks of H. armigera due to its high efficacy and low persistence, while CP should be used to control D. watersi infestations. More persistent insecticides such as spinosad and emamectin-benzoate should be recommended to control continuous and mixed-species populations of bollworms in the field.
Keywords: Insecticide; Residual activity; Pyrethroid resistance; Helicoverpa armigera; Earias spp.; Diparopsis watersi; Cotton

G.T. Gujar, R. Nair, B.P. Singh, A. Kumari, V. Kalia, Toxicity to the cotton bollworm, Helicoverpa armigera, of some Cry1Ac toxins expressed in cotton in India,
Crop Protection, Volume 27, Issues 3-5, March-May 2008, Pages 537-544, ISSN 0261-2194, DOI: 10.1016/j.cropro.2007.08.008.
(http://www.sciencedirect.com/science/article/B6T5T-4PYYFWR-1/2/54ab8cd17897e81160d1a1cdd0c06bcc)
Abstract:
Bacillus thuringiensis (Bt) transgenic cotton, grown over about 3.8 million hectare in 2006 in India, is essentially a mosaic of different cry1 genes, predominantly based on Monsanto's 531 event carrying the cry1Ac gene, and to some extent JK AgriGenetics's

event 1 with native modified cry1Ac, Nath Seeds's GFM event with fusion genes of cry1Ab and cry1Ac, and cry1Ab and cry1C in single-stacked hybrids, and the Monsanto's 15985 event with two cry1Ac and cry2Ab genes. In view of different cry1Ac genes used for transformation, toxicity (96 h LC50) of some Cry1Ac proteins to the neonates of the cotton bollworm, Helicoverpa armigera, varied, with a range of 0.158-5.42 [mu]g/g for BGSC Cry1Ac (23 populations), 0.076-5.76 [mu]g/g for JK Cry1Ac (24 populations) and 0.0085-0.822 [mu]g/g for MVP Cry1Ac (21 populations). There are significant differences in the toxicity of these Cry1Ac proteins; despite the use of genetically diverse insect populations, suggesting a need of evolving a consensus on Cry1Ac resistance monitoring of the larvae of H. armigera.

Keywords: Toxicity; Bacillus thuringiensis; Cry1Ac; The cotton bollworm; Helicoverpa armigera

Zi-jun WANG, Hai LIN, Ji-kun HUANG, Rui-fa HU, Scott Rozelle, Carl Pray, Bt Cotton in China: Are Secondary Insect Infestations Offsetting the Benefits in Farmer Fields?, ***Agricultural Sciences in China,*** Volume 8, Issue 1, January 2009, Pages 83-90, ISSN 1671-2927, DOI: 10.1016/S1671-2927(09)60012-2.
(http://www.sciencedirect.com/science/article/B82XG-4VFMC51-D/2/051106c1b0a90656b6267f9212a607cb)

Abstract:

The area sown to Bt cotton has expanded rapidly in China since 1997. It has effectively controlled the bollworm. However, in recent years, concern has surfaced about the emergence of secondary insect pests, particular mirids, in Bt cotton fields. This study measures the patterns of insecticide use based on farm-level from 1999 to 2006, the analysis demonstrates a rise in insecticide use to control mirids between 2001 and 2004, secondary insect infestations is largely related to the rise of mirids, but this rising did not continue in more than half of sample villages studied in 2004-2006. Moreover, the increase in insecticide use for the control of secondary insects is far smaller than the reduction in total insecticide use due to Bt cotton adoption. Further econometric analyses show that rise and fall of mirids is largely related to local temperature and rainfall.

Keywords: Bt cotton; secondary insect; mirid; China

Richard V. Sequeira, Steven E. Naranjo, Sampling and management of Bemisia tabaci (Genn.) biotype B in Australian cotton,
Crop Protection, Volume 27, Issue 9, September 2008, Pages 1262-1268, ISSN 0261-2194, DOI: 10.1016/j.cropro.2008.04.002.
(http://www.sciencedirect.com/science/article/B6T5T-4SR6FM7-1/2/8708505dc542761b610cb8fce2160637)

Abstract:

Data on seasonal population abundance of Bemisia tabaci biotype B (silverleaf whitefly (SLW)) in Australian cotton fields collected over four consecutive growing

seasons (2002/2003-2005/2006) were used to develop and validate a multiple-threshold-based management and sampling plan. Non-linear growth trajectories estimated from the field sampling data were used as benchmarks to classify adult SLW field populations into six density-based management zones with associated control recommendations in the context of peak flowering and open boll crop growth stagesControl options based on application of insect growth regulators (IGRs) are recommended for high-density populations (>2 adults/leaf) whereas conventional (non-IGR) products are recommended for the control of low to moderate population densities. A computerised re-sampling program was used to develop and test a binomial sampling plan. Binomial models with thresholds of T=1, 2 and 3 adults/leaf were tested using the field abundance data. A binomial plan based on a tally threshold of T=2 adults/leaf and a minimum sample of 20 leaves at nodes 3, 4 or 5 below the terminal is recommended as the most parsimonious and practical sampling protocol for Australian cotton fields. A decision support guide with management zone boundaries expressed as binomial counts and control options appropriate for various SLW density situations is presented. Appropriate use of chemical insecticides and tactics for successful field control of whiteflies are discussed.

Keywords: Bemisia tabaci; Cotton; Management zones; Binomial sampling plan

Y.H. Lu, K.M. Wu, K.A.G. Wyckhuys, Y.Y. Guo, Potential of mungbean, Vigna radiatus as a trap crop for managing Apolygus lucorum (Hemiptera: Miridae) on Bt cotton,
Crop Protection, Volume 28, Issue 1, January 2009, Pages 77-81, ISSN 0261-2194, DOI: 10.1016/j.cropro.2008.08.018.
(http://www.sciencedirect.com/science/article/B6T5T-4TPF8W0-1/2/bb6e8690b3b8bc0d7c3a8751ee68c2dc)

Abstract:

In recent years, the mirid Apolygus lucorum has become the key insect pest of Bt cotton in China. Currently, insecticide use is the sole pest management option available for most Chinese cotton farmers. As irrational pesticide use may have several undesirable effects, environmentally sound and sustainable management alternatives are urgently needed. In this paper, we evaluate the potential of mungbean, Vigna radiatus as a trap crop for A. lucorum in Bt cotton. Plant suitability trials showed that A. lucorum population densities on mungbean were significantly higher than those on cotton. Large-scale field experiments were conducted during 2006 and 2007 to determine the effectiveness of mungbean strips for managing A. lucorum in Bt cotton fields. In this experiment, 0.1 ha Bt cotton fields were established, and mungbean strips covered approximately 10% of the total area. With periodical insecticide applications in mungbean strips, average mirid population densities in cotton fields were 18.1 +/- 2.1 individuals per 100 plants, versus 36.0 +/- 3.4 in the fields without mungbean strips in 2006. However, A. lucorum population still surpassed economic threshold (i.e., 5, 10, and 20 individuals per 100 cotton plants at the seeding stage, the squaring and flowering stages, and the belling stage, respectively). In 2007, aside from the insecticide sprays within the mungbean strips, 2-3 insecticide applications were done in the cotton

field. As a result, A. lucorum populations were kept below economic threshold, and the total amount of insecticides reduced about 70% of those used in the common chemical-controlled fields. Our work shows that mungbean has considerable potential as a trap crop in Bt cotton fields, and its adoption by Chinese farmers very likely will reduce current levels of pesticide use in this crop.

Keywords: Mungbean; Apolygus lucorum; Cotton; Host preference; Trap crop

Zhen Luo, Hezhong Dong, Weijiang Li, Zhao Ming, Yuqing Zhu, Individual and combined effects of salinity and waterlogging on Cry1Ac expression and insecticidal efficacy of Bt cotton,

Crop Protection, Volume 27, Issue 12, December 2008, Pages 1485-1490, ISSN 0261-2194, DOI: 10.1016/j.cropro.2008.06.006.
(http://www.sciencedirect.com/science/article/B6T5T-4T9TBY5-1/2/a4c133427d43bc6f890a3121ab83204a)

Abstract:

Salinity, waterlogging and a combination of both stresses are severe threats to plant growth, development and yield of field-grown cotton (Gossypium hirsutum L.), but their individual or combined effects on insecticidal efficacy of Bacillus thuringiensis (Bt) transgenic cotton and the underlying mechanisms are not well understood. In the present study, two cotton cultivars (33B and SCRC17) containing the Cry1Ac insecticidal protein gene were planted in 10 L pots filled with soil and allowed to grow in a greenhouse. The potted plants were either treated with NaCl (5 mg/g, w/w), waterlogging, or a combination of both stresses at the three true-leaf stage, and levels of total soluble protein, Bt insecticidal protein, gossypol and the control efficacy as indicated by mortality of bollworm larvae were examined at 7-day intervals after stress. Waterlogging and a combination of salinity and waterlogging reduced total protein content by 40-46% and 45-65% and Bt protein content by 38-50% and 45-72% from 7 to 21 days after stress, relative to the non-stressed control, respectively. The control efficacy was significantly reduced by either waterlogging or the combined stress. Regression analysis indicated that Bt protein content was correlated to total soluble protein content (R2 = 0.7677*), while Bt cotton efficacy was correlated to Bt protein level (R2 = 0.7917**). Salinity reduced Bt protein by 11-22% and total soluble protein by 5.7-7.2% from 7 to 21 days after NaCl stress, but did not result in reduction in control efficacy. It is concluded that reduced bollworm control efficacy under waterlogging or the combined stress could be mainly attributed to the declined levels of Bt protein, which is closely associated with the inhibited nitrogen metabolism by stresses. As one of the secondary compounds that are toxic to pests, increases in gossypol may be involved in maintaining the efficacy when Bt protein level was reduced under salinity.

Keywords: Bt cotton; Gossypol; Insecticidal efficacy; Insecticidal protein; Salinity; Waterlogging

T. Brevault, L. Couston, A. Bertrand, M. Theze, S. Nibouche, M. Vaissayre, Sequential pegboard to support small farmers in cotton pest control decision-making in Cameroon, ***Crop Protection***, Volume 28, Issue 11, November 2009, Pages 968-973, ISSN 0261-2194, DOI: 10.1016/j.cropro.2009.07.004.
(http://www.sciencedirect.com/science/article/B6T5T-4WW16MT-1/2/dd770f70149719ac0dfb73b366a2a65b)

Abstract:

A method (SPID) based on sequential plan for individual decision with a pegboard was tested over the 2006 and 2007 cropping seasons in 15 cotton producing villages in Cameroon - covering almost 700 farmers and 2000 ha to help farmers decide on when to spray their cotton crops against bollworms. This method was promoted

through training sessions, from researchers to farmers through the technical staff of the cotton company (SODECOTON). This innovation led to a significant reduction in the number of sprays in 5 village-years out of 17 (total number of villages for 2006 and 2007). The number of sprays was larger than in the calendar-based programme in nine village-years, mainly due to poorly controlled infestations of Diparopsis watersi (Rothschild). However, this larger number of sprays led to a greater (seven village-years) or equal (two village-years) seed-cotton yield than that obtained with the calendar-based programme. When the number of sprays was equal or smaller, seed-cotton yield was greater (two village-years) or equal (six village-years) to LPD. Lastly, income increased proportionally to seed-cotton yield. An analysis of decisions made by farmers using the pegboard, as well as an a posteriori evaluation test, showed that users successfully learned the method and were confident in its diagnosis. This new method is not hampered by the constraints experienced with the former LEC (`targeted staggered control') spraying decision method - sequential sampling reduces the number of plants to be monitored, spraying decisions are made for individual plots, income rises and the role of supervisors is reduced. However, large-scale dissemination of this innovation is being hampered by the collective management of cotton production and the need to train a large number of farmers.

Keywords: Cotton; Bollworms; Spraying threshold; Sampling; Cameroon; Dissemination

Bonnie H. Ownley, Mary R. Griffin, William E. Klingeman, Kimberly D. Gwinn, J. Kevin Moulton, Roberto M. Pereira, Beauveria bassiana: Endophytic colonization and plant disease control,
Journal of Invertebrate Pathology, Volume 98, Issue 3, Special Issue for SIP 2008, SIP 2008, July 2008, Pages 267-270, ISSN 0022-2011, DOI: 10.1016/j.jip.2008.01.010.
(http://www.sciencedirect.com/science/article/B6WJV-4S2F5V6-4/2/ef3c00d3daa053f848688f520c4fcbe9)

Abstract:

Seed application of Beauveria bassiana 11-98 resulted in endophytic colonization of tomato and cotton seedlings and protection against plant pathogenic Rhizoctonia solani and Pythium myriotylum. Both pathogens cause damping off of seedlings and root rot of older plants. The degree of disease control achieved depended upon the

population density of B. bassiana conidia on seed. Using standard plating techniques onto selective medium, endophytic 11-98 was recovered from surface-sterilized roots, stems, and leaves of tomato, cotton, and snap bean seedlings grown from seed treated with B. bassiana 11-98. As the rate of conidia applied to seed increased, the proportion of plant tissues from which B. bassiana 11-98 was recovered increased. For rapid detection of B. bassiana 11-98 in cotton tissues, we developed new ITS primers that produce a PCR product for B. bassiana 11-98, but not for cotton. In cotton samples containing DNA from B. bassiana11-98, the fungus was detected at DNA ratios of 1:1000; B. bassiana 11-98 was detected also in seedlings grown from seed treated with B. bassiana 11-98. Using SEM, hyphae of B. bassiana11-98 were observed penetrating epithelial cells of cotton and ramifying through palisade parenchyma and mesophyll leaf tissues. B. bassiana11-98 induced systemic resistance in cotton against Xanthomonasaxonopodis pv. malvacearum (bacterial blight). In parasitism assays, hyphae of B. bassiana 11-98 were observed coiling around hyphae of Pythium myriotylum.

Keywords: Biological control; Endophytic colonization; Plant disease; Pythium myriotylum; Rhizoctonia solani; Xanthomonas axonopodis pv. malvacearum

D. Pemsl, H. Waibel, Assessing the profitability of different crop protection strategies in cotton: Case study results from Shandong Province, China,
Agricultural Systems, Volume 95, Issues 1-3, December 2007, Pages 28-36, ISSN 0308-521X, DOI: 10.1016/j.agsy.2007.02.013.
(http://www.sciencedirect.com/science/article/B6T3W-4NT255H-1/2/b399deaaabb5994cd2272fb99e9b03a1)

Abstract:

The paper compares the economic performance of different crop protection strategies in cotton including the use of transgenic varieties in Shandong Province, China. By means of a Monte Carlo simulation model a comparison was made between conventional insecticide strategies, planting of bollworm-resistant Bt varieties and a strategy of combining both technologies. To account for the observed variation in the toxin content of the Bt varieties in China, two different quality levels of Bt seed are included in the model.The data for the model are season-long records of input use and yield of 150 small-scale cotton producers in five villages in Shandong Province, which are complemented with a survey of Chinese cotton experts. Results show that the high cost pest control strategy based on expensive, good quality Bt seeds is economically inferior to low cost strategies. Scenarios for different pest population levels were included and while the use of low quality Bt seed with need-based applications of insecticides is the dominant control strategy for the normal and high pest pressure scenarios, the use of non-Bt varieties performs well under low pest pressure conditions. These results imply the need to include agro-ecosystem aspects such as pest pressure

conditions and the impact of control interventions on both pests and natural enemies in the assessment of pest control strategies.

Keywords: Bt cotton profitability; Uncertainty; Simulation model; China

Kongming Wu, Monitoring and management strategy for Helicoverpa armigera resistance to Bt cotton in China,

Journal of Invertebrate Pathology, Volume 95, Issue 3, Special Issue for SIP 2007, SIP 2007, July 2007, Pages 220-223, ISSN 0022-2011, DOI: 10.1016/j.jip.2007.03.012.
(http://www.sciencedirect.com/science/article/B6WJV-4NBH239-6/2/055dd4e639efe9611ed06429cd033e3c)

Abstract:

The cotton bollworm, Helicoverpa armigera, is one of the most important insect pests in cotton growing regions of China. Transgenic cotton that expresses a gene derived from the bacterium Bacillus thuringiensis (Bt) has been deployed for combating cotton bollworm since 1997. Natural refuges derived from the mixed planting system consisting of cotton, corn, soybean, vegetables, peanut and others on single-familyfarms of a small scale were used for delaying the evolution of resistance to Bt cotton. Susceptibility of H. armigera field populations to the Bt insecticidal protein Cry1Ac was monitored from 1997 to 2006. The results indicate that the field populations are still susceptible to Cry1Ac, and monitoring indication no apparent shifts in susceptibility in field populations of this important pest.

Keywords: Bt cotton; Helicoverpa armigera; Resistance management; Natural refugia

Geographic Populations of Cotton Bollworm, Helicoverpa armigera (Hubner) Occurring in South Indian Cotton Ecosystems,

Journal of Asia-Pacific Entomology, Volume 10, Issue 1, March 2007, Pages 39-44, ISSN 1226-8615, DOI: 10.1016/S1226-8615(08)60329-5.
(http://www.sciencedirect.com/science/article/B8JJN-4V6TFFF-8/2/8751a98df83b82ee4288280cc3d70018)

Abstract:

Morphometric characterization of twelve geographic populations of cotton bollworm, Helicoverpa armigera occurring in south Indian cotton ecosystems was done at larval, pupal and adult stages over three cropping seasons. Traits such as length and weight of larvae, pupa and length and width of the wing, length of fore-, mid- and hind femur, male reproductive organ-length of genital capsule, valves, and ejaculatory duct, female reproductive organ-length of appendix bursae and ductus bursae at adult stage were measured across three years. Populations significantly differed for most of the traits studied. It was evident that populations from northern parts recorded higher phenotypic attributes compared to those from southern parts of south Indian cotton ecosystem. Besides larval, pupal and adult external phenotypic traits, attributes of male reproductive organ viz., length of genital capsule, valves, and ejaculatory duct and female reproductive organ viz., length of appendix bursae and ductus bursae differed

significantly among populations. Information on population structure and differences based on morphometry would be useful in better understanding of population dynamics and management of this pest in cotton and other crops in south India.

Keywords: Phenotype; Helicoverpa armigera; Cotton bollworm; Population structure; Morphometric variation; Geographic population

Carlos Avilla, Jose E. Gonzalez-Zamora, Monitoring resistance of Helicoverpa armigera to different insecticides used in cotton in Spain,
Crop Protection, Volume 29, Issue 1, January 2010, Pages 100-103, ISSN 0261-2194, DOI: 10.1016/j.cropro.2009.09.007.
(http://www.sciencedirect.com/science/article/B6T5T-4XH5626-1/2/30a6af937f1715228eb5d801fbb7b459)

Abstract:

Helicoverpa armigera is the key pest of cotton in Spain, resulting in many insecticide treatments against it. The resistance status of H. armigera to different insecticides currently used in cotton was evaluated in Spain in two different seasons, 1999 and 2004. Four populations were tested in total, two in each season. Toxicological bioassays were conducted in the laboratory, and performed on third instar larvae by topical application of the insecticides. LD50's were estimated by probit analysis and resistance factors (RF) were calculated at the LD50 level. Four insecticides were evaluated, but only endosulfan reached a moderate resistance level (RF = 11.4), and the others (methomyl, chlorpyrifos and lambda-cyhalothrin) showed low resistance (RF between 1.9 and 6.0). Such results indicate the generally low resistance of H. armigera to most of the insecticides used against this pest in cotton in Spain. Possible explanations for this situation are discussed.

Keywords: Insecticide resistance; Cotton; Helicoverpa armigera; Endosulfan; Methomyl; Chlorpyrifos; Lambda-cyhalothrin

Simoni Campos Dias, Maria Cristina Mattar da Silva, Fabiola R. Teixeira, Edson Luis Zangrando Figueira, Osmundo Brilhante de Oliveira-Neto, Loaiane Alves de Lima, Octavio Luiz Franco, Maria Fatima Grossi-de-Sa, Investigation of insecticidal activity of rye [alpha]-amylase inhibitor gene expressed in transgenic tobacco (Nicotiana tabacum) toward cotton boll weevil (Anthonomus grandis),
Pesticide Biochemistry and Physiology, Volume 98, Issue 1, September 2010, Pages 39-44, ISSN 0048-3575, DOI: 10.1016/j.pestbp.2010.04.008.
(http://www.sciencedirect.com/science/article/B6WP8-501FPGM-4/2/5bec88976acd879116cdc64b93b283b9)

Abstract:

Innumerable proteinaceous [alpha]-amylase inhibitors have been isolated and identified from different plant species. Among them, an [alpha]-amylase inhibitor gene with bioinsecticidal potential toward Anthonomus grandis (cotton boll weevil) was previously identified in rye seeds (Secale cereale). This cereal inhibitor was expressed in tobacco plants (Nicotiana tabacum) under control of phytohemaglutinin promoter by using Agrobacterium tumefasciens - mediated transformation. Presence of [alpha]BIII-

rye gene and further protein expression were confirmed by PCR and Western blot analysis, respectively. Immunological assays indicated that the recombinant inhibitor was expressed in concentration range from 0.1% to 0.28% (w:w) of the total protein in tobacco seeds of R0 plants. From 14 independent transformants, five plants with expression levels between 0.20% and 0.28% in seeds were in vitro assayed against A. grandis amylolytic enzymes causing clear inhibition. Moreover, bioassays using transgenic seed flour mixture for artificial diet produced 74% mortality in A. grandis first larval instar. These data suggest that rye inhibitor could be a promising biotechnological tool for produce transgenic cotton plants with an increased resistance to cotton boll weevil. Moreover, [alpha]BIII-rye gene should be considered a potential compound for a pyramiding strategy aiming to delay insect-resistance.

Keywords: [alpha]-Amylase inhibitor; Transgenic plants; Insect pest; Cotton boll weevil

Mohamed Hashem, Nabil A. Ibrahim, Wfaa A. El-Sayed, Shereef El-Husseiny, Elham El-Enany, Enhancing antimicrobial properties of dyed and finished cotton fabrics, ***Carbohydrate Polymers,*** Volume 78, Issue 3, 15 October 2009, Pages 502-510, ISSN 0144-8617, DOI: 10.1016/j.carbpol.2009.05.007.
(http://www.sciencedirect.com/science/article/B6TFD-4W9XG81-4/2/13620635380c84f5afb2d4259f8b09fa

Abstract:

1,2,3-Benzothiazole-7-thiocarboxylic acid-S-methylester (commercially known as Actigard(R) AM-87) was utilized to impart cotton fabric durable antimicrobial properties. Finishing treatment was carried out under a variety of conditions. The latter were included, effect of pH, concentration of antibacterial agents, curing temperature and curing time. The effect of fabric construction, mercerization, and dyeing with different dyestuff were also investigated. The study was also extended to investigate the technical feasibility of combining antimicrobial finishing treatment in question with other finishing treatment generally carried out on cotton fabric, like soft finishing and crease recovery finishing. The treated fabrics were monitored for antimicrobial properties before and after washing. The treated fabrics were also evaluated for the physio-mechanical properties like fabric tensile strength, elongation at break (or bursting strength for knitted fabric), wettability, crease recovery angle, whiteness index and roughness. Results obtained show that, the most appropriate conditions for treatment cotton fabric with Actigard(R) are: padding the cotton fabric in aqueous solution containing 6% Actigard(R) at pH 5 (adjusted using formic acid) then squeezed to wet pick up of 100%, dried at 80 [degree sign]C for 5 min then cured at 100 [degree sign]C for 150 s. The untreated cotton fabric did not show any antimicrobial activity towards Staphylococcus aureus or Escherichia coli. Treatment of cotton fabric with Actigard(R) improves its antimicrobial properties towards S. aureus or E. coli. It is also observed that, treatment of cotton fabric with Actigard(R) marginally decreases fabric tensile strength, elongation at break, roughness and WI, whereas; both wettability and crease recovery angle remain practically intact. This was observed whether the fabric was pre-mercerized or not.

Keywords: 1,2,3-Benzothiazole-7-thiocarboxylic acid-S-methylester;

Antimicrobial; Biocides; Cotton fabric; Finishing

K.C. Allen, R.G. Luttrell, Spatial and temporal distribution of heliothines and tarnished plant bugs across the landscape of an Arkansas farm,
Crop Protection, Volume 28, Issue 9, September 2009, Pages 722-727, ISSN 0261-2194, DOI: 10.1016/j.cropro.2009.04.007.
(http://www.sciencedirect.com/science/article/B6T5T-4WK3YBS-1/2/b05847fd56a9230bdeaf72988d77d647)

Abstract:

Farm records were used to study the temporal and spatial distribution of bollworm, Helicoverpa zea (Boddie), tobacco budworm, Heliothis virescens (F.), (collectively heliothines) and tarnished plant bug, Lygus lineolaris (Palisot de Beauvois), on cotton, Gossypium hirsutum L., across a 4000 ha farm in southeastern Arkansas. The influence of the percentage of corn, Z. mays L., cotton, rice, Oryza sativa L.,soybean, Glycine max L., and non-crop land within a 0.4 km buffer surrounding a cotton field and populations of heliothine eggs and tarnished plant bugs in cotton were examined over a three-year period. There was a positive relationship between the area in corn, Zea mays L., within 0.4 km of cotton fields and numbers of heliothine eggs in cotton in June 2004 and 2005. Positive relationships were observed between numbers of tarnished plant bugs in cotton and the surrounding area planted to corn, while negative relationships were observed for the area planted to cotton. Cotton fields with earlier dates of first flower had greater overall populations of tarnished plant bugs. Distributions of all three pests in cotton were at least partially explained by the time of year and the type of crop within the local environment. This indicates that more detailed spatial information and historical records may have value for managing cotton insects across large farms or communities.

Keywords: Helicoverpa zea; Heliothis virescens; Lygus lineolaris; IPM; Historical data

Steven E. Naranjo, Peter C. Ellsworth, The contribution of conservation biological control to integrated control of Bemisia tabaci in cotton,
Biological Control, Volume 51, Issue 3, December 2009, Pages 458-470, ISSN 1049-9644, DOI: 10.1016/j.biocontrol.2009.08.006.
(http://www.sciencedirect.com/science/article/B6WBP-4X2DD0J-1/2/4f8d2c64e38931c6f898fd082ce37ac6)

Abstract:

Integrated control systems are based on the complimentary contribution of chemical and biological control fostered by conservation of natural enemies. Yet, in the 50 years since the integrated control concept [ICC] [Stern, V.M., Smith, R.F., van den Bosch, R., Hagen, K.S., 1959. The integrated control concept. Hilgardia 29, 81-101]

was introduced there are few operational programs and even fewer attempts to analyze the mechanisms that allow chemical and biological control to act in concert. The dearth of demonstrable evidence for the ICC has eroded the credibility of biological control and its usage in operational IPM plans. We used in situ life tables within an experimental design to measure and compare the contribution and interaction of biological control and insecticides as tactical components within three pest management systems for Bemisia tabaci (Gennadius) in cotton. Insecticides were the key factor immediately following applications of broad-spectrum materials or one of two selective insect growth regulators (IGRs), and this mortality replaced that provided by natural enemies. Two to six weeks later, however, mortality from natural enemies, primarily predation, in the IGR regimes rebounded to the high levels observed in untreated controls and became the key factor. Mortality from natural enemies remained depressed in the broad-spectrum insecticide regime. Single IGR applications were sufficient to suppress B. tabaci populations throughout the season, while up to five broad-spectrum applications were needed to achieve comparable control. The chemical residual of IGRs was limited to several weeks, demonstrating a key role for mortality from conserved natural enemies that extended the control interval. This 'bioresidual' allows for long-term, commercially-acceptable pest suppression following the use of selective insecticides. We provide a rare experimental illustration of integrated control, where chemical and biological controls 'augment one another'. Our approach and methodology could be applied to demonstrate and validate integrated control in many other systems, addressing a critical need for implementation of biological control in practicing IPM systems.

Keywords: Bemisia tabaci; Life tables; Key factor; Irreplaceable mortality; Predation; Parasitism; Contemporaneous mortality; Selective insecticides; Bioresidual; Integrated control

Robin V. Gunning, Graham D. Moores, The effects of diet on the detection of resistance to Cry1Ac toxin in Australian Helicoverpa armigera Hubner (Lepidoptera: Noctuidae), ***Pesticide Biochemistry and Physiology***, Volume 97, Issue 1, May 2010, Pages 55-59, ISSN 0048-3575, DOI: 10.1016/j.pestbp.2009.12.004.
(http://www.sciencedirect.com/science/article/B6WP8-4Y0T90H-6/2/4fd2be1afeb46f90bb92f15ff7bca7f4)

Abstract:

The effects of raw or heat-denatured soybean flour in an artificial diet on the detection of Cry1Ac resistance in Helicoverpa armigera were examined. Resistant neonate larvae reared on denatured soybean flour diet showed resistance factors of 7980 and 16,901 at the LC50 and LC99.9 levels, respectively. By comparison, resistance could not be detected in neonate larvae reared on raw flour diet. Third instar larvae reared on denatured flour diet showed resistance factors of 322 and 21,190 at the LC50 and LC99.9 levels. Resistance was not detected in third instar larvae reared on raw flour diet. There was 68% survival of resistant neonate larvae on Bollgard II cotton leaf feeding assays, compared to 100% mortality in a susceptible strain. We

conclude that detection of CRY1Ac resistance in H. armigera from Australia can be masked, if an artificial diet gives chronic exposure to potent, protease inhibitors present in raw soy flour.

Keywords: Helicoverpa armigera; Cry1Ac; Resistance; Bollgard II cotton

Y.C. Zhu, C.A. Abel, M.S. Chen, Interaction of Cry1Ac toxin (Bacillus thuringiensis) and proteinase inhibitors on the growth, development, and midgut proteinase activities of the bollworm, Helicoverpa zea,

Pesticide Biochemistry and Physiology, Volume 87, Issue 1, January 2007, Pages 39-46, ISSN 0048-3575, DOI: 10.1016/j.pestbp.2006.05.004.
(http://www.sciencedirect.com/science/article/B6WP8-4K4G2FH-1/2/60c69cad9c5526069b4c6a4c1c15f390)

Abstract:

Potential resistance development to Bt cotton in certain lepidopterans has prompted research to develop strategies that will preserve this environmental-friendly biotechnology. Proteinase inhibitors are potential candidates for enhancing Bt toxicityagainst lepidopteran pests and for expanding the spectrum of control for other insects. Interactions of Bt toxin from Bacillus thuringiensis and proteinase inhibitors were investigated by monitoring growth, development, and gut proteinase activities of the bollworm, Helicoverpa zea. Several proteinase inhibitors were combined with Bt protoxin Cry1Ac in artificial diet and fed to newly molted 3rd-instar bollworm larvae to determine effects on larval body weight and length, pupation progress, and mortality rate. Major midgut proteinase activities, including caseinase, tryptic, and chymotrypsin activities, were examined after treatment. A concentration of Bt at a level causing minimal mortality (<10%), was mixed with the following proteinase inhibitors: benzamidine, phenylmethylsulfonyl fluoride (PMSF), and N-[alpha]-tosyl-l-lysine chloromethyl ketone (TLCK). When compared with controls, the synergistic effect of Bt toxin and proteinase inhibitors caused significant decreases in mean larval weight and length over time. Midgut samples tested against the substrates azocasein, [alpha]-benzoyl-dl-arginine-p-nitroanilide (BApNA), and N-succinyl-alanine-alanine-proline-phenylalanine-p-nitroanilide (SAAPFpNA) showed significant decreases in the protease activity of larvae fed Bt plus inhibitor versus control. Interaction of Bt and proteinase inhibitors significantly retarded larval growth and resulted in developmental delay and up to 20% mortality.

Keywords: Bt; Cry1Ac; Bacillus thuringiensis; Proteinase; Inhibitor; Resistance; Cotton; Bollworm; Helicoverpa zea

Deying Ma, Kevin Gorman, Greg Devine, Wanchun Luo, Ian Denholm, The biotype and insecticide-resistance status of whiteflies, Bemisia tabaci (Hemiptera: Aleyrodidae), invading cropping systems in Xinjiang Uygur Autonomous Region, northwestern China, ***Crop Protection,*** Volume 26, Issue 4, April 2007, Pages 612-617, ISSN 0261-2194, DOI: 10.1016/j.cropro.2006.04.027.
(http://www.sciencedirect.com/science/article/B6T5T-4KJ5T26-1/2/7b892ac16ae640f45e43959ab463cd90)

Abstract:

Xinjiang Uygur Autonomous Region in northwestern China is undergoing rapid development of its agricultural industries. Areas planted with cotton, grapes and vegetables have expanded dramatically in recent years. The tobacco whitefly, Bemisia tabaci, was first found in Xinjiang in 1998 on poinsettias (Euphorbia pulcherrima) and may have been imported to the region on that crop. Analysis of non-specific esterases using native polyacrylamide gel electrophoresis showed six samples of B. tabaci collected within a 200 km radius of Urumqi (Xinjiang's capital city) to belong to the highly invasive B biotype. The samples showed very similar profiles of insecticide resistance with very strong (>1000-fold) resistance to pyrethroids, low to moderate resistance to imidacloprid and pyriproxyfen, and no resistance to abamectin. The implications for resistance management and contending with further invasions of aggressive B. tabaci biotypes are discussed.

Keywords: Bemisia tabaci; Biotype; Insecticide resistance; Cotton; Xinjiang; China

Jae Su Kim, Yeon Ho Je, En Ok Woo, Roles of adjuvants in aphicidal activity of enzymes from Beauveria bassiana (Ascomycota: Hypocreales) SFB-205 supernatant, ***Journal of Asia-Pacific Entomology***, Volume 13, Issue 4, December 2010, Pages 345-350, ISSN 1226-8615, DOI: 10.1016/j.aspen.2010.06.002.
(http://www.sciencedirect.com/science/article/B8JJN-508PR18-1/2/73e197196b52c7db8ff432d34368038c)

Abstract:

Enzymes from Hypocrealean entomopathogenic fungi often encounter unfavorable abiotic and biotic factors during pathogenesis. The present work describes the roles of adjuvants, such as corn oil and polyoxyethylene-(3)-isotridecyl ether (TDE-3), in promoting aphicidal activity of enzyme precipitate from Beauveria bassiana SFB-205 supernatant. Supernatant enzymes including chitinase and proteases were lyophilized by attagel-mediated protein precipitation to produce attagel-mediated enzyme powder (AMEP). Corn oil-based AMEP + TDE-3 suspension showed 96.3% control efficacy against cotton aphids, Aphis gossypii Glover (Hemiptera: Aphididae), in glasshouse conditions at 2 days post-application, whereas water-based AMEP + TDE-3 suspension or TDE-3 alone showed < 20% efficacy. Corn oil-based AMEP + TDE-3 suspension was superior in degrading chitinase-specific substrate (p-nitrophenyl-[beta]-d-acetylglucosaminide) under a drying condition compared to water-based AMEP + TDE-3 suspension. TDE-3 made supernatant, a source material of AMEP, degraded more cotton aphid proteins than supernatant alone in SDS-polyacrylamide gel electrophoresis; supernatant was used to clearly show the degradation without

interfering with other proteins such as AMEP. These results suggest that 1) corn oil can slow down the evaporation of the diluted suspension drop and provide more time for enzymes from AMEP to degrade more cuticles at the time of application and 2) TDE-3 can disrupt chitin-protein matrixes within procuticle and facilitate enzymes from AMEP in degrading proteins which increases the exposure of chitin fibers to the attack of chitinases. This approach can provide another strategy in developing biopesticides using entomopathogenic fungi.

Keywords: Corn oil; Polyoxyethylene-(3)-isotridecyl ether; Beauveria bassiana; Attagel-mediated enzyme powder; Cotton aphid

Christof F. Stumpf, Daniel L. Comins, Thomas C. Sparks, Kevin V. Donohue, R. Michael Roe, Insecticidal activity and mode of action of novel nicotinoids synthesized by new acylpyridinium salt chemistry and directed lithiation,
Pesticide Biochemistry and Physiology, Volume 87, Issue 3, March 2007, Pages 211-219, ISSN 0048-3575, DOI: 10.1016/j.pestbp.2006.07.012.
(http://www.sciencedirect.com/science/article/B6WP8-4KJTYPS-2/2/9bba81ad8ea6918c36bb1cead6c9dfb4)

Abstract:

Novel acylpyridinium salt chemistry and directed lithiation methodology was developed to add for the first time substitutions directly to the phenylpyridine heterocyclic ring of nicotine. A variety of 3-(1-methylpyrrolidin-2-yl)-4-(alkyl, aromatic, heterocyclic and silanyl) and -N-alkyl pyridines were synthesized (compounds 1-9). In vial tests with the green peach aphid, Myzus persicae, compounds 1-4 were 1.1, 1.8,2.3 and 1.9x, respectively, more active than nicotine and 64, 40, 31 and 38x, respectively, less active than acetamiprid. Against the western flower thrips, Frankliniella occidentalis, 1-4 were 1.4, 2.1, 2.0 and 1.6x, respectively, more active than nicotine and 9, 6, 6 and 8x, respectively, less active than acetamiprid. For the cotton aphid, Aphis gossypii, the activity of 1-9 was similar to nicotine. Compounds 7 and 9 when incorporated into artificial diet produced low mortality for larvae of the beet armyworm, Spodoptera exigua, but were not active against the corn earworm, Helicoverpa zea. When 1-4 and 6-9 were injected into larvae of the beet armyworm, a variety of symptoms similar to acetamiprid were observed which included tremors, uncoordinated movement, diuresis, paralysis and death. In addition, imidacloprid-binding to membranes from the house fly head, Musca domestica, was inhibited by compounds 1-9, when using a concentration range of 1-100 [mu]M. These studies demonstrate that our new chemistry enhances the insecticidal activity of nicotine with an apparent mode of action as an acetylcholine agonist.

Keywords: Nicotinoid; Neonicotinoid; Nicotine; Acetamiprid; Insecticidal activity; Mode of action; Green peach aphid; Cotton aphid; Western flower thrips; Corn earworm; Beet armyworm; House fly

Gregory S. Sorensen, Bronwen W. Cribb, David Merritt, Marie-Louise Johnson, Myron P. Zalucki, Structure and ultrastructure of the silk glands and spinneret of Helicoverpa armigera (Hubner) (Lepidoptera: Noctuidae),
Arthropod Structure & Development, Volume 35, Issue 1, March 2006, Pages 3-13, ISSN 1467-8039, DOI: 10.1016/j.asd.2005.10.002.
(http://www.sciencedirect.com/science/article/B6W66-4JKB15X-3/2/b7189d4098f37ff48b189c6e1a4e5806)

Abstract:

This study provides comprehensive documentation of silk production in the pest moth Helicoverpa armigera from gland secretion to extrusion of silk thread. The structure of the silk glands, accessory structures and extrusion apparatus are reported. The general schema of the paired silk glands follows that found for Lepidoptera. Morphology of the duct, silk press, muscle attachments and spigot are presented as a three-dimensional reconstruction and the cuticular crescent-shaped profile of the silk press is demonstrated in both open and closed forms with attendant muscle blocks, allowing advances in our knowledge of how the silk press functions to regulate the extrusion of silk. Growth of the spigot across instars is documented showing a distinctive developmental pattern for this extrusion device. Its shape and structure are related to use and load-bearing activity.

Keywords: Silk press; Spigot; Cuticle; Integument; Cotton bollworm; Insect

Mushtaq Ahmad, M. Iqbal Arif, Resistance of beet armyworm Spodoptera exigua (Lepidoptera: Noctuidae) to endosulfan, organophosphorus and pyrethroid insecticides in Pakistan,
Crop Protection, Volume 29, Issue 12, December 2010, Pages 1428-1433, ISSN 0261-2194, DOI: 10.1016/j.cropro.2010.07.025.
(http://www.sciencedirect.com/science/article/B6T5T-50V4VHP-1/2/ec04f2338ceda2d8b57db70fb846d237)

Abstract:

Field populations of beet armyworm, Spodoptera exigua (Lepidoptera: Noctuidae), from Pakistan were assessed for their resistance to the chlorinated hydrocarbon endosulfan, the organophosphates chlorpyrifos and quinalphos, and the pyrethroids cypermethrin, deltamethrin, bifenthrin and fenpropathrin. Using a leaf-dip bioassay, resistance to endosulfan was high during 1998-2000 but declined to very low, to low levels during 2001-2007, following a reduced use of the insecticide. Organophosphates and pyrethroids were consistently used over the past three decades, and the resistance had been increasing to these insecticide classes. Generally, the resistance to chlorpyrifos and pyrethroids remained low from 1998 to 2002-2003, but resistance increased to moderate to high levels from 2003-2004 to 2006-2007. For deltamethrin, resistance was very high during 2004-2007. Quinalphos resistance remained low during 1998-2006. Correlation analysis of LC50 and LC90 values showed a positive correlation between organophosphates and pyrethroids, but no correlation between endosulfan and organophosphates or pyrethroids tested herein. These results suggest that the conventional chemistries should be replaced with new chemistries for the successful management of S. exigua.

Keywords: Spodoptera exigua; Insecticide resistance; Pakistan; Endosulfan; Chlorpyrifos; Quinalphos; Cypermethrin; Deltamethrin; Bifenthrin; Fenpropathrin; Cotton

D.J. Rogers, H.B. Brier, Pest-damage relationships for Helicoverpa armigera (Hubner) (Lepidoptera: Noctuidae) on vegetative soybean,
Crop Protection, Volume 29, Issue 1, January 2010, Pages 39-46, ISSN 0261-2194, DOI: 10.1016/j.cropro.2009.08.016.
(http://www.sciencedirect.com/science/article/B6T5T-4XCY3XN-1/2/d5b4b86c13c8ecab239d94bc26293d0c)

Abstract:

The response of vegetative soybean (Glycine max) to Helicoverpa armigera feeding was studied in irrigated field cages over three years in eastern Australia to determine the relationship between larval density and yield loss, and to develop economic injury levels. Rather than using artificial defoliation techniques, plants were infested with either eggs or larvae of H. armigera, and larvae allowed to feed until death or pupation. Larvae were counted and sized regularly and infestation intensity was calculated in Helicoverpa injury equivalent (HIE) units, where 1 HIE was the consumption of one larva from the start of the infestation period to pupation. In the two experiments where yield loss occurred, the upper threshold for zero yield loss was 7.51 +/- 0.21 HIEs and 6.43 +/- 1.08 HIEs respectively. In the third experiment, infestation intensity was lower and no loss of seed yield was detected up to 7.0 HIEs. The rate of yield loss/HIE beyond the zero yield loss threshold varied between Experiments 1 and 2 (-9.44 +/- 0.80 g and -23.17 +/- 3.18 g, respectively). H. armigera infestation also affected plant height and various yield components (including pod and seed numbers and seeds/pod) but did not affect seed size in any experiment. Leaf area loss of plants averaged 841 and 1025 cm2/larva in the two experiments compared to 214 and 302 cm2/larva for cohort larvae feeding on detached leaves at the same time, making clear that artificial defoliation techniques are unsuitable for determining H. armigera economic injury levels on vegetative soybean. Analysis of canopy leaf area and pod profiles indicated that leaf and pod loss occurred from the top of the plant downwards. However, there was an increase in pod numbers closer to the ground at higher pest densities as the plant attempted to compensate for damage. Defoliation at the damage threshold was 18.6 and 28.0% in Experiments 1 and 2, indicating that yield loss from H. armigera feeding occurred at much lower levels of defoliation than previously indicated by artificial defoliation studies. Based on these results, the economic injury level for H. armigera on vegetative soybean is approximately 7.3 HIEs/row-metre in 91 cm rows or 8.0 HIEs/m2.

Keywords: Glycine max; Cotton bollworm; Economic injury level; Economic threshold

D.J. Rogers, H.B. Brier, Pest-damage relationships for Helicoverpa armigera (Hubner) (Lepidoptera: Noctuidae) on soybean (Glycine max) and dry bean (Phaseolus vulgaris) during pod-fill,
Crop Protection, Volume 29, Issue 1, January 2010, Pages 47-57, ISSN 0261-2194, DOI: 10.1016/j.cropro.2009.08.015.
(http://www.sciencedirect.com/science/article/B6T5T-4XC972S-1/2/c22cdc0e1f01df5dc11002a72416ae15)

Abstract:

The response of soybean (Glycine max) and dry bean (Phaseolus vulgaris) to feeding by Helicoverpa armigera during the pod-fill stage was studied in irrigated field cages over three seasons to determine the relationship between larval density and yield loss, and to develop economic injury levels. H. armigera intensity was calculated in Helicoverpa injury equivalent (HIE) units, where 1 HIE was the consumption of one larva from the start of the infestation period to pupation. In the dry bean experiment, yield loss occurred at a rate 6.00 +/- 1.29 g/HIE while the rates of loss in the three soybean experiments were 4.39 +/- 0.96 g/HIE, 3.70 +/- 1.21 g/HIE and 2.12 +/- 0.71 g/HIE. These three slopes were not statistically different ($P > 0.05$) and the pooled estimate of the rate of yield loss was 3.21 +/- 0.55 g/HIE. The first soybean experiment also showed a split-line form of damage curve with a rate of yield loss of 26.27 +/- 2.92 g/HIE beyond 8.0 HIE and a rapid decline to zero yield. In dry bean, H. armigera feeding reduced total and undamaged pod numbers by 4.10 +/- 1.18 pods/HIE and 12.88 +/- 1.57 pods/HIE respectively, while undamaged seed numbers were reduced by 35.64 +/- 7.25 seeds/HIE. In soybean, total pod numbers were not affected by H. armigera infestation (out to 8.23 HIE in Experiment 1) but seed numbers (in Experiments 1 and 2) and the number of seeds/pod (in all experiments) were adversely affected. Seed size increased with increases in H. armigera density in two of the three soybean experiments, indicating plant compensatory responses to H. armigera feeding. Analysis of canopy pod profiles indicated that loss of pods occurred from the top of the plant downwards, but with an increase in pod numbers close to the ground at higher pest densities as the plant attempted to compensate for damage. Based on these results, the economic injury levels for H. armigera on dry bean and soybean are approximately 0.74 HIE and 2.31 HIE/m2, respectively (0.67 and 2.1 HIE/row-m for 91 cm rows).

Keywords: Cotton bollworm; Economic injury level; Economic threshold; Navy bean; Soybean

Pampapathy Gurulingappa, Gregory A. Sword, Gregory Murdoch, Peter A. McGee, Colonization of crop plants by fungal entomopathogens and their effects on two insect pests when in planta,
Biological Control, Volume 55, Issue 1, October 2010, Pages 34-41, ISSN 1049-9644, DOI: 10.1016/j.biocontrol.2010.06.011.
(http://www.sciencedirect.com/science/article/B6WBP-50F3PK4-3/2/54f195e11474525b8b0c4e8d7d018880)

Abstract:

Fungal entomopathogens can directly regulate populations of various insects. The entomopathogen Beauveria bassiana can also endophytically colonize various plants. Endophytic colonization by entomopathogens might be more widespread than

currently realized and may provide a source of indirect interactions between fungi and insects. We tested whether some common entomopathogens could colonize six crop plants. We also assessed whether the performance of two insects, Aphis gossypii and Chortoicetes terminifera, was affected by entomopathogens in plants. The entomopathogens B. bassiana, Lecanicillium lecanii and Aspergillus parasiticus individually colonized the leaves of all six crop plants when inoculated as conidia. L. lecanii also readily colonized five different cultivars of cotton. When the entomopathogens were present in the soil in which either cotton or wheat seedlings were grown, A. parasiticus was subsequently isolated from the leaves, stem and roots of both plants and B. bassiana from the leaves, stem and root of wheat only, whereas L. lecanii failed to colonize either plant through the soil. Of the three entomopathogens tested, endophytic presence of A. parasiticus reduced growth of cotton, but none reduced growth of wheat. Feeding by A. gossypii on cotton leaves colonized by either B. bassiana or L. lecanii slowed aphid reproduction, and consumption of wheat leaves colonized by either B. bassiana or A. parasiticus slowed the growth of C. terminifera nymphs. The life cycle of at least three entomopathogens potentially includes plants. The presence of entomopathogens as endophytes can influence growth and fecundity of insect herbivores, suggesting a possible role for endophytic entomopathogens in the regulation of insect populations.

Keywords: Aphis gossypii; Aspergillus parasiticus; Beauveria bassiana; Chortoicetes terminifera; Lecanicillium lecanii; Biological control; Endophyte; Entomopathogen; Fungal ecology; Interactions

Guangchun Cao, Qiong Lu, Lili Zhang, Fang Guo, Gemei Liang, Kongming Wu, Kris A.G. Wyckhuys, Yuyuan Guo, Toxicity of chlorantraniliprole to Cry1Ac-susceptible and resistant strains of Helicoverpa armigera,
Pesticide Biochemistry and Physiology, Volume 98, Issue 1, September 2010, Pages 99-103, ISSN 0048-3575, DOI: 10.1016/j.pestbp.2010.05.006.
(http://www.sciencedirect.com/science/article/B6WP8-505F9FN-2/2/43621d3111e72392816d8c8e879e4a9d)

Abstract:

Transgenic Bt cotton expressing Cry1Ac is important in controlling various agricultural pests, including Helicoverpa armigera. Especially for transgenic crops that are cultivated in large expanses, avoiding resistance development is a key for ensuring sustainability of Bt technologies. Integrated pest management, in which transgenic crops are strategically combined with rational pesticide use, may help to prevent H. armigera resistance acquisition in Bt cotton. In this study, we evaluated the toxicity of a novel insecticide (chlorantraniliprole) on Cry1Ac-susceptible and resistant individuals of H. armigera. More specifically, we assessed the effect of chlorantraniliprole on the activity of two enzymes and conducted laboratory bioassays to determine its toxicity on H. armigera larvae. Chlorantraniliprole increased esterase and glutathione-S-transferase activities in Cry1Ac susceptible and resistant populations of H. armigera. Cry1Ac resistant populations XJ-F (Cry1Ac resistance ratio 21.8-fold), XJ-10.0 (95.8-fold) and BTR (3536.5-fold) did not show cross-resistance to chlorantraniliprole, with LC50 values of 0.0733 ([mu]g/mL) in XJ-F, 0.0545 ([mu]g/ml) in XJ-10.0 and 0.0731

([mu]g/mL) in BTR, which were close to that in the susceptible strain 96S (0.0954 [mu]g/mL). Our work shows that chlorantraniliprole could be considered to be integrated in Bt cotton management schemes to delay the H. armigera resistance development.

Keywords: Chlorantraniliprole; Cry1Ac resistance; Glutathione-S-transferase; Helicoverpa armigera; Total esterase

John J. Obrycki, James D. Harwood, Timothy J. Kring, Robert J. O'Neil, Aphidophagy by Coccinellidae: Application of biological control in agroecosystems,

Biological Control, Volume 51, Issue 2, Trophic Ecology of the Coccinellidae, November 2009, Pages 244-254, ISSN 1049-9644, DOI: 10.1016/j.biocontrol.2009.05.009.
(http://www.sciencedirect.com/science/article/B6WBP-4WDGCPR-5/2/c8ead11180cc6ef93b1814bec814fae2)

Abstract:

Coccinellids and aphids interact in a wide range of agricultural and forest habitats and the value of coccinellid predation for aphid suppression in these systems varies from a minor role to significant reductions leading to within-season control. Although aphid-feeding coccinellids rarely play a role in the long-term regulation of population dynamics of aphid species within agroecosystems, they are effective predators reducing within-season densities of selected species of aphid pests. For example, conserving Coccinellidae through the presence of non-target aphid prey has resulted in reliable suppression of target aphid pests in cereal grain crops. Methods to manipulate within field-distributions of Coccinellidae have been developed (e.g., semiochemically basedlures, artificial food sprays) and associations with flowering plants and extrafloral nectaries have been documented, but these components have yet to be integrated into biological control systems based on experimental assessments of the numerical, reproductive, and functional responses of these predators. A comparative discussion of the management of the cotton aphid (Aphis gossypii Glover) and the soybean aphid (Aphis glycines Matsumura) highlights the importance of documenting levels of pest mortality by coccinellids. Recently, the planting of transgenic cotton varieties has reduced insecticide use in cotton, thereby allowing predaceous Coccinellidae to be incorporated into IPM treatment decisions for A. gossypii. Detailed long-term field research was required to include coccinellid predation into economic thresholds for management of the cotton aphid. In contrast, the relatively recent pest status of the soybean aphid in North America has resulted in a series of studies showing the variation in the role of predation by Coccinellidae and other natural enemies across the aphid's North American range. Our understanding of coccinellid predation in aphid suppression will ultimately be enhanced through comprehensive behavioral studies that include manipulative laboratory experimentation, field studies and molecular techniques to analyze coccinellid feeding behavior and enhance our understanding of intercrop movement and their dispersal among crop and non-crop habitats.

Keywords: Aphid predation; Arthropod predators; Biological control; Pest management; Aphid suppression; Conservation biological control

Yanhui Lu, Kongming Wu, Kris A.G. Wyckhuys, Yuyuan Guo, Overwintering hosts of Apolygus lucorum (Hemiptera: Miridae) in northern China,
Crop Protection, Volume 29, Issue 9, September 2010, Pages 1026-1033, ISSN 0261-2194, DOI: 10.1016/j.cropro.2010.03.017.
(http://www.sciencedirect.com/science/article/B6T5T-4YYGPH0-2/2/d7ee8cc00c35b2d3473e3818370b403b)

Abstract:

During the past decade, Apolygus lucorum Meyer-Dur (Heteroptera: Miridae) has become a key pest of cotton in northern China, due to widespread planting of Bt cotton and an associated drop in the use of broad-spectrum insecticides. Because of a lack of management alternatives, A. lucorum outbreaks are presently exclusively controlled with insecticides. In this study, we determined A. lucorum overwintering locations and host plants during the 2006-2009 winter seasons. A total of 126 plant species were screened and nymphal emergence of A. lucorum was monitored over time. Eggs of A. lucorum successfully overwintered in cotton field soils and on 86 plant species, including weeds, fruit trees, pastures and agricultural crops. More specifically, Vitis vinifera L., Ricinus communis L., Momordica charantia L., Artemisia argyi Levl. et Vant., Artemisia annua L., Artemisia lavandulaefolia DC., Isatis indigotica Fort., Artemisia scoparia Waldst. et Kit., Vigna radiate (L.) Wilczek, Ziziphus jujuba Mill., Vigna angularis (Willd.) Ohwi et, Ocimum basilicum L., Onobrychi viciifolia Scop., Pyrus bretschneideri Rehd., Malus domestica Borkh. and Brassica juncea (L.) Czern. et Coss proved optimal overwintering hosts of A. lucorum. Based upon plant species occurrence and distribution in Chinese cotton-growing regions, several weeds and fruit trees, such as V vinifera, Z. jujuba, P. bretschneideri and M. domestica can be termed key overwintering hosts of A. lucorum. Our findings can form the basis for future formulation of targeted management actions to lower A. lucorum overwintering populations in cotton-growing landscapes of northern China.

Keywords: Apolygus lucorum; Overwintering; Host plant

Karen Bianchi dos Santos, Pedro Neves, Ana Maria Meneguim, Rachel Bianchi dos Santos, Walter Jorge dos Santos, Gislaine Villas Boas, Vinicius Dumas, Erica Martins, Lilian Botelho Praca, Paulo Queiroz, Colin Berry, Rose Monnerat, Selection and characterization of the Bacillus thuringiensis strains toxic to Spodoptera eridania (Cramer), Spodoptera cosmioides (Walker) and Spodoptera frugiperda (Smith) (Lepidoptera: Noctuidae),
Biological Control, Volume 50, Issue 2, August 2009, Pages 157-163, ISSN 1049-9644, DOI: 10.1016/j.biocontrol.2009.03.014.
(http://www.sciencedirect.com/science/article/B6WBP-4W04KJ0-2/2/a61477602aeb7a0f266aad6bc74ef421)

Abstract:

Among the pests of cultivated plants, the Spodoptera species complex is one of the most important. This genus is composed of polyphagous insects that attack, among other crops, cotton, corn, soy and castor bean. In Brazil Spodoptera frugiperda has been recognized as a primary pest in cotton, and Spodoptera eridania (Cramer) and Spodoptera cosmioides (Walker) species are important pests in cotton and soy. This

study was performed in 2008 and was focused on selecting and characterizing Bacillus thuringiensis strains highly pathogenic to S. cosmioides, S. eridania and S. frugiperda and identifying Cry proteins toxic to these species. One hundred strains that exhibited toxicity to Lepidoptera were evaluated through bioassay and the most toxic ones were characterized through morphologic, biochemical and molecular analyses and LC50 values were determined. Since the cry1Aa, cry1Ab, cry1Ac and cry2Aa genes were present in most of the toxic strains, recombinant Bt producing toxins encoded by representative genes from these families, were individually tested. The Cry proteins showed different levels of toxicity to the three Spodoptera species, with Cry1Aa and Cry1Ab the most toxic to S. cosmioides, Cry2Aa the most toxic to S. eridania and Cry1Aa, Cry1Ab and Cry2Aa most toxic to S. frugiperda. Cry1Ac, a component of some transgenic cotton varieties such as Bollgard I, extensively used in Brazil, presented low toxicity to the three species studied.

Keywords: Bacillus thuringiensis; Spodoptera eridania; Spodoptera cosmioides; Spodoptera frugiperda; Cry protein

Ge-Mei Liang, Kong-Ming Wu, Hong-Kun Yu, Ke-Ke Li, Xue Feng, Yu-Yuan Guo, Changes of inheritance mode and fitness in Helicoverpa armigera (Hubner) (Lepidoptera: Noctuidae) along with its resistance evolution to Cry1Ac toxin,

Journal of Invertebrate Pathology, Volume 97, Issue 2, February 2008, Pages 142-149, ISSN 0022-2011, DOI: 10.1016/j.jip.2007.09.007.
(http://www.sciencedirect.com/science/article/B6WJV-4PPMXWX-2/2/6e449b04e07b6142b22cd3ca760e2565)

Abstract:

The changes of inheritance mode and fitness of resistance in Helicoverpa armigera (Hubner) along with its resistance evolution to Cry1Ac toxin were evaluated in the laboratory. The resistance levels reached 170.0-, 209.6- and 2893.3-fold, on selection of the field population in the 16th (BtR-F16), 34th (BtR-F34) and 87th (BtR-F87) generation with artificial diet containing Cry1Ac toxin, respectively. As the resistance levels increased, more larvae feeding on the Bt cotton expressing Cry1Ac toxin survived. Most larvae of BtR-F87 could develop to the 5th instar and about 3% individuals reached the adult stage. The inheritance of Cry1Ac resistance trait at three resistant levels was autosomal and incompletely recessive, but the degree of dominance decreased as the resistance increased. The resistance was primarily monogenic in BtR-F16 strain, but polygenic as resistance increased. The relative fitness of H. armigera, measured as a ratio of R0 (the net replacement rate) of resistant strain divided by R0 of the susceptible strain, decreased with an increase of the resistance levels, with ratios of 0.79, 0.64 and 0.59 in their respective BtR-F16, BtR-F34 and BtR-F87 strains.

Keywords: Helicoverpa armigera; Bt resistance; Inheritance; Fitness

Sakuntala Sivasupramaniam, Graham P. Head, Leigh English, Yue Jin Li, Ty T. Vaughn, A global approach to resistance monitoring,
Journal of Invertebrate Pathology, Volume 95, Issue 3, Special Issue for SIP 2007, SIP 2007, July 2007, Pages 224-226, ISSN 0022-2011, DOI: 10.1016/j.jip.2007.03.013.
(http://www.sciencedirect.com/science/article/B6WJV-4NBBYYG-2/2/e023985055808460e0e4604aeda8f952)

Abstract:

Transgenic crops producing insecticidal toxins from the bacterium Bacillus thuringiensis (Bt) have been grown in many parts of the world since 1996. In the United States, the Environmental Protection Agency (EPA) has required that industry submit insect resistance management (IRM) plans for each Bt corn and cotton product commercialized. A coalition of stakeholders including the EPA, USDA, academic scientists, industry, and grower organizations have cooperated in developing specific IRM strategies. Resistance monitoring (requiring submission of annual reports to the EPA), and a remedial action plan addressing any contingency if resistance should occur, are important elements of these strategies. At a global level, Monsanto conducts baseline susceptibility studies (prior to commercialization), followed by monitoring studies on target pest populations, for all of its commercialized Bt crop products. To date, Monsanto has conducted baseline/monitoring studies in Argentina, Australia, Brazil, Canada, China, Colombia, India, Mexico, the Philippines, South Africa, Spain, and the United States. Examples of pests on which resistance monitoring has been conducted include cotton bollworm, Helicoverpa zea, European corn borer, Ostrinia nubilalis, pink bollworm, Pectinophora gossypiella, Southwestern corn borer, Diatraea grandiosella, tobacco budworm, Heliothis virescens, and western corn rootworm, Diabrotica virgifera virgifera, in the United States, cotton bollworm, Helicoverpaarmigera, in China, India and Australia, and H. virescens and H. zea in Mexico. No field-selected resistance to Bt crops has been documented.

Keywords: Monsanto; Bacillus thuringiensis; Resistance monitoring; Bollgard(R); Bollgard(R) II; Yieldgard(R); Cry1Ab, Cry1Ac; Cry2Ab2

Carlos A. Blanco, Omaththage P. Perera, Debbie Boykin, Craig Abel, Jeff Gore, Sharlene R. Matten, Juan C. Ramirez-Sagahon, Antonio P. Teran-Vargas, Monitoring Bacillus thuringiensis-susceptibility in insect pests that occur in large geographies: How to get the best information when two countries are involved,
Journal of Invertebrate Pathology, Volume 95, Issue 3, Special Issue for SIP 2007, SIP 2007, July 2007, Pages 201-207, ISSN 0022-2011, DOI: 10.1016/j.jip.2007.03.009.
(http://www.sciencedirect.com/science/article/B6WJV-4NC392C-2/2/b014fd4c4fa87347a096aab0ab04f60c)

Abstract:

The adoption of cotton producing insecticidal proteins of Bacillus thuringiensis, commonly referred to as Bt cotton, around the world has proven to be beneficial for growers and the environment. The effectiveness of this important genetically-modified crop can be jeopardized by the development of resistance to Bt cotton by pests it is meant to control, with the possibility that this phenomenon could develop in one country and spread to another by means of insect migration. To preserve the effectiveness of

this agricultural biotechnology, regulatory agencies have developed plans to mitigate the development of resistance, and research institutions constantly monitor for shifts in Bt-susceptibility in important pests. If Bt-resistance is detected, this finding needs to be corroborated by an independent laboratory according to current regulatory requirements; a process that presents numerous challenges. We investigated the biological activity of Bt-incorporated diet on Helicoverpa virescens L. after it was stored for several days at different temperatures. Diet stored up to nine days at different temperatures (-14 to 27 [degree sign]C) produced the same biological effect on H. virescens as freshly-prepared diet. Elevating the temperature of Bt stock solution to 76 [degree sign]C as compared to 26 [degree sign]C yielded significantly higher reading of apparent Cry1Ac concentration from MVP II, but not enough to elicit a significant biological response when these stock solutions were incorporated into insect artificial diet. These findings are important particularly when the confirmation of resistance is done at a distant location, such as Mexico, or when diet is shared between laboratories, and must be stored for later use, as in the case of international collaboration.

Keywords: Heliothis virescens; Bioassays; Cry1Ac; Storage time; Temperature

Dong Wang, Xinghui Qiu, Xuexiang Ren, Fang Niu, Kaiyun Wang, Resistance selection and biochemical characterization of spinosad resistance in Helicoverpa armigera (Hubner) (Lepidoptera: Noctuidae),
Pesticide Biochemistry and Physiology, Volume 95, Issue 2, October 2009, Pages 90-94, ISSN 0048-3575, DOI: 10.1016/j.pestbp.2009.07.003.
(http://www.sciencedirect.com/science/article/B6WP8-4WP47M7-3/2/e4bf2744b1b5c53ba160ffdb7e3ba270)

Abstract:

A Helicoverpa armigera population was collected from Shandong province, China. After 15 generations of selection in the laboratory, the H. armigera strain developed more than 20-fold resistance to spinosad. At LD50 level, no significant cross-resistance was found between spinosad and chlorpyrifos, methomyl, avermectin and chlorfenapyr except for fenvalerate with a low cross-resistance of 2.4-fold. However, LD99 values of fenvalerate against the parental and resistant strains were not different significantly. After inhibitors were used, spinosad resistance could be partially suppressed by piperonylbutoxide (PBO) and triphenylphosphate (TPP), but not by diethylmaleate (DEM). Activities of p-nitroanisole O-demethylase (ODM) developed to 8.26-fold compared with the parental strain, but no obvious changes were found in activities of carboxyl esterase (CarE) and glutathione-S-transferase (GST). The results indicated that resistance to spinosad in the cotton bollworm might be associated with an increase in cytochrome P450 monooxygenase.

Keywords: Helicoverpa armigera; Spinosad; Cross-resistance; Synergism; Carboxyl esterase; Glutathione-S-transferase; p-Nitroanisole O demethylase

Jing Chang, Chuan-Wang Cao, Xi-Wu Gao, The effect of pretreatment with S,S,S-tributyl phosphorotrithioate on deltamethrin resistance and carboxylesterase activity in Aphis gossypii (Glover) (Homoptera: Aphididae),
Pesticide Biochemistry and Physiology, Volume 98, Issue 2, October 2010, Pages 296-299, ISSN 0048-3575, DOI: 10.1016/j.pestbp.2010.06.021.
(http://www.sciencedirect.com/science/article/B6WP8-50GWN49-7/2/d9c06d97b13164eb6b5b95faf22df477)

Abstract:

The synergism of S,S,S-tributyl phosphorotrithioate (DEF) and its effect on carboxylesterase activity were investigated in deltamethrin-selected resistant (DRR) and susceptible (DSS) strains of cotton aphids, Aphis gossypii (Glover). Compared to the DSS strain, the DRR strain showed 23,900-fold resistance to deltamethrin, and 7560- and 99-fold cross-resistance to bifenthrin and ethofenprox, respectively. The synergist, DEF, increased the toxicity of both deltamethrin and bifenthrin, but not of ethofenprox when DEF was pretreated of 15 h. DEF exhibited significant inhibition on the carboxylesterase activity in the DRR strain, but no significant effect on that of the DSS strain in vitro. After the cotton aphids exposing to DEF, the carboxylesterase activity decreased gradually until 15 h and then gradually recovered until 24 h in the DRR strain, which fluctuated according to the effect of DEF on the deltamethrin toxicity detected using DEF pretreatment in the DRR strain. Therefore, our studies suggested that the effect of DEF on carboxylesterase was associated with deltamethrin resistance in the DRR strain.

Keywords: Pyrethroid; Insecticide resistance; Synergism; Carboxylesterase; S,S,S-tributyl phosphorotrithioate; Aphis gossypii (Glover)

Robert S. Pfannenstiel, Spider predators of lepidopteran eggs in south Texas field crops,
Biological Control, Volume 46, Issue 2, August 2008, Pages 202-208, ISSN 1049-9644, DOI: 10.1016/j.biocontrol.2008.03.011.
(http://www.sciencedirect.com/science/article/B6WBP-4S5FJDJ-4/2/8ec67f0e52da88965c7d18d0fff48eb2)

Abstract:

Observations were made of spiders attacking lepidopteran eggs in south Texas field crops (cotton, corn, and soybean) from 2001 to 2004. Twelve species of spider from seven families were observed feeding on the eggs during the 4 years. These spiders were primarily cursorial hunting spiders, and they were observed feeding on eggs most frequently in cotton, representing 26.6% of all observations in cotton over the 4 years. Spider predation on eggs was proportionally less frequent in corn and soybean with 6.3% and 15.4% of observed predation in those crops, respectively. Four species of spider were responsible for 86.1% of the predation by spiders. The anyphaenid Hibana futilis (Banks) was the spider most frequently observed feeding on lepidopteran eggs during the 4 years of this study, constituting 45.1% of all spiders observed. Grammonota texana Banks (Linyphiidae), Hibana arunda Platnick (Anyphaenidae), and Cheiracanthium inclusum (Hentz) (Miturgidae) were the 2nd, 3rd, and 4th most

frequently observed spiders constituting 15.6%, 12.8%, and 11.7% of all spiders observed, respectively. Most spiders represented taxa that are known to forage without a web. However, G. texana was observed feeding on eggs independent of a web, which is uncharacteristic of linyphiids. Other cursorial hunting spiders feeding on eggs included members of the Clubionidae, Corrinnidae, and Salticidae. Ninety-eight percent of all observations of egg predation by spiders were nocturnal; only the Salticidae were diurnal. It is likely that previous studies of predation in crops have vastly underestimated the importance of spiders as predators of lepidopteran eggs due to inadequate evaluation of nocturnal predation.

Keywords: Nocturnal; Cursorial spiders; Egg predation

Stephanie Williamson, Andrew Ball, Jules Pretty, Trends in pesticide use and drivers for safer pest management in four African countries,

Crop Protection, Volume 27, Issue 10, October 2008, Pages 1327-1334, ISSN 0261-2194, DOI: 10.1016/j.cropro.2008.04.006.
(http://www.sciencedirect.com/science/article/B6T5T-4SR07SJ-1/2/ac597f7960e3370380660c582083e63c)

Abstract:

Patterns in pesticide practice were studied among smallholder farmers in Benin, Ethiopia, Ghana and Senegal, growing cotton, vegetables, pineapple, cowpea, and mixed cereals and legumes, for export and local markets. Quantitative and qualitative methods were used to examine pesticide use and handling, costs and access and health, welfare and sustainability issues. Drivers encouraging pesticides as the dominant form of pest management include food staple varieties highly susceptible to insect attack; increased pest incidence; lack of advice on alternative methods; a growing informal market in `discount' and often unauthorised pesticides; subsidy; and poor attention to the economics of pest control. The paper contrasts the situation of food crops for African consumers with the increasing attention to food safety and pesticide restrictions in export horticulture to Europe and the growing demand for organic cotton, and discusses challenges for implementation of IPM and safer practice.

Keywords: Pesticides; Smallholder farmers; Food safety; Africa; IPM; External costs

Yu Cheng Zhu, Gordon L. Snodgrass, Ming Shun Chen, Comparative study on glutathione S-transferase activity, cDNA, and gene expression between malathion susceptible and resistant strains of the tarnished plant bug, Lygus lineolaris,

Pesticide Biochemistry and Physiology, Volume 87, Issue 1, January 2007, Pages 62-72, ISSN 0048-3575, DOI: 10.1016/j.pestbp.2006.06.002.
(http://www.sciencedirect.com/science/article/B6WP8-4K4XJDT-2/2/ccf4a5ac740b91723c57406e2be32563)

Abstract:

Control of the tarnished plant bug, Lygus lineolaris (Palisot de Beauvois), in cotton in the mid-South relies heavily on pesticides, mainly organophosphates. Continuous and dominant use of chemical sprays has facilitated resistance

development in the tarnished plant bug. A natural population in Mississippi with resistance to malathion was studied to examine whether and how glutathione S-transferases (GST) played an important role in the resistance. Bioassays were first conducted to examine synergism of two GST inhibitors. Both ethacrynic acid (EA) and diethyl maleate (DM) effectively abolished resistance and increased malathion toxicity against two resistant strains by more than 2- and 3-fold, whereas incorporation of GST inhibitors did not significantly increase malathion toxicity against a susceptible strain. GST activities were compared in vitro between malathion susceptible and resistant strains by using 1-chloro-2,4-dinitrobenzene as a GST substrate. The resistant strain had significantly higher (1.5-fold) GST activity than the susceptible strain. Up to 99%, 75%, and 85% of the GST activities were inhibited by EA, sulfobromophthalein (SBT), and DM, respectively. The GST activities tended to increase from May to October by 1.76-fold. All three inhibitors significantly suppressed the GST activity to a constant low level over the season. Further examination of GST cDNA indicated that in the coding region only one nucleotide variation was revealed between the susceptible and resistant strain. This variation did not cause a protein sequence change, and an identical amino acid sequence was predicted for both strains. Multiple sequence alignment and phylogenetic analysis showed that the 216-residue GST from the tarnished plant bug was highly similar (up to 68% of amino acid sequence identity) to the GSTs from other insects, which conferred organophosphate resistance. GST gene expression levels were examined using real-time PCR, and the results indicated that GST gene transcripts were elevated in the resistant strain by 1.3-fold.

Keywords: Malathion; Resistance; cDNA; mRNA; Expression; Glutathione S-transferase; GST; Inhibitor; Tarnished plant bug; Lygus lineolaris

Suvama Patil, Fakmdin Bashasab, Vijaykumar, Basavanagoud, Mahaling S Kuruvinashetti, Basavaraj V Patil, Genetic relatedness among Helicoverpa armigera (Hubner) occurring on different host plants as revealed by random amplified polymorphic DNA markers,
Journal of Asia-Pacific Entomology, Volume 9, Issue 3, September 2006, Pages 227-233, ISSN 1226-8615, DOI: 10.1016/S1226-8615(08)60295-2.
(http://www.sciencedirect.com/science/article/B8JJN-4V6TFFH-4/2/28610d1165af459d808008743d81bf66)

Abstract:

The genetic relatedness among Helicoverpa armigera (Hubner) occurring on different host plants prevailing in South India was studied using PCR-RAPD. Genomic DNA was isolated individually from five larvae collected from each of 10 different host plants (except in okra). PCR-RAPD analysis was carried out using a set of 20 random primers which had produced repeatable banding patterns from a original set of 60 primers. A set of 155 amplicon levels were available for analysis, of which 154 were polymorphic. An average of 7.75 bands per primer was recorded. Similarity coefficients based on the frequency of band sharing among host strains varied from 0.25 in cotton and sunflower to 0.72 in groundnut. Clustering analysis on the basis of the PCR-RAPD-generating band sharing indicated that most of the individuals occurring on niger, safflower, green gram, abutilon and lagasca clustered together, indicating greater

genetic similarity among themselves, than those occurring on other crops. Furthermore, the pattern of genetic variation in the individuals collected from niger, safflower, green gram, groundnut, abutilon and lagasca was seem to be largely host-dependent.
Keywords: Genetic relatedness; DNA markers; Helicoverpa armigera; Host plants

PLANT DISEASES (29 jdl)

Pei-zheng WANG, Li-fang SHI, Li SU, Bao-min HU, Quantitative Trait Loci for Resistance Against Fusarium Wilt Based on Three Cotton F2 Populations,
Agricultural Sciences in China, Volume 9, Issue 12, December 2010, Pages 1799-1806, ISSN 1671-2927, DOI: 10.1016/S1671-2927(09)60278-9.
(http://www.sciencedirect.com/science/article/B82XG-51SFPYJ-C/2/0f3f66cd65eaaa03b3b462ee3bcaaa74)
Abstract:

Fusarium wilt (FW) is one of the most common cotton diseases in the world. Identification of QTLs conferring resistance to FW is key for the incorporation of resistance genes into elite cultivars. Two intraspecific (cross between Gossypium hirsutum L.) and one interspecific (cross between Gossypium hirsutum L. and Gossypium bardence L.) F2 populations were constructed by using a highly resistant cultivar and crossing it to a susceptible cultivar with 154, 79, and 148 offsprings, respectively. Simple sequence repeats (SSR) were used to screen genomic regions closely linked to FW resistance. The results showed that five QTLs associated with FW resistance were detected in two intraspecific populations using a composite interval mapping method under four different conditions. Four of these loci located on Chr. 2/Chr. 17 neighboring markers JESPR304 or CIR305 which explained 13.1 to 45.9% of the phenotypic effect. Furthermore, JESPR304 and CIR305 were previously testified and found to be tightly linked. It is possible that these four QTLs detected under different conditions were the same resistance QTL/gene. We consider that there is the possibility of a major FW resistant gene in intraspecific populations. In the interspecific mapping populations two QTLs were detected on Chr. 9 and Chr. 12/26 which explained great phenotypic variance of 49.4 and 45.7%. As the location of QTLs for FW resistance among the intraspecific and the interspecfic populations were totally different, it is suggested that there may be different resistance mechanisms between G. bardence L. and G. hursutum L. Thus, the present research provides an opportunity to understand the genetic control of resistance to FW in Gossypium hirsutum and Gossypium bardence and to conduct MAS in breeding programs to develop FW resistant cultivars.
Keywords: cotton; Fusarium wilt; resistance QTL; molecular mapping

Bo Wang, Michael J. Priest, Amy Davidson, Curt L. Brubaker, Matt J. Woods, Jeremy J. Burdon, Fungal endophytes of native Gossypium species in Australia,
Mycological Research, Volume 111, Issue 3, March 2007, Pages 347-354, ISSN 0953-7562, DOI: 10.1016/j.mycres.2006.11.004.

(http://www.sciencedirect.com/science/article/B7XMR-4N74JF0-2/2/7c6e323188463ddd04cc1ae4b0e1f3e6)

Abstract:

Fungal endophytes of 17 genera were found in stems of four native Gossypium species (G. australe, G. bickii, G. nelsonii, G. sturtianum) collected from inland areas in Queensland, the Northern Territory, and South Australia in 2001. Phoma, Alternaria, Fusarium, Botryosphaeria, Dichomera, and Phomopsis were common, accounting for 58, 18, 11, 3, 1, and 1 % of the 281 recovered isolates, respectively, and occurring in 47, 29, 19, 5, 5, and 4 % of the 79 sampled populations. Among the four Gossypium species in Queensland and the Northern Territory, Alternaria spp. and Fusarium spp. had the greatest recovery frequency in G. bickii stems. The recovery frequencies of Phoma spp. and Alternaria spp. were significantly greater in the G. sturtianum stems collected from South Australia than in those from Queensland and the Northern Territory. Pathogenicity of 42 representative isolates was tested on cultivated cotton (G. hirsutum). All isolates caused some localized discoloration in stem tissue when inoculation was conducted with the stem puncturing method, but none of the isolates could induce any foliar symptoms during the five-week experimental period by either inoculation method (root dipping or stem puncturing), suggesting that the endophytic fungi of native Gossypium species are unlikely sources of cotton pathogens.

Keywords: Cotton; Fungal endophyte; Gossypium

M. Erhan Gore, Oncul K. Caner, Nedim Altin, M. Hadi Aydin, Oktay Erdogan, Funda Filizer, Arzu Buyukdogerlioglu, Evaluation of cotton cultivars for resistance to pathotypes of Verticillium dahliae,

Crop Protection, Volume 28, Issue 3, March 2009, Pages 215-219, ISSN 0261-2194, DOI: 10.1016/j.cropro.2008.10.004.

(http://www.sciencedirect.com/science/article/B6T5T-4TY3XRJ-5/2/f83d8458fc4d4f84b61ddccb76c18f13)

Abstract:

After the recent detection of serious losses caused by Verticillium wilt of cotton, incited by the defoliating pathotype of Verticillium dahliae in the Aegean Region of Turkey, 28 of the most commonly grown cotton cultivars (Gossypium hirsutum L.) of Turkey, were evaluated for the presence of field resistance to wilt. Six-week-old plants were inoculated with a cotton nondefoliating (ND) or a cotton defoliating (D) pathotype of V. dahliae under controlled conditions. Resistance was evaluated on the basis of external symptoms by calculating areas under disease progress curves. The percentage of plants killed and of those which recovered from the disease was used as additional parameters for including a particular cultivar into a defined category. Most of the evaluated cultivars were susceptible, although at different levels, to both pathotypes of V. dahliae. All cultivars were more susceptible to the D than to the ND pathotype. The most promising cultivars in the experiments appeared to be Carmen and ST-373. Carmen showed differential resistance: it was susceptible to the D but resistant to the ND pathotype. ST-373 was moderately susceptible to both pathotypes of V. dahliae. A resistance related phenotypic reaction to the disease was quantified by using six growth parameters (plant height, number of nodes, leaf weight, stem weight, leaf to stem ratio,

and total shoot weight) measured 13 d after inoculation. The percentage decrease in leaf-stem ratio and leaf weight were found to be the best indicators of resistance. Results obtained in this study will be useful to quantify resistance to V. dahliae and identify the best parameters to phenotype in genetic studies.
Keywords: Cotton; Resistance; Verticillium wilt; Pathotypes

Suiyun Chen, Hezhong Dong, Yuqin Fan, Weijiang Li, Yigal Cohen, Dry mycelium of Penicillium chrysogenum induces expression of pathogenesis-related protein genes and resistance against wilt diseases in Bt transgenic cotton,
Biological Control, Volume 39, Issue 3, December 2006, Pages 460-464, ISSN 1049-9644, DOI: 10.1016/j.biocontrol.2006.07.014.
(http://www.sciencedirect.com/science/article/B6WBP-4KM43C5-1/2/d18bfb0708effc511a4b97032ab268a2)
Abstract:
Dry mycelium (DM) of Penicillium chrysogenum (PEN), a waste product of the pharmaceutical industry, is used as an organic fertilizer for agricultural production. Our previous studies have indicated that DM of PEN is effective in controlling a number of soil born fungal diseases, but the mode of action is unclear. In the present study, DM of PEN was extracted with water and applied to the roots of the Bt (Bacillus thuringiensis) transgenic cotton (Gossypium hirsutum) cultivar SCRC 21. The efficacy in controlling Fusarium oxysporum f.sp vasinfectum (Fov) and Verticillium dahliae Kleb (Vd), as well as the accumulation of pathogenesis-related (PR) protein transcripts in the plants were examined. The results showed that soil drench with PEN provided significant protection against Fov and Vd. The controlling efficacy of PEN was dose-dependent, and the highest efficacy was obtained with 5-7% PEN. Soil drench with 5% induced the accumulation of six PR protein transcripts, PR-1a, PR-1b, PR-2, PR-3, A-C and B-C in cotyledons of cotton seedlings, suggesting that these PR proteins may be involved in induced resistance against wilt diseases in cotton by PEN. It seems that DM of PEN represents a new agent capable of inducing both resistance and the accumulation of PR protein transcripts.
Keywords: Pathogenesis-related proteins; Cotton; Penicillium chrysogenum; Fusarium oxysporum f.sp vasinfectum (Fov); Verticillium dahliae Kleb (Vd)

Y.-X. Li, S.M. Greenberg, T.-X. Liu, Effects of Bt cotton expressing Cry1Ac and Cry2Ab and non-Bt cotton on behavior, survival and development of Trichoplusia ni (Lepidoptera: Noctuidae),
Crop Protection, Volume 25, Issue 9, September 2006, Pages 940-948, ISSN 0261-2194, DOI: 10.1016/j.cropro.2005.12.007.
(http://www.sciencedirect.com/science/article/B6T5T-4J6W6VP-1/2/1e4b1cda31d85c63d02609050f5ab225)
Abstract:
With an assumption that the larvae of cabbage looper, Trichoplusia ni (Hubner), a secondary pest of cotton, Gossypium hirsutum (L.), could move between cotton plants in the field, we conducted a series of laboratory experiments to determine the larval movement, food choice, consumption, survival, and development on Bt (Bollgard II

expressing Cry1Ac and Cry2Ab) and non-Bt cotton. On non-Bt cotton, all T. ni larvae fed and stayed on the leaves. In choice tests between a non-Bt and Bt cotton leaves, 73.3%, 86.7% and 93.3% of first instar larvae moved to non-Bt cotton leaves after 1, 8 and 48 h, respectively, indicating that larvae were able to detect and avoid Bt cotton leaves. On the non-Bt cotton leaves, 90% of larvae initiated detectable feeding damage, compared with only 16.7% on the Bt cotton leaves. The larvae feeding on non-Bt cotton leaves consumed an average of 0.226 cm2 leaf per larva in 48 h, whereas the larvae feeding on Bt cotton leaves consumed an average of 0.018 cm2 leaf per larva. The developmental times of each of the five larval stages or pupal stage were generally not significantly different with a few exceptions when they fed either on non-Bt leaves or a mixture of non-Bt and Bt leaves. The pupae that developed from the larvae that fed on non-Bt were 21.6-24.7% heavier than those that developed from the larvae that fed on a mixture of non-Bt and Bt cotton leaves. The total developmental time of larvae in the mixed-leaf treatment was significantly longer than that of larvae on non-Bt leaves. No T. ni larvae survived when they fed exclusively on Bt cotton leaves. Starved larvae died significantly sooner than those on Bt leaves. High percentages of larvae survived when they fed either on non-Bt leaves (92.7%) or on the mixture of non-Bt and Bt cotton leaves (91.7%) for 5 days. The recognition and migration of the first instar T. ni larvae from Bt cotton leaves to non-Bt cotton leaves imply that the merit of Bt and non Bt cotton seed mixture at planting should be further evaluated as a strategy for Bt cotton resistance management of lepidopteran pests.

Keywords: Trichoplusia ni; Bacillus thuringensis; Bt cotton; Behavior; Development; Survival

Junli Huang, Honglian Li, Hongxia Yuan, Effect of organic amendments on Verticillium wilt of cotton,
Crop Protection, Volume 25, Issue 11, November 2006, Pages 1167-1173, ISSN 0261-2194, DOI: 10.1016/j.cropro.2006.02.014.
(http://www.sciencedirect.com/science/article/B6T5T-4JRM011-2/2/b6f8d3b1a3fae9f33827a1333fb97ae6)

Abstract:

Verticillium wilt is the most devastating disease of cotton in China and a challenge for producers to find effective means of control. Here, we report the effects of different organic amendments on the incidence of this disease and on the rhizosphere microflora of cotton plants. Seven organic amendments were evaluated for their suppressive effect on cotton Verticillium wilt caused by Verticillium dahliae Kleb. The results showed that organic amendments applied to soil reduced disease severity in both inoculated pots and naturally infested cotton field plots. The most effective control was achieved with crab shell (chitin), soybean stalk and alfalfa, and in pots the efficacy was 72%, 60% and 56% for vascular tissues, respectively. Rice chaff gave moderate control, while poultry manure, peanut cake and wheat straw showed a weak suppressive effect with efficacy of 21%, 28% and 11% for vascular tissues, respectively. Organic amendments increased the population size of rhizosphere microbes (including fungi, bacteria and actinomycetes), which varied at the different ages of the cotton plants. The organic materials with the best biocontrol capacity strongly stimulated the

proliferation of antagonists to V. dahliae in the rhizosphere. However, poultry manure, peanut cake and wheat straw caused only small changes in the total numbers of microflora and the percentage of antagonists was lower. Extracts from organic amendments were highly inhibitory to V. dahliae. The changes undergone by rhizosphere microbes after the addition of organic amendments may contribute to suppression of cotton wilt and help to explain the protective effect of the amendments. The results indicate that application of organic amendments is an effective control measure against cotton Verticillium wilt.

Keywords: Organic amendments; Cotton; Verticillium dahliae; Control efficacy; Rhizosphere microbes

Hezhong Dong, Xuekun Zhang, Yigal Choen, Yu Zhou, Weijiang Li, Zhenhuai Li, Dry mycelium of Penicillium chrysogenum protects cotton plants against wilt diseases and increases yield under field conditions,

Crop Protection, Volume 25, Issue 4, April 2006, Pages 324-330, ISSN 0261-2194, DOI: 10.1016/j.cropro.2005.05.003.
(http://www.sciencedirect.com/science/article/B6T5T-4GJM3C3-1/2/0b4081d339c22af6a1df81ad4bec61c8)

Abstract:

Previous studies have indicated that dry mycelium (DM) of Penicillium chrysogenum (PEN), a waste product of the pharmaceutical industry, is effective in controlling fungal diseases in crop plants under greenhouse or shade-house conditions. In the present study, cotton was grown in fields amended with DM before planting, or squaring, or both, in Linqing and Liaocheng, Shandong province, China, and disease severity of Fusarium oxysporum f.sp vasinfectum (Fov) and Verticillium dahliae (Vd) was monitored from 2001 to 2004. Results from the first experiment in 2001 and 2002 showed that DM was effective in protecting, in an application mode-dependent manner, against these two pathogens. At a dose of 30 g m-2, either basal application alone or basal application plus side dressing of DM provided significant protection against Fusarium wilt and Verticillium wilt, but side dressing alone was not significantly effective in controlling the two diseases. In the second experiment in 2003 and 2004, it was shown that disease-control efficacy of DM was dependent on application rates. Averaged across two sites and both years (2003 and 2004), basal application plus side dressing at doses of 30, 90 and 150 g m-2 provided protection of 20.1, 34.6 and 42.7% against Fov, and of 26.8, 47.8 and 49.6% against Vd, respectively, compared to their corresponding DM-free controls. Increases in lint yield of cotton was also obtained by application of DM each year, which could be attributed to both disease control and nutritional effects of DM. DM ([less-than-or-equals, slant]2%) had no effect on mycelial growth of the pathogens in vitro, suggesting that the protection was probably attributable to induced resistance. It is concluded that DM of PEN may serve as an organic product for both disease control and plant nutrition in cotton production.

Keywords: Penicillium chrysogenum; Cotton; Wilt disease; Induced resistance

Oktay Erdogan, Kemal Benlioglu, Biological control of Verticillium wilt on cotton by the use of fluorescent Pseudomonas spp. under field conditions,
Biological Control, Volume 53, Issue 1, April 2010, Pages 39-45, ISSN 1049-9644, DOI: 10.1016/j.biocontrol.2009.11.011.
(http://www.sciencedirect.com/science/article/B6WBP-4XVBP6B-1/2/6923e079cd6d3ff850db77acb54296b3)
Abstract:

Four out of 59 fluorescent Pseudomonas spp. strains collected from cotton and weed rhizosphere were selected based on the following criteria: (1) inhibition of Verticillium dahliae in vitro, (2) disease suppression on two cotton cultivars grown from bacterized seeds using stem-injection with the conidia of V. dahliae, and (3) seedling vigor test (dry weight) under greenhouse conditions. Four selected Pseudomonas strains isolated from Xanthium strumarium (FP22), Portulaca sp. (FP23), Gossypium hirsitum (FP30), and Convolvulus arvensis (FP35), as well as the known biocontrol agent Serratia plymuthica (HRO-C48), were further tested for the impact on Verticillium wilt, growth parameters of cotton, and yield in a naturally infested field. The reduction of AUDPC by the seed bacterization with FP22, FP23, FP30, FP35, and HRO-C48 compared to non-bacterized control ranged from 39.2% to 50.9% and 22.1% to 36.8% in trials done in 2005 and 2006, respectively. The growth parameters (plant height, number of nodes on main stem, and NAWF-nodes above white flower) were significantly higher in seed bacterized plants compared to the untreated control. In the 2005 field trial, the increase of seed cotton yield by the treatment with four Pseudomonas strains and HRO-C48 ranged from 13.1% to 22.3% in Sayar 314 and 4.2% to 12.8% in Acala Maxxa. Seed cotton yield was not significantly influenced by the 2006 treatments. Our results indicate that seed treatment of cotton plants with our Pseudomonas spp. strains and the known strain Serratia plymuthica can help in the biocontrol of V. dahliae and improve growth parameters in cotton fields.
Keywords: Verticillium; Cotton; Fluorescent Pseudomonas; Serratia plymuthica; Weed; Field trial

Roberta Cassano, Sonia Trombino, Teresa Ferrarelli, Rita Muzzalupo, Lorena Tavano, Nevio Picci, Synthesis and antibacterial activity evaluation of a novel cotton fiber (Gossypium barbadense) ampicillin derivative,
Carbohydrate Polymers, Volume 78, Issue 3, 15 October 2009, Pages 639-641, ISSN 0144-8617, DOI: 10.1016/j.carbpol.2009.05.030.
(http://www.sciencedirect.com/science/article/B6TFD-4WGDR3F-1/2/26b4ec92a50583788edb93bc0da6285a)
Abstract:

We prepared cellulose cotton fibers containing ampicillin moieties and evaluated their antibacterial activity. In spite of recent progress in experimental and clinical medicine, the problem of chronic wounds treatment remains to be solved. In fact conventional methods are based on solutions of antibiotics and antiseptics and ointment bandages but the efficacy of this method is low and so the idea to use modified cotton gauzes would have to prevent infections insorgence during wounds healing. Ampicillin, a large spectrum antibiotic, was covalently coupled to cellulose backbone of hydrophilic

cotton fibers by a heterogeneous synthesis to produce a functionalized biopolymer with a satisfactory degree of substitution (DS) and antibacterial activity. The obtained biopolymer was characterized by infrared spectroscopy (FT-IR). Finally, the antibacterial activity in inhibiting microorganism growth in Petri dishes, was evaluated. The results suggested that these biomaterials posses an excellent 'in vitro' antibacterial activity and so they can be efficiently employed in biomedical fields for chronic wounds management to ensure a valid protection against infections and contaminations. Biopolymers so functionalized were found to be very efficient to contrast sensible bacteria growth.

Keywords: Biopolymers; Cotton fibers (Gossypium barbadense); Ampicillin; Antibacterial activity

D.M. Olson, A.M. Cortesero, G.C. Rains, T. Potter, W. Joe Lewis, Nitrogen and water affect direct and indirect plant systemic induced defense in cotton,
Biological Control, Volume 49, Issue 3, June 2009, Pages 239-244, ISSN 1049-9644, DOI: 10.1016/j.biocontrol.2009.02.011.
(http://www.sciencedirect.com/science/article/B6WBP-4VNH3Y5-5/2/05911284c1c4c6066b3c62d690662046)

Abstract:

Plants have direct and indirect constitutively produced and inducible defenses against herbivores and pathogens, which can substantially aid in their ability to defend themselves. However, very little is known about the influence of agronomic factors on such defenses. Here, we tested the effects of nitrogen levels and water availability on the ability of cotton plants to deter feeding by Spodoptera exigua through induction of anti-feedants, and to attract Microplitis croceipes through systemic induction of volatile emission. Cotton plants were grown with various nitrogen levels and were either exposed to water stress or normal water before being exposed to S. exigua for 48 h for induction of defenses. Dual choices of various nitrogen and water treatments were provided to M. croceipes in flight tunnel bioassays. Dual choices of leaf tissue from the various nitrogen and water treatments were provided to S. exigua larvae. Both water stress and nitrogen levels under and over the recommended levels increased leaf tissue consumption and decreased attraction of M. croceipes to the plants. Analyses of induced volatiles released from herbivore damaged plants indicate that their concentrations differ among the nitrogen levels tested with plants receiving no nitrogen or twice the recommended dose having amounts much lower than plants receiving the recommended dose. Because both direct and indirect plant defense mechanisms are negatively affected by improper nitrogen and insufficient water, we argue that these factors should be considered for a better natural control of pests in cotton and most probably in other crops.

Keywords: Gossypium hirsutum; Microplitis croceipes; Heliocoverpa zea; Spodoptera exigua; Nitrogen; Water stress; Direct and indirect induced plant defense; Volatiles; Anti-feedants

Jeong Jun Kim, Kyu Chin Kim, Selection of a highly virulent isolate of Lecanicillium attenuatum against cotton aphid,
Journal of Asia-Pacific Entomology, Volume 11, Issue 1, March 2008, Pages 1-4, ISSN 1226-8615, DOI: 10.1016/j.aspen.2008.02.001.
(http://www.sciencedirect.com/science/article/B8JJN-4SMNV9V-5/2/4a4d7411a69ac9a1da1e7291e75e96c1)

Abstract:

Pathogenicity tests of six isolates of entomogenous fungi collected in Korea, including two isolates of Beauveria bassiana, three isolates of Paecilomyces spp. and one isolate of Lecanicillium attenuatum, were conducted to select for highly virulent isolates against the cotton aphid, Aphis gossypii. An isolate of L. attenuatum CS625, had the highest virulence against A. gossypii when the host was treated with either conidia or blastospores of the fungus. The median lethal time (LT50) with either conidial or blastospore treatments of L. attenuatum CS625 to A. gossypii was 2.7 and 3.3 days, respectively and this was shorter than treatments with the other isolates. Mortality caused by L. attenuatum CS625 was dependent on temperature, relative humidity and conidial concentration. Mortality 5 days after treatment with 108 conidia/ml was 100% at 25 and 30 [degree sign]C. Infection required over 97% RH for 100% mortality, and this isolate was unable to infect cotton aphid at a relative humidity below 75%. This isolate shows promise for development as an alternative control agent for use against the cotton aphid in Korea.

Keywords: Aphis gossypii; Biological control; Cotton aphid; Entomopathogenic fungi; Lecanicillium attenuaum; Verticillium lecanii

David O. Simelane, Donald C. Steinkraus, Timothy J. Kring, Predation rate and development of Coccinella septempunctata L. influenced by Neozygites fresenii-infected cotton aphid prey,
Biological Control, Volume 44, Issue 1, January 2008, Pages 128-135, ISSN 1049-9644, DOI: 10.1016/j.biocontrol.2007.10.004.
(http://www.sciencedirect.com/science/article/B6WBP-4PWF0MJ-2/2/7387c9264edc0727ebe58be19b5e53a1)

Abstract:

Laboratory studies were conducted to determine the effect of cotton aphids [Aphis gossypii Glover (Homoptera: Aphididae)] infected with Neozygites fresenii (Nowakowski) Batko (Entomophthorales: Neozygitaceae), on the number of prey attacked by and development of Coccinella septempunctata L. (Coleoptera: Coccinellidae). A diet of N. fresenii-infected aphids (in early stages of infection) did not have a significant effect on predation rate by either the fourth-stage larvae or adults of C. septempunctata. Second-, third- and fourth-stage larvae of C. septempunctata reared on fungus-infected aphids had significantly longer stadia than those reared on uninfected aphids. Mortality of C. septempunctata larvae reared on fungus-infected aphids increased between the second and the fourth instars, whereas mortality for those reared on uninfected aphids was significantly lower than those reared on infected aphids. Feeding on N. fresenii-infected aphids resulted in significantly smaller body size of C. septempunctata adults and a corresponding reduction in the number of eggs

oviposited during a 29-day period relative to those fed a diet of uninfected aphids. Although our findings suggest that a diet of N. fresenii-infected aphids had no effect on the number of prey consumed by C. septempunctata, it had a significant effect on the development of the predator and its capacity to reproduce. These fitness costs could alter the capacity of the predator population to reduce subsequent pest populations in cotton or adjacent crops.

Keywords: Coccinella septempunctata; Neozygites fresenii; Entomopathogenic fungus; Cotton aphid; Fungus; Entomophthoralean fungus; Intraguild predation; Interaction; Development

Bing CHEN, Shao-kun LI, Ke-ru WANG, Jing WANG, Fang-yong WANG, Chun-hua XIAO, Jun-chen LAI, Na WANG, Spectrum Characteristics of Cotton Canopy Infected with Verticillium Wilt and Applications,
Agricultural Sciences in China, Volume 7, Issue 5, May 2008, Pages 561-569, ISSN 1671-2927, DOI: 10.1016/S1671-2927(08)60053-X.
(http://www.sciencedirect.com/science/article/B82XG-4SK60RT-7/2/5646b9cfd32e17cfb9a3e3f254b8400a)

Abstract:

Hyper spectrum remote sensing with fine spectrum information is an efficient method to estimate the verticillium wilt of cotton. The research was conducted in Xinjiang, the largest cotton plant region of China, by using the data which were collected both by canopy spectrum infected with verticillium wilt and severity level (SL) in the year 2005-2006. The quantitative correlation was analyzed between SL and canopy of reflectance spectrum or derivative spectrum reflectance. The results indicated that spectrum characteristics of cotton canopy infected with verticillium wilt changed regularly with the increase of SL in different periods and varieties. Spectrum reflectance increased in the visible light region (620-700 nm) with the increase of the SL, which inverted in near-infrared region and was extremely significant in the region of (780-1 300 nm). When SL attained b2 (DI = 25), cotton canopy infected with verticillium wilt was used as a watershed and diagnosed index in the beginning stages of the disease. The results also indicated that there were marked different characteristics of the first derivative spectrum in these SL, it changed significantly in the red edge ranges (680-760 nm) with different SL, i.e., red edge swing decreased, and red edge position equally moved to the blue. In this study 1 001-1 110 nm and 1 205-1 320 nm were selected out as sensitive bands for SL of canopy. Inversion models established for estimating cotton canopy infected with verticillium wilt reached the most significant level. Finally, the different spectrum characteristics of cotton canopy infected with verticillium wilt were marked, some inversion models were established, which could estimate SL of canopy infected with verticillium wilt. The best recognized model was the first derivative spectra at (FD 731 nm - FD 1 317 nm), and it might be used to forecast the position of cotton canopy infected with verticillium wilt quantitatively.

Keywords: cotton; verticillium wilt; canopy spectrum; SL; inversion models

Kamal A.M. Abo-Elyousr, M. Hashem, E.H. Ali, Integrated control of cotton root rot disease by mixing fungal biocontrol agents and resistance inducers,
Crop Protection, Volume 28, Issue 4, April 2009, Pages 295-301, ISSN 0261-2194, DOI: 10.1016/j.cropro.2008.11.004.
(http://www.sciencedirect.com/science/article/B6T5T-4V402CB-2/2/4b710cecd9d538ac7cc1288c2283acde)

Abstract:

The aim of this study was to evaluate mixtures of bioagents and resistance inducers for protection of cotton roots against root infecting fungal pathogens. Three biological control agents (BCAs); Trichoderma hamatum (TM), Trichoderma harzianum (TZ) and Paecilomyces lilacinus (PL) and two resistance inducers (RIs); Bion (benzo(1,2,3)thiadiazole-7-carbothioic acid S-methyl ester) (BTH), salicylic acid (SA) were applied individually or in combination to test their efficacy in controlling cotton root rot disease caused by Fusarium oxysporum (FO) and Pythium debaryanum (PD) under greenhouse and field conditions. In greenhouse experiments, all applied treatments protected cotton seedlings against FO root rot. Disease index percentage (DI%) was significantly reduced up to 78.8%, while germination percentage increased significantly up to 199.60% compared with the infected control. All treatments significantly reduced PD DI% compared to infected controls. In field experiments, the maximum protection of cotton roots against FO and PD resulted from application of TM + PL + SA + BTH, where DI% was reduced to 72.3% and 69.3% relative to infected controls, respectively. Increase in cell wall fractions (cellulose, hemicelluloses and lignin) resulted from application of both BCAs and RIs in case of PD. Lignin content significantly increased 1.68-1.93 (FO) and 1.07-1.39 (PD) fold over the infected controls. A significant increase in free phenolics content was positively proportional to the degree of plant resistance against the two pathogens. The main conclusion of this study is that by combining BCAs with RIs there was increased consistency of suppression of root rot of cotton seedlings caused by either F. oxysporum or P. debaryanum.

Keywords: Acibenzolar-S-methyl (ASM); Salicylic acid; Cotton, Root rot; Fusarium oxysporum; Pythium debaryanum; Paecilomyces; Trichoderma spp.

Takeshi Haga, Niho Murayama, Yuya Shimizu, Akatsuki Saito, Takumi Sakamoto, Tetsuo Morita, Katsuhiro Komase, Tetsuo Nakayama, Kazuyuki Uchida, Tetsuro Katayama, Akio Shinohara, Chihiro Koshimoto, Hiroshi Sato, Hironori Miyata, Kiyoaki Katahira, Yoshitaka Goto, Analysis of antibody response by temperature-sensitive measles vaccine strain in the cotton rat model, Comparative Immunology,
Microbiology and Infectious Diseases, Volume 32, Issue 5, September 2009, Pages 395-406, ISSN 0147-9571, DOI: 10.1016/j.cimid.2007.11.011.
(http://www.sciencedirect.com/science/article/B6T5H-4RRXJ92-5/2/5e45e4c2c4767279ddaab488bb8bdb78)

Abstract:

Measles virus (MeV) vaccine strain, AIK-C, is temperature sensitive (ts), which is thought to be associated with attenuation of virus pathogenicity. In this study, replication and antibody response were examined in cotton rats using viruses carrying different forms of the P gene, which is responsible for the ts phenotype of strain AIK-C and its

parental Edmonston strain. When cotton rats were inoculated intranasally, ts viruses neither replicated in lungs, nor reproducibly generated an antibody response. When inoculated intramusculary (i.m.), however, ts strains raised an antibody titer in all animals. This response was not observed when ultraviolet-inactivated virus was used. ts virus, inoculated i.m., was recovered from cotton rat drainage lymph nodes. These results suggest that ts virus, inoculated i.m., could replicate in the cotton rat, presumably at the superficial lymph node, and induce an antibody response. Therefore, cotton rats can serve as a small-animal model for investigating immune responses to safer ts vaccine, as well as recombinant vaccine using AIK-C as a vector for protection against other infectious agents.

Keywords: Cotton rat; Measles vaccine; Temperature sensitive; Rat Sigmodon, Vaccin contre la rougeole, Modele animal, Virus sensible a la temperature

Jeong Jun Kim, Mark S. Goettel, David R. Gillespie, Evaluation of Lecanicillium longisporum, Vertalec(R) against the cotton aphid, Aphis gossypii, and cucumber powdery mildew, Sphaerotheca fuliginea in a greenhouse environment,
Crop Protection, Volume 29, Issue 6, June 2010, Pages 540-544, ISSN 0261-2194, DOI: 10.1016/j.cropro.2009.12.011.
(http://www.sciencedirect.com/science/article/B6T5T-4Y4XCDK-1/2/14c772153bca3f3b7d89a89253bb1cd2)

Abstract:

The commercial mycopesticide, Vertalec(R) based on Lecanicillium longisporum, was evaluated for simultaneous control of aphids and powdery mildew on cucumbers in a greenhouse setting where temperature and RH were allowed to fluctuate within normal operating ranges. Five to six week old cucumber plants were inoculated with either Sphaerotheca fuliginea (Sf) spores, cotton aphids (Aphis gossypii) or both. Vertalec, Vertalec containing irradiation-inactivated blastospores (II Vertalec) or sterilized water (control) were applied to the plants 1, 4, and 7 days later. Vertalec treatment provided complete control of aphids 16 days after aphid inoculation, whereas effects of the II Vetalec were not significantly different from the water-treated control. The number of powdery mildew spots on cucumber leaves and the number of S. fuliginea spores in each spot were significantly lower in Vertalec-treated plants than II Vertalec-treated plants or the controls, whereas numbers in the II Vertalec treatment were lower that the untreated control. These results demonstrate that Vertalec has potential for simultaneous management of both cotton aphid and powdery mildew in greenhouse cucumber production.

Keywords: Aphis gossypii, cotton aphid; Dual control; Entomopathogenic fungi; Lecanicillium longisporum; Microbial control; Powdery mildew; Sphaerotheca fuliginea; Verticillium lecanii

Jeong Jun Kim, Mark S. Goettel, David R. Gillespie, Evaluation of Lecanicillium longisporum, Vertalec(R) for simultaneous suppression of cotton aphid, Aphis gossypii, and cucumber powdery mildew, Sphaerotheca fuliginea, on potted cucumbers, ***Biological Control***, Volume 45, Issue 3, June 2008, Pages 404-409, ISSN 1049-9644, DOI: 10.1016/j.biocontrol.2008.02.003.
(http://www.sciencedirect.com/science/article/B6WBP-4RSYC91-3/2/e6a144b950b031d081a5d013ecfe0d73)

Abstract:

The commercial preparation of Lecanicillium longisporum, Vertalec(R) was evaluated for simultaneous suppression of cotton aphid and cucumber powdery mildew on potted cucumber plants. Vertalec was applied onto cucumber plants that had been infested with either cotton aphid, spores of Sphaerotheca fuliginea or both. Irradiation-inactivated Vertalec (II Vertalec) was also applied to an identical series of cucumber plants as a control. The Vertalec was highly pathogenic against adult aphids with an LT50 of 6.9 days. II Vertalec did not affect aphid survival. Application of either active or II Vertalec significantly suppressed spore production of S. fuliginea compared to the water control. For dual control assays, Vertalec applications were made one day after infestation of both aphid and S. fuliginea onto potted cucumbers. Fifteen days after the Vertalec treatments, the numbers of surviving aphids and the production of powdery mildew spores were significantly reduced compared with the water control. The presence of aphids also suppressed S. fuliginea spore production. Our results suggest the potential of a dual role for Vertalec as a microbial control agent of aphids and powdery mildew in cucumber.

Keywords: Aphis gossypii; Cotton aphid; Entomopathogenic fungi; Lecanicillium longisporum; Microbial control; Powdery mildew; Simultaneous control; Sphaerotheca fuliginea; Verticillium lecanii

David J. Perovic, Geoff M. Gurr, A. Raman, Helen I. Nicol, Effect of landscape composition and arrangement on biological control agents in a simplified agricultural system: A cost-distance approach,
Biological Control, Volume 52, Issue 3, Australia and New Zealand Biocontrol Conference, March 2010, Pages 263-270, ISSN 1049-9644, DOI: 10.1016/j.biocontrol.2009.09.014.
(http://www.sciencedirect.com/science/article/B6WBP-4XFPR0D-1/2/05f9c534b3457d2bbd996a3243787709)

Abstract:

Landscape simplification has been clearly demonstrated to have negative impacts on the in-crop density and biological-control activity of natural enemies in agricultural landscapes. The role of spatial arrangement of the landscape, however, has not been investigated in agroecosystems. We applied cost-distance modeling to investigate the relationship between the in-crop density of natural enemies and the structural connectivity of non-crop land uses surrounding crops within Australian cotton landscapes. We further compared the explanatory power of this approach with the more commonly used spatially specific proportional-area approach, which considers landscape composition in terms of the proportional area of a given land use within a given radius. Cost-distance metrics offered a more significant explanation of in-crop

density for the predatory beetle Dicranolaius bellulus (Coleoptera: Melyridae) than did the proportional-area approach. The in-crop density for this species was positively and significantly correlated with the connectivity of wooded land uses within a 3000 m radius. However, for natural enemy taxa that responded to landscape characteristics at smaller spatial scales (within a 750 m radius), namely Oxyopes spp. (Araneae: Oxyopidae) and Trichogramma spp., (Hymenoptera: Trichogrammatidae), the proportional-area approach gave a more significant explanation of in-crop density. Herbivore taxa responded weakly to proportional area at all scales and showed no correlation to cost-distance metrics. Findings indicate potential for simplified agricultural landscapes to be `selectively' manipulated to enhance colonization of the crop by natural enemies, but not herbivores, by improving connectivity between crops and non-crop resources, through the presence of woody vegetation.

Keywords: Cotton; Dispersal; GIS; Habitat manipulation; Landscape; Natural enemies; Oxyopes; Trichogramma; Dicranolaius bellulus

Shuping Luo, Jiancheng Li, Xiaoxia Liu, Ziyun Lu, Wenliang Pan, Qingwen Zhang, Zhangwu Zhao, Effects of six sugars on the longevity, fecundity and nutrient reserves of Microplitis mediator,
Biological Control, Volume 52, Issue 1, January 2010, Pages 51-57, ISSN 1049-9644, DOI: 10.1016/j.biocontrol.2009.09.002.
(http://www.sciencedirect.com/science/article/B6WBP-4X66S4B-1/2/8909952b4982b50463bede09f745f055)

Abstract:

Parasitoid adults can directly feed on floral nectar and honeydew containing monosaccharides and disaccharides. Oligosaccharides such as maltose, melezitose and raffinose are also found in honeydew but are rare in floral nectar. The effects of six different sugar resources on the longevity, fecundity and nutrient reserves of Microplitis mediator, a larval endoparasitoid in the cotton bollworm Helicoverpa armigera (Hubner) were determined in our laboratory. The results showed that both food and sex affected longevity of this wasp. Females and males of M. mediator fed with 1 M sucrose solution survived longer than controls fed with water (5.7- and 3.7-fold longer, respectively). When provided with sucrose, glucose or fructose solutions, the parasitoid generated 3.6- to 3.7-fold more offspring than controls, and 60-75% of these progenies were produced during the first 5 days. When separately given fructose, sucrose or glucose, this wasp accumulated fructose and total sugar at the highest level, which means a high sugar levels might lead to prolonging longevity and more offspring in M. mediator. In addition, compared with organisms fed galactose or raffinose, M. mediator fed sucrose or fructose accumulated high glycogen levels. Furthermore, in M. mediator, the lipid content declined with the advancing age. Females showed the slowest lipid metabolic rates when fed with sucrose, glucose, fructose, mannose and galactose solutions versus when fed with raffinose and control. In addition, only sucrose had a significant effect on lipid levels in males nearing the end of life.

Keywords: Sugar; Glycogen; Lipid; Energy cost; Microplitis mediator; Cotton bollworm

Wei-Bing Shi, Li-Li Zhang, Ming-Guang Feng, Field trials of four formulations of Beauveria bassiana and Metarhizium anisoplae for control of cotton spider mites (Acari: Tetranychidae) in the Tarim Basin of China,
Biological Control, Volume 45, Issue 1, April 2008, Pages 48-55, ISSN 1049-9644, DOI: 10.1016/j.biocontrol.2007.11.006.
(http://www.sciencedirect.com/science/article/B6WBP-4R7NR55-1/2/1f0ca1e538a049f85499141dcfe3285f)

Abstract:

Aerial conidia of four isolates of Beauveria bassiana (Bb734 and Bb2860) and Metarhizium anisoplae (Ma456 and Ma759) produced on rice were formulated with an emulsifiable oil and sprayed in block-randomized triple plots (6 x 8 m each) of two irrigated cotton fields (Trials 1 and 2) for control of summer populations of cotton spider mites, mainly Tetranychus truncates and T. turkestani, in the Tarim Basin of northwestern China, where the weather is of typical continental desert with a paucity of summer rain. The formulations of B. bassiana and M. anisoplae were sprayed at the rates of 1.5 x 1013 and 1.05 x 1013 conidia/ha, respectively, yielding deposits of 808-1059 and 600-721 conidia/mm2 on the leaves of cotton plants (55-65 cm tall). In both trials, the spider mites were significantly controlled by all the fungal sprays despite some variation among the candidates. Pure sprays of Ma456 and Bb734 resulted in desirable control for 35 days in Trial 1 (sprayed twice at 15-day interval) or 30 days in Trial 2 (sprayed once). Overall means of relative efficacies during the periods of both trials were 85.8% (77.9-94.9%) and 88.0% (82.4-94.0%) for Ma456, and 77.9% (68.6-89.6%) and 85.7% (77.8-87.7%) for Bb734. However, inclusion of a low rate of chlorpyrifos (7.2 g AI/ha) in the fungal sprays in Trial 2 did not significantly enhance the field efficacies despite somewhat improved. An unusually hot week encountered during the trial caused dramatic decreases of the mite densities in blank control. Hourly field records of relative humidity and temperature under cotton canopy showed 349 and 298 h of [greater-or-equal, slanted]95% RH in the two trials and a daily mean temperature of 23.6 [degree sign]C for both. Our results highlight for the first time the potential of the emulsifiable formulations of Ma456 and Bb734 for practical control of the cotton spider mites in the desert area under routine irrigation.

Keywords: Beauveria bassiana; Metarhizium anisoplae; Emulsifiable formulation; Tetranychus spp.; Chlorpyrifos; Microbial control

Erica Soares Martins, Lilian Botelho Praca, Vinicius Fiuza Dumas, Joseilde O. Silva-Werneck, Eduardo Hideki Sone, Isabel C. Waga, Colin Berry, Rose Gomes Monnerat, Characterization of Bacillus thuringiensis isolates toxic to cotton boll weevil (Anthonomus grandis),
Biological Control, Volume 40, Issue 1, January 2007, Pages 65-68, ISSN 1049-9644, DOI: 10.1016/j.biocontrol.2006.09.009.
(http://www.sciencedirect.com/science/article/B6WBP-4M0B2J5-1/2/4e911df625b1e3db982a0a8ac6f84e44)

Abstract:

The cotton boll weevil (Anthonomus grandis) is the major cotton pest in the Americas. One of the alternatives for its control is the utilization of Bacillus thuringiensis (Bt), an entomopathogenic bacterium characterized by its production of insecticidal

crystal proteins. Embrapa Genetic Resources and Biotechnology has a collection of Bacilli in which different isolates of Bt are stored. A method for rearing and maintenance of Anthonomus grandis on artificial diet in the laboratory was developed, and a robust larval bioassay protocol was established for the selection of B. thuringiensis isolates toxic to boll weevil. After preliminary bioassays performed with 215 isolates, 5 were selected that demonstrated a good level of toxicity and these were analyzed in more detail. The most toxic were S601 and S1806 presenting LC50 (lethal concentration to kill 50% if the larvae) of 0.14 mg/ml and 0.30 mg/ml, respectively. S601 showed an LC50 value that was half that of the standard B. thuringiensis subspecies tenebrionis and S1806 demonstrated similar values of LC50 to the standard. S601 contained the cry1B gene and S1806 had the cry4A, cry4B, cry10, cry11, cyt1 and cyt2 genes like B. thuringiensis subspecies israelensis.

Keywords: Bacillus thuringiensis; Anthonomus grandis; Biological control; Toxicity; cry genes

Xiulian Sun, Dong Wu, Xincheng Sun, Liang Jin, Yan Ma, Bryony C. Bonning, Huiyin Peng, Zhihong Hu, Impact of Helicoverpa armigera nucleopolyhedroviruses expressing a cathepsin L-like protease on target and nontarget insect species on cotton,
Biological Control, Volume 49, Issue 1, April 2009, Pages 77-83, ISSN 1049-9644, DOI: 10.1016/j.biocontrol.2008.12.011.
(http://www.sciencedirect.com/science/article/B6WBP-4V8GB4W-3/2/6b1383053d0073e8f8793ad0d140ee0f)

Abstract:

Baculoviruses have been genetically engineered to improve their insecticidal properties and reduce crop damage. In this study, a recombinant Helicoverpa armigera nucleopolyhedrovirus (HearNPV-cathL) expressing a cathepsin L-like cysteine protease from the flesh fly, Sarcophaga peregrina, was constructed. Its insecticidal properties in the laboratory, occlusion body yield in diseased larvae, efficacy of protecting cotton from larval feeding damage and impact on predator densities in the fields were assessed. In the laboratory, the infectivity of this recombinant was not different from the wild-type parent (HearNPV-WT) and a recombinant virus (HearNPV-AaIT) which expresses an insect-selective neurotoxin from the scorpion Androctonus australis. The median survival times of 2nd or 3rd instar H. armigera larvae after infection with HearNPV-cathL were reduced about 26% in comparison to HearNPV-WT. Occlusion body yield in the diseased larvae inoculated with HearNPV-cathL, which were similar to that with HearNPV-AaIT, was reduced 63% in comparison to HearNPV-WT. In the field, when virus formulations were multiply applied to control natural infestations of H. armigera on cotton, both HearNPV-cathL and HearNPV-AaIT treatments protected cotton from larval feeding damage better than the wild-type virus treatment. Predator densities in the recombinant virus treatments were similar to those in wild-type virus treatments and untreated control. These results suggest that the recombinant HearNPVs have potential for practical use.

Keywords: Helicoverpa armigera nucleopolyhedrovirus; Genetically modified viruses; Cathepsin L-like cysteine protease; Insecticidal activity; Control efficacy

Jarrod E. Leland, Michael R. McGuire, Effects of different Beauveria bassiana isolates on field populations of Lygus lineolaris in pigweed (Amaranthus spp.),
Biological Control, Volume 39, Issue 3, December 2006, Pages 272-281, ISSN 1049-9644, DOI: 10.1016/j.biocontrol.2006.08.005.
(http://www.sciencedirect.com/science/article/B6WBP-4KN5JV1-5/2/64ccd7937b38c7db40d013992a4134b6)

Abstract:

The tarnished plant bug, Lygus lineolaris (Palisot de Beauvois), is a pest of various fruit, vegetable, fiber, and seed crops; including cotton. Lygus spp. populations often build on alternate host plants before moving to cotton, and in the midsouthern U.S. wild host plants, such as pigweed (Amaranthus spp.), play a major role in L. lineolaris population development. Three isolates of the entomopathogenic fungus Beauveria bassiana (Balsamo) were evaluated for L. lineolaris control in redroot pigweed (Amaranthus retroflexus L.): one from L. lineolaris in Mississippi (TPB3); one from Lygus hesperus (Knight) in California (WTPB2); and one commercial isolate from Mycotrol(R) (GHA). Fungal applications resulted in moderate to high mycosis in adults (33 to 80%) and moderate mycosis in nymphs (36 to 53%) that were collected from field plots at 2 days post-treatment and incubated under laboratory conditions. Although TPB3 was previously found to be more pathogenic in laboratory bioassays, there was not a consistent separation of this isolate from the other two isolates in field trials. Where differences in adult mycosis or mortality were observed, TPB3 was the most pathogenic. However, in one field trial 7 day mortality for nymphs treated with GHA was higher than those treated with TPB3 or WTPB2. Infection rates at 2, 7, and 14 days post-treatment from caged and non-caged adults suggested that movement of adults among plots occurred, which could have masked some treatment effects. Fungal treatments did not significantly reduce populations relative to controls. This may have been caused by delayed mortality rates under field conditions and/or difficulties with estimating population change under field conditions characteristic of wild host plant populations (e.g., heterogeneous populations, adult movement, and small plot size). Further work evaluating time-dose-mortality over dynamic temperatures, spring and fall field trials on this and other wild hosts, and improved methods for estimating populations on wild hosts are needed.

Keywords: Beauveria bassiana; Lygus lineolaris; Amaranthus; Cotton; Area wide management

F.J. Lopez-Escudero, C. Mwanza, M.A. Blanco-Lopez, Reduction of Verticillium dahliae microsclerotia viability in soil by dried plant residues,
Crop Protection, Volume 26, Issue 2, February 2007, Pages 127-133, ISSN 0261-2194, DOI: 10.1016/j.cropro.2006.04.011.
(http://www.sciencedirect.com/science/article/B6T5T-4K4PSFG-1/2/a7f751c518b4042167ffd6d6dcadd110)

Abstract:

Experiments were conducted to assess the eradicative effectiveness of a number of organic amendments from various botanical species on microsclerotia (MS) of defoliating (D) and non-defoliating (ND) Verticillium dahliae isolates in infested soil. All the substrates studied significantly diminished the viability of V. dahliae MS when

applied as amendments to infested soil. The efficacy was found to depend on the particular species, incubation time, pathogen isolate and whether the soil was sterilized. The effect generally increased with increasing incubation time. The ND isolate of the pathogen was more markedly affected than the D isolate. Organic tissue debris from Diplotaxis virgata, Lavandula stoechas and Thymus mastichina in the non-sterilized soil proved highly effective in reducing the viability of MS of both isolates over time. The D. virgata debris provided the most consistent reduction of MS viability among all types of organic matter and no viable inoculum of either isolate was detected after 6 weeks incubation (wai) in sterilized and non-sterilized soil. The L. stoechas amendment killed the ND V. dahliae isolate propagules in non-sterilized soil. Although the viability of D isolate MS was reduced only 58.6% 3 wai, no viable propagules were detected 6 or 9 wai. Similarly, the control rate with L. stoechas was lower in sterilized than in non-sterilized soil for both isolates. No viable MS were detected after 3 weeks incubation in the non-sterilized soil amended with T. mastichina. Plant debris from C. albidus and C. salvifolius had an intermediate effect on MS viability, but affected the viability of MS of both isolates more markedly in sterilized than in non-sterilized soil. The eradicative effect of organic amendments on V. dahliae MS was confirmed by examining the development of disease incidence and severity of symptoms of Verticillium wilt in cotton plants growing in infested, amended soil. All organic materials reduced the disease incidence and severity in soils infested with both isolates. Thus, no diseased cotton plants were detected in soils that were infested with the ND isolate and amended with any of the organic substrates. Similarly, the C. albidus and L. stoechas treatments completely prevented development of the disease in soil infested with the D isolate. The other organic treatments applied to this isolate strongly diminished the final disease incidence levels, which fell below 16.7%.

Keywords: Disease control; Cotton; Defoliating and non-defoliating isolates; Microsclerotia; Organic amendment; Plant debris; Verticillium dahlia

Jae Su Kim, Jong Yul Roh, Jae Young Choi, Yong Wang, Hee Jin Shim, Yeon Ho Je, Correlation of the aphicidal activity of Beauveria bassiana SFB-205 supernatant with enzymes,

Fungal Biology, Volume 114, Issue 1, January 2010, Pages 120-128, ISSN 1878-6146, DOI: 10.1016/j.mycres.2009.10.011.
(http://www.sciencedirect.com/science/article/B9879-4YFWTF4-G/2/35f6224e053d33919be3fc3a880e998a)

Abstract:

The supernatant of Beauveria bassiana SFB-205 reduced the population of cotton aphid, Aphis gossypii Glover, with a dosage-dependant manner, which allowed a quality control (QC) factor to be determined for the evaluation of the supernatant as the first step of a development. Enzymes were assumed as possible QC factors based on 1) the comparable aphicidal activity of the supernatant protein pellet to the raw supernatant, 2) the supernatant-induced degradation of the insect cuticles, observed by transmission electron microscopy, and 3) the confirmation of enzymes related to the fungal penetration - chitinase, and the Pr1- and Pr2 proteases - in the supernatant. Finally, from the bioassay with the enzyme-inhibited supernatants processed by substrate inhibition one by one, decreased aphicidal activities were observed for all

three enzyme-inhibited treatments. This phenomenon, furthermore, was more remarkable in the chitinase-inhibited supernatant. This finding provides that those enzymes (and most particularly the chitinase) in the supernatant were strongly involved in the aphicidal activity. Consequently, the amount of the chitinase may be used as one of the QC factors to determine the insecticidal activity of the supernatant of B. bassiana SFB-205 in the optimization of mass production.

Keywords: Chitinase; Cotton aphid; Liquid culture; Quality control

Xiao-Mu Ma, Xiao-Xia Liu, Xia Ning, Bo Zhang, Fei Han, Xiu-Min Guan, Yun-Feng Tan, Qing-Wen Zhang, Effects of Bacillus thuringiensis toxin Cry1Ac and Beauveria bassiana on Asiatic corn borer (Lepidoptera: Crambidae),

Journal of Invertebrate Pathology, Volume 99, Issue 2, October 2008, Pages 123-128, ISSN 0022-2011, DOI: 10.1016/j.jip.2008.06.014.
(http://www.sciencedirect.com/science/article/B6WJV-4SXYG3M-1/2/14e90a443b7c78b27540f451d7e2c7a3)

Abstract:

In this study, interactions between Cry1Ac, a toxic crystal protein produced by Bacillus thuringiensis (Berliner), and Beauveria bassiana on the mortality and survival of Ostrinia furnacalis was evaluated in the laboratory. The results showed that Cry1Ac is toxic to O. furnacalis. Not only were larval growth and development delayed, but pupation, pupal weight and adult emergency also decreased when larvae were fed on artificial diet containing purified Cry1Ac toxin. When third instars O. furnacalis were exposed to combination of B. bassiana (1.8 x 105, 1.8 x 106 or 1.8 x 107 conidia ml-1) and Cry1Ac, (0.2 or 0.8 [mu]g g-1), the effect on mortality was additive, however, the combinations of sublethal concentrations showed antagonism between Cry1Ac (3.2 or 13 [mu]g g-1) and B. bassiana (1.8 x 105 or 1.8 x 106 conidia ml-1). When neonates were reared on sublethal concentrations of Cry1AC until the third instar, and survivors exposed B. bassiana conidial suspension, such treatments showed additive effect on mortality of O. furnacalis except for the combination of Cry1Ac (0.2 [mu]g g-1) and B. bassiana (1.8 x 106 conidia ml-1) that showed antagonism.

Keywords: Bacillus thuringiensis; Ostrinia furnacalis; Beauveria bassiana; Cry1Ac; Interaction; Resistance; Cotton

Jia-Xing Huang, Xiao-Mei Liang, Jian-Jun Zhang, Xiao-Jing Yan, Yan-Hong Dong, Chang-Song Li, Li-Ping Zhang, Zuo-Ting Xu, Ling Li, Hui-Zhu Yuan, Shu-Hua Qi, Fu-Heng Chen, Dao-Quan Wang, Fungicidal activity of 12-propoxyimino-1, 15-pentadecanlactam on selected crops,

Crop Protection, Volume 28, Issue 11, November 2009, Pages 947-951, ISSN 0261-2194, DOI: 10.1016/j.cropro.2009.07.017.
(http://www.sciencedirect.com/science/article/B6T5T-4X1GFSH-1/2/5f87a9d5de1c360efbc5be988aa8b507)

Abstract:

Fungicide candidate 7B3, featuring a structure of macrolactam with an oxime side chain, was evaluated through pot culture test and field efficacy trials. The results showed that 7B3 has excellent fungicidal activity against Rhizoctonia solani and Botrytis cinerea. In the pot culture test 7B3 showed good control against R. solani on cucumber and B. cinerea on tomato. In two-year four-place field efficacy trials the control of R. solani on cotton by 7B3 reached 64-92% at a rate of 140 g ai ha-1 and was better than or comparable to the commercial fungicide, carbendazin at the same dose. In a one-year one-place field efficacy trial the control effect of 7B3 against B. cinerea on cucumber reached 95% at a rate of 450 g ai ha-1 and was comparable to the commercial fungicide, huimeike at a rate of 504 g ai ha-1. Study on the dynamic distribution in cotton plants showed that 7B3 has almost no acropetal translocation or systemic activity in cotton plants. The toxicological profile of 7B3 indicated that it is a low toxicological compound and safe to humans, i.e. teratogenesis, mutagenesis and carcinogenesis tests were negative. All of the results suggested that 7B3 may be expected to be further developed as a practical fungicide.

Keywords: 12-Propoxyimino-1,15-pentadecanlactam; Fungicide; Rhizoctonia solani; Botrytis cinerea

Eileen M. Johnson, Kelly E. Allen, Roger J. Panciera, Sidney A. Ewing, Susan E. Little, Mason V. Reichard, Field survey of rodents for Hepatozoon infections in an endemic focus of American canine hepatozoonosis,
Veterinary Parasitology, Volume 150, Issues 1-2, 30 November 2007, Pages 27-32, ISSN 0304-4017, DOI: 10.1016/j.vetpar.2007.08.050.
(http://www.sciencedirect.com/science/article/B6TD7-4PYMWXT-1/2/2fb4dddd4770da7ec37a58555176fd8e)

Abstract:

Eighteen of 31 (58%) cotton rats (Sigmodon hispidus) and 8 of 24 (33.3%) white-footed mice (Peromyscus leucopus) that were wild-trapped from 4 American canine hepatozoonosis endemic sites in Oklahoma were infected with Hepatozoon species. The predilection organ for merogony of the Hepatozoon species in cotton rats was the liver. Meronts were not detected in any of the white-footed mice. A 488 bp DNA fragment that includes a variable region of the 18S rRNA Hepatozoon gene amplified from blood or tissue of these infected animals. Sequences from eight cotton rats were 100% identical to each other as were sequences from three white-footed mice 100% identical to each other. The cotton rat sequence and the white-footed mouse sequence were 98.8% identical, differing in 6 bp of the 488 bp fragment. The DNA sequence from cotton rats was 97.7% identical to a Hepatozoon sp. described in a large bandicoot rat from Thailand and 97.5% identical to a Hepatozoon sp. in a bank vole from Brazil. The sequence from white-footed mice was 98.6% identical to the bandicoot rat sequence and 98.4% identical to the bank vole sequence. However, the sequences were only 90.6% (cotton rat) and 91.4% (white-footed mouse) identical to H. americanum. These findings suggest that the rodents are obligate intermediate hosts for distinct Hepatozoon spp., but not H. americanum.

Keywords: Hepatozoon spp; Hepatozoonosis; Merogony; Gamontogony; Peromyscus leucopus; Sigmodon hispidus

Adriana J. Najar-Rodriguez, Elizabeth A. McGraw, Robert K. Mensah, Geoffrey W. Pittman, Gimme H. Walter, The microbial flora of Aphis gossypii: Patterns across host plants and geographical space,
Journal of Invertebrate Pathology, Volume 100, Issue 2, February 2009, Pages 123-126, ISSN 0022-2011, DOI: 10.1016/j.jip.2008.10.005.
(http://www.sciencedirect.com/science/article/B6WJV-4TVTJYR-1/2/04b3cc187e99d6c570dbb3e68bfbf75f)

Abstract:

The cotton aphid, Aphis gossypii, has a worldwide distribution and causes damage to numerous economically important crops. The bacterial symbionts associated with cotton aphids, sampled mainly from malvaceous and cucurbitaceous plants within Japan and Australia, were characterised using molecular profiling approaches. The goal was to document the aphid symbionts present and determine if patterns of microbial diversity are consistent with the existence of host plant related cryptic species in A. gossypii. The bacterial profiles of the aphids are diverse and reflect local geography more than host plant use.

Keywords: Symbiont; Microbial flora; Aphid; Aphis gossypii

WEED CONTROL (2 jdl)

Jason K. Norsworthy, Marilyn McClelland, Griff M. Griffith, Conyza canadensis (L.) Cronquist response to pre-plant application of residual herbicides in cotton (Gossypium hirsutum L.),
Crop Protection, Volume 28, Issue 1, January 2009, Pages 62-67, ISSN 0261-2194, DOI: 10.1016/j.cropro.2008.08.012.
(http://www.sciencedirect.com/science/article/B6T5T-4TK2P5J-1/2/fe47673fe1b1521dff842600db9aab5d)

Abstract:

Glyphosate-resistant Conyza canadensis emerging in autumn and spring in the southern USA must be controlled prior to establishment of spring-seeded glyphosate-resistant crops. Research was conducted to evaluate C. canadensis control with residual herbicides labeled for pre-emergence use in cotton and to determine the length of residual activity of each herbicide. Additionally, glufosinate and dicamba-based pre-plant burndown programs were evaluated for control and reduction in C. canadensis emergence at three locations in 2007 in Arkansas, USA, with two of these sites containing glyphosate-resistant C. canadensis. Fluometuron, oxyfluorfen, and norflurazon were the most consistent and efficacious herbicides evaluated, providing at least 80% residual control of glyphosate-resistant C. canadensis through 8 weeks after treatment. Glufosinate alone applied in early and late March (8 and 10 weeks before cotton sowing) usually provided less than complete control, resulting in C. canadensis regrowth and subsequent seedling emergence. Addition of dicamba in a tank-mix with glufosinate generally improved C. canadensis control in addition to providing some residual suppression of further emergence. No C. canadensis emerged over a 10- to 12-week period in plots treated with glufosinate plus dicamba plus flumioxazin. Although dicamba does provide short-lived residual C. canadensis control, this research confirms

that additional residual herbicides are needed with pre-plant burndown programs to prevent subsequent emergence when conditions are conducive for C. canadensis germination.

Keywords: Conyza canadensis; Dicamba; Glufosinate; Herbicide resistance; Horseweed; Residual weed control; Weed emergence

M.N. Dogan, A. Unay, O Boz, D. Ogut, Effect of pre-sowing and pre-emergence glyphosate applications on weedsin stale seedbed cotton,
Crop Protection, Volume 28, Issue 6, June 2009, Pages 503-507, ISSN 0261-2194, DOI: 10.1016/j.cropro.2009.01.013.
(http://www.sciencedirect.com/science/article/B6T5T-4VP1CH4-2/2/7d541d84f70788050ad65f7157ddfd04)

Abstract:

The effect of pre-emergence or pre-sowing glyphosate treatments in stale seedbed cotton was evaluated in 2005, 2007 and 2008. Main soil tillage at the experimental fields was carried out in early April to allow weed emergence before sowing. Glyphosate was applied on plots with or without seedbed preparation as pre-sowing or pre-emergence treatments. Efficacies of glyphosate treatments were compared with untreated control and plots which received seedbed preparation + trifluralin. 2 and 4 weeks after cotton emergence, weed cover was visually estimated and weed biomass determined, respectively. A combination of stale seedbed technique with glyphosate treatment can be considered an effective alternative weed control system to reduce weeds by up to 90% during the critical period. This would reduce the intensity, costs and negative environmental impact of mechanical and chemical treatments.

Keywords: Cotton; Stale seedbed; Glyphosate; Weed control

SOIL CHEMISTRY (5 jdl)

G. NABI, C.E. MULLINS, Soil Temperature Dependent Growth of Cotton Seedlings Before Emergence,
Pedosphere, Volume 18, Issue 1, February 2008, Pages 54-59, ISSN 1002-0160, DOI: 10.1016/S1002-0160(07)60102-7.
(http://www.sciencedirect.com/science/article/B82XV-4RGFFJ5-6/2/cd38103b1a387474d12764ce1225bff5)

Abstract:

Soil temperature is an important variable governing plant growth and development. Studies were conducted under laboratory conditions to determine the effect of soil temperature on root and shoot growth of cotton during emergence. Cotton seedlings were grown for 192 h at 20, 32 and 38 [degree sign]C in soil packed in 300 mm long and 50 mm diameter cylinders. The data indicated that the longest roots (173 mm) as well as shoots (152 mm) were recorded at 32 [degree sign]C followed by 20 (130 mm root and 82 mm shoot) and 38 [degree sign]C (86 mm root and 50 mm shoot).

Roots grown at 20 and 38 [degree sign]C were 20% and 50% shorter, respectively, than those grown at 32 [degree sign]C after 192 h. Roots and shoots exhibited the lowest length and dry biomass at 38 [degree sign]C. Shoot lengths grown at 20 (74 mm) and 38 [degree sign]C (51 mm) were 44% and 61% shorter than those grown at 32 [degree sign]C (131 mm) after 180 h growth period, respectively. Growth at all three temperatures followed a similar pattern. Initially there was a linear growth phase followed by the reduction or cessation of growth. Time to cessation of growth varied with temperature and decreased faster at higher temperatures. Sowing of cotton should be accomplished before seedbed reaches a soil temperature (>= 38 [degree sign]C) detrimental for emergence. Further, the seedbeds should be capable of providing sufficient moisture and essential nutrients for emerging seedling before its seed reserves are exhausted to enhance seedling establishment in soil.

Keywords: linear growth; root/shoot elongation; soil temperature

Cynthia L. Withington, Robert L. Sanford Jr., Decomposition rates of buried substrates increase with altitude in the forest-alpine tundra ecotone,

Soil Biology and Biochemistry, Volume 39, Issue 1, January 2007, Pages 68-75, ISSN 0038-0717, DOI: 10.1016/j.soilbio.2006.06.011.
(http://www.sciencedirect.com/science/article/B6TC7-4KHBYG0-4/2/86b618159c002ca25a7827b6905816a8)

Abstract:

Decomposition rates were measured across the forest-alpine tundra ecotone on two mountains in the Colorado Front Range. Cotton strips decomposed in the surface soils of forest, krummholz, and tundra plots for one year. We expected decomposition rates to decline with altitude or be most rapid in the krummholz. Surprisingly, decomposition rates increased from forest to tundra on Mt. Evans and remained constant across the ecotone on Niwot Ridge, highlighting differences in biogeochemical processes between two nearby mountains with otherwise similar alpine and subalphine ecosystems. Our results support the concept that decomposition rates exhibit a curvilinear relationship with soil temperature and moisture. However, soil moisture was found to be the primary factor controlling cellulose decomposition rates in soils in the forest-alpine tundra ecotone. Cellulose decomposition rates increased with soil depth indicating greater microbial activity in the mineral soil than in the organic horizon due to greater soil moisture. In addition to microbial activity, decomposition rates in the tundra may be enhanced by physical degradation from freeze-thaw events and vigorous root growth.

Keywords: Alpine; Cellulose; Cotton strips; Decomposition; Forest-alpine tundra ecotone; Soil moisture; Soil temperature; Subalpine forest; Treeline

M. Tejada, C. Garcia, J.L. Gonzalez, M.T. Hernandez, Use of organic amendment as a strategy for saline soil remediation: Influence on the physical, chemical and biological properties of soil,

Soil Biology and Biochemistry, Volume 38, Issue 6, June 2006, Pages 1413-1421, ISSN 0038-0717, DOI: 10.1016/j.soilbio.2005.10.017.

(http://www.sciencedirect.com/science/article/B6TC7-4J0WP59-2/2/ad93fef562583941a55605d02288dae1)

Abstract:

The effectiveness of adding two organic wastes (cotton gin crushed compost, CGCC, and poultry manure, PM) to a saline soil (Salorthidic Fluvaquent) in dryland conditions near Seville (Guadalquivir Valley, Andalusia, Spain) was studied during a period of 5 years. Organic wastes were applied at rates of 5 and 10 t organic matter ha-1. One year after the assay began, spontaneous vegetation had appeared in the treated plots, particularly in that receiving a high PM dose. After 5 years the plant cover in this treated plot was around 80% (compared with the 8% of the control soil). The effect on the soils physical and chemical properties, soil microbial biomass, and six soil enzymatic activities (dehydrogenase, urease, protease, [beta]-glucosidase, arylsulfatase, and phosphatase activities) were ascertained. Both added organic wastes had a positive effect on the physical, chemical and biological properties of the soil, although at the end of the experimental period, the soil physical properties, such as bulk density, increased more significantly in the CGCC-amended soils (23%) and the exchangeable sodium percentage (ESP) decreased more significantly in the CGCC-amended soils (50%) compared to the unamended soil. Water soluble carbohydrates and soil biochemical properties were higher in the PM-amended soils compared to the CGCC-amended soils (by 70% for water soluble carbohydrates, and by 34, 18, 37, 39, 40 and 30% for urease, protease, [beta]-glucosidase, phosphatase, arylsulfatase and dehydrogenase activities, respectively). After 5 years, the percentage of plant cover was >50% in all treated plots and 8% in the control soil.

Keywords: Saline soil; Soil remediation; Cotton gin crushed compost; Poultry manure; Microbial activity; Soil enzymes

Ramon Jaime-Garcia, Peter J. Cotty, Crop rotation and soil temperature influence the community structure of Aspergillus flavus in soil,

Soil Biology and Biochemistry, Volume 42, Issue 10, October 2010, Pages 1842-1847, ISSN 0038-0717, DOI: 10.1016/j.soilbio.2010.06.025.
(http://www.sciencedirect.com/science/article/B6TC7-50HVYYH-9/2/9c87459c402284f775e0624c8cc94306)

Abstract:

Aspergillus flavus, the most important cause of aflatoxin contamination, has two major morphotypes commonly termed `S' and `L' strains. Strain S isolates, on average, produce more aflatoxins than the strain L isolates. The S strain has been implicated as the primary causal agent of several contamination events in both North America and Africa. Strain S incidence and A. flavus propagules were quantified periodically in 11 agricultural fields in South Texas from spring 2001 through spring 2003. Both A. flavus populations and S strain incidence varied significantly among seasons, with warm seasons having higher average quantities of A. flavus (718 CFU g-1) and higher

incidences of the S strain (32.3%) than cold seasons (403 CFU g-1 and 16.9% incidence). Previous crop influenced both the quantity of A. flavus and S strains incidence. Corn favors higher soil populations of A. flavus (1628 CFU g-1) compared to cotton (374 CFU g-1) and sorghum (237 CFU g-1). In the agroecosystem of South Texas, both cotton (23.7%) and sorghum (23.5%) favored greater S strain incidence compared to corn (14.0%). Soil surface temperature greatly influenced fungal communities with propagule density decreasing when daily average soil temperature was either below 18 [degree sign]C or above 30 [degree sign]C, and the proportion of A. flavus belonging to the S strain increasing as soil temperature increased. The results suggest it may be possible to manipulate crop rotations in order to reduce aflatoxin severity, and that periods of increased soil temperature drive selection of the highly toxigenic S strain of A. flavus in warm climates.

Keywords: Maize; Cottonseed; Biocontrol; Population structure

V. Acosta-Martinez, S. Dowd, Y. Sun, V. Allen, Tag-encoded pyrosequencing analysis of bacterial diversity in a single soil type as affected by management and land use,
Soil Biology and Biochemistry, Volume 40, Issue 11, November 2008, Pages 2762-2770, ISSN 0038-0717, DOI: 10.1016/j.soilbio.2008.07.022.
(http://www.sciencedirect.com/science/article/B6TC7-4T8YVC7-1/2/24104c23e4bca529ba3ba1ec25b76d3a)

Abstract:

Impacts of management and land use on soil bacterial diversity have not been well documented. Here we present the application of the bacterial tag encoded FLX amplicon pyrosequencing (bTEFAP) diversity method, which will promote studies in soil microbiomes. Using this modified FLX pyrosequencing approach we evaluated bacterial diversity of a soil (Pullman soil; fine, mixed, thermic Torrertic Paleustolls) with 38% clay and 34% sand (0-5 cm) under four systems. Two non-disturbed grass systems were evaluated including a pasture monoculture (Bothriochloa bladhii (Retz) S.T. Blake) [P] and a diverse mixture of grasses in the Conservation Reserve Program (CRP). Two agricultural systems were evaluated including a cotton (Gossypium hirsutum L.) -winter wheat (Triticum aestivum L.)-corn (Zea mays L.) rotation [Ct-W-Cr] and the typical practice of the region, which is continuous monoculture cotton (Ct-Ct). Differences due to land use and management were observed in soil microbial biomass C (CRP > P = Ct-W-Cr > Ct-Ct). Using three estimators of diversity, the maximum number of unique sequences operational taxonomic units (OTU; roughly corresponding to the species level) never exceeded 4500 in these soils at the 3% dissimilarity level. The following trend was found using the most common estimators of bacterial diversity: Ct-W-Cr > P = CRP > Ct-Ct. Predominant phyla in this soil were Actinobacteria, Bacteriodetes and Fermicutes. Bacteriodetes were more predominant in soil under agricultural systems (Ct-W-Cr and Ct-Ct) compared to the same soil under non-disturbed grass systems (P and CRP). The opposite trend was found for the Actinobacteria, which were more predominant under non-disturbed grass systems (P and CRP). Higher G- bacteria and lower G+ bacteria were found under Ct-W-Cr rotation and highest abundance of actinomycetes under CRP. The bTEFAP technique proved to be a powerful method to characterize the bacterial diversity of the soil studied under different management and land use in terms not only on the presence or absence, but also in terms of distribution.

Keywords: Soil management; Bacterial diversity; 454 Pyrosequencing; Conservation Reserve Program; Land use; Cotton; Integrated crop-livestock production

SOIL BIOLOGY (4 jdl)

O.G.G. Knox, D.B. Nehl, T. Mor, G.N. Roberts, V.V.S.R. Gupta, Genetically modified cotton has no effect on arbuscular mycorrhizal colonisation of roots,
Field Crops Research, Volume 109, Issues 1-3, October-December 2008, Pages 57-60, ISSN 0378-4290, DOI: 10.1016/j.fcr.2008.06.005.
(http://www.sciencedirect.com/science/article/B6T6M-4T1X2G4-1/2/4bd0b2a21d9701c4512fc1de2fe5f5b5)

Abstract:

There is conjecture that genetically modified (GM) plants, expressing insecticidal or herbicide tolerance traits, do not form mycorrhizal symbioses. For cotton, Gossypium hirsutum, which is grown worldwide as a high and low input crop, such an issue would be of concern because it depends upon symbiosis with arbuscular mycorrhizal (AM) fungi for uptake of immobile elements, such as phosphorus and zinc, and GM cotton varieties are widely grown. We compared mycorrhizal development in commercial cultivars of cotton expressing genes for insect resistance (Cry1Ac and Cry2Ab), glyphosate tolerance (5-enolpyruvylshikimate-3-phosphate synthase gene (EPSPS)), or both, and their conventional parent line. AM development in cotton roots increased rapidly in the first three weeks after sowing, reaching a plateau level of around 70-80% root length. The observed pattern of colonisation was virtually identical among both conventional and GM cultivars of cotton at each assessment, clearly indicating that colonisation by AM fungi were not affected by the expressed transgenic traits.

Keywords: Gossypium hirsutum; GM; Transgenic; AM

Biao Liu, Liang Wang, Qing Zeng, Jun Meng, Wenjun Hu, Xiaogang Li, Kexin Zhou, Kun Xue, Doudou Liu, Yangping Zheng, Assessing effects of transgenic Cry1Ac cotton on the earthworm Eisenia fetida,
Soil Biology and Biochemistry, Volume 41, Issue 9, September 2009, Pages 1841-1846, ISSN 0038-0717, DOI: 10.1016/j.soilbio.2009.06.004.
(http://www.sciencedirect.com/science/article/B6TC7-4WM6089-2/2/54ade8ba2fd04bc7a464069b9e8f18c0)

Abstract:

Transgenic insect-resistant cotton containing a synthetic version of the insecticidal toxin gene from Bacillus thuringiensis subsp. kurstaki has been planted in China in a large scale and may have adverse impacts on soil organisms. The leaves of the transgenic cotton and the non-transgenic parental cotton were collected and their impacts on the earthworm, Eisenia fetida, were tested in laboratory studies. No significant acute toxicity on E. fetida from oral exposure to the transgenic cotton line, GK19, was detected. The average weight, numbers of cocoons and new offsprings of E.

fetida in the GK19 groups were all higher than in the Simian3 groups, but the differences were not significant.

Keywords: Transgenic; Cry1Ac gene; Cotton; Leaf; Eisenia fetida; Growth; Reproduction

S. Mahieu, J. Fustec, E.S. Jensen, Y. Crozat, Does labelling frequency affect N rhizodeposition assessment using the cotton-wick method?,
Soil Biology and Biochemistry, Volume 41, Issue 10, October 2009, Pages 2236-2243, ISSN 0038-0717, DOI: 10.1016/j.soilbio.2009.08.008.
(http://www.sciencedirect.com/science/article/B6TC7-4X366YD-1/2/dec3dca0c100725188b96d81b2e790c6)

Abstract:

The aim of the present study was to test and improve the reliability of the 15N cotton-wick method for measuring soil N derived from plant rhizodeposition, a critical value for assessing belowground nitrogen input in field-grown legumes. The effects of the concentration of the 15N labelling solution and the feeding frequency on assessment of nitrogen rhizodeposition were studied in two greenhouse experiments using the field pea (Pisum sativum L.). Neither the method nor the feeding frequency altered plant biomass and N partitioning, and the method appeared well adapted for assessing the belowground contribution of field-grown legumes to the soil N pool. However, nitrogen rhizodeposition assessment was strongly influenced by the feeding frequency and the concentration of labelling solution. At pod-filling and maturity, despite similar root 15N enrichment, the fraction of plants' belowground nitrogen allocated to rhizodeposition in both Frisson pea and the non-nodulating isoline P2 was 20 to more than 50% higher when plants were labelled continuously than when they were labelled using fortnightly pulses. Our results suggest that when 15N root enrichment was high, nitrogen rhizodeposition was overestimated only for plants that were 15N-fed by fortnightly pulses, and not in plants 15N-fed continuously. This phenomenon was especially observed for plants that rely on symbiotic N2 fixation for N acquisition, and it may be linked to the concentration of the labelling solution. In conclusion, the assessment of nitrogen rhizodeposition was more reliable when plants were labelled continuously with a dilute solution of 15N urea.

Keywords: N rhizodeposition; 15N; Cotton-wick method; Legumes; Pisum sativum L.; Isotopic methods

M. Tejada, J.L. Gonzalez, Influence of organic amendments on soil structure and soil loss under simulated rain,
Soil and Tillage Research, Volume 93, Issue 1, March 2007, Pages 197-205, ISSN 0167-1987, DOI: 10.1016/j.still.2006.04.002.
(http://www.sciencedirect.com/science/article/B6TC6-4K18VKF-1/2/6998d9177777b933d68620e1ab60a2b3)

Abstract:

The influence on soil properties and soil loss under simulated rain, of four organic by-products (cotton gin crushed compost (CCGC), by-product obtained after the two-step olive oil extraction process (BOO), sewage sludge (SS) and organic municipal solid

by-product (MSW) applied annually at 10,000 kg organic matter ha-1, was studied over 4 years on a Typic Xerofluvent under dryland conditions near Sevilla (Spain). All organic by-product treatments reduce bulk density, aggregate instability and soil loss. The CCGC and BOO treatments had similar effects and were more effective than SS and MSW treatments. Compared with the control (no organic amendment) treatment, CCGC and BOO treatments reduced bulk density by 20% and 19%, respectively, aggregate instability by 33% and 28%, respectively, and soil loss under simulated rain at 140 mm h-1 by 32% and 30%, respectively. Compared with the control treatment, the SS and MSW treatments reduced bulk density by 12% and 9%, respectively, aggregate instability by 16% and 14%, respectively, and soil loss under simulated rain at 140 mm h-1 by 23% and 19%, respectively. The stronger effects of CCGC and BOO might have been because they had humic acid contents than SS and MSW.

Keywords: Cotton gin crushed compost; By-product obtained after the two-step olive oil extraction process; Sewage sludge; Municipal solid by-product; Rainfall simulator; Soil loss

SOIL FERTILITY (1 jdl)

Bo Liu, Marcia L. Gumpertz, Shuijin Hu, Jean Beagle Ristaino, Long-term effects of organic and synthetic soil fertility amendments on soil microbial communities and the development of southern blight,

Soil Biology and Biochemistry, Volume 39, Issue 9, September 2007, Pages 2302-2316, ISSN 0038-0717, DOI: 10.1016/j.soilbio.2007.04.001.
(http://www.sciencedirect.com/science/article/B6TC7-4NNPR0T-4/2/f3ae6769fb0cce556c620f47a7627d15)

Abstract:

The effects of tillage and soil fertility amendments on the relationship between the suppressiveness of soils to southern blight and soil physical, chemical and biological factors were examined in experimental station plots in North Carolina. Main plots were either tilled frequently or surface-mulched after one initial tillage. Organic soil amendments including composted cotton gin trash, composted poultry manure, an incorporated rye-vetch green manure, or synthetic fertilizer were applied to subplots in a split-plot design experiment. Incidence of southern blight was lower in surfaced-mulched than tilled soils. Incidence of southern blight was also lower in soils amended with cotton gin trash than those amended with poultry manure, rye-vetch green manure or synthetic fertilizer. Soil water content was negatively correlated with the incidence of disease in both years. Disease incidence was negatively correlated with the level of potassium, calcium, cation exchange capacity (CEC), base saturation (BS) and humic matter in 2002, and net mineralizable nitrogen in 2001. Although, populations of thermophilic organisms were significantly higher in soils amended with cotton gin trash than the other three fertility amendments in each year, there was no significant correlation between the populations of thermophiles and incidence of the disease. Bacterial community diversity indices based on community-level physiological profiling (CLPP) and denaturing gradient gel electrophoresis (DGGE) were significantly higher in

soils amended with cotton gin trash than those amended with poultry manure, green manure or synthetic fertilizer. There was a significant negative correlation between the incidence of southern blight, and CLPP and DGGE diversity indices. Greater differences in the richness of bacterial functional groups than genotypes were observed. These results demonstrate that organic soil fertility amendments and cotton gin trash in particular, reduced the development of the disease and affected soil physical, chemical and biological parameters.

Keywords: Sclerotium rolfsii; Soil physical, chemical and biological parameters; Organic and synthetic fertility amendments; Disease; Microbial communities; BIOLOG; DGGE

WATER RESOURCES (1 jdl)

Ahmet Uludag, Ilhan Uremis, Ahmet Can Ulger, Bulent Cakir, Eda Aksoy, The use of maize as replacement crop in trifluralin treated cotton fields in Turkey,
Crop Protection, Volume 25, Issue 3, March 2006, Pages 275-280, ISSN 0261-2194, DOI: 10.1016/j.cropro.2005.05.005.
(http://www.sciencedirect.com/science/article/B6T5T-4GNCFTR-2/2/8f3f6bba8351b867afe0fc951a480d43)

Abstract:

Maize and cotton are primary crops in Turkey. Trifluralin is commonly used in cotton. In some years heavy rain after cotton sowing kills cotton seedlings. Although maize is the best choice as a replacement crop, the trifluralin label prohibits maize sowing for 12 months. The current study was carried out to look at possible use of maize as a catch crop in trifluralin treated cotton fields. Maize varieties showed varying response to trifluralin. However, better and worse responding varieties responded to trifluralin similarly in field conditions due to environmental conditions which was favorable for higher trifluralin loss. Temperature during flooding and duration of flooding do not have any affect on trifluralin injury.

Keywords: Bioassay; Catch crop; Flooding; Varietal response

SURVEYING METHODS (13 jdl)

Pei-Pei ZHANG, Xia-Qing WANG, Yang YU, Yu Yu, Zhong-Xu LIN, Xian-Long ZHANG, Isolation, Characterization, and Mapping of Genomic Microsatellite Markers in Sea-Island Cotton (Gossypium barbadense),
Acta Agronomica Sinica, Volume 35, Issue 6, June 2009, Pages 1013-1020, ISSN 1875-2780, DOI: 10.1016/S1875-2780(08)60087-5.
(http://www.sciencedirect.com/science/article/B94TW-4XV5JMW-4/2/e843b19a25cafa59d1a94a337a386315)

Abstract:

For developing novel microsatellite markers from the genome of sea-island cotton (Gossypium barbadense L.), 2 approaches were used to isolate microsatellites from the genetic standard line G. barbadense acc. 3-79, that is, cloning amplified

fragments from either inter simple sequence repeat (ISSR) or degenerated primers. A total of 239 unique clones were generated from 1447 recombinants, and 214 unique sequences were obtained. Eighty-six primer pairs were developed from 70 sequences that had flanking regions sufficient for primer design. The 86 microsatellite primer pairs were evaluated with 56 sea-island cotton accessions and 4 upland cotton (G. hirsutum L.) cultivars. Of them, 16 primers had no amplification, 43 primers amplified identical products among all the accessions, 27 primers presented polymorphism between sea-island and upland cotton, and the remaining 19 primers were polymorphic among accessions of the sea-island cotton. On the basis of Jaccard's genetic similarity coefficient detected by the 27 polymorphic microsatellites, sea-island cotton was separated from upland cotton in the phylogentic tree, and all the sea-island cotton accessions were classified into 4 groups. Nine interspecific polymorphic markers were mapped on the cotton genetic map, of which 4 on chromosomes A subgenome and 5 on chromosome of D subgenome.

Keywords: sea-island cotton; microsatellites; genetic variation; genetic mapping

Reginald S. Fletcher, Allan T. Showler, Surveying kaolin-treated cotton plots with airborne multispectral digital video imagery,

Computers and Electronics in Agriculture, Volume 54, Issue 1, October 2006, Pages 1-7, ISSN 0168-1699, DOI: 10.1016/j.compag.2006.06.004.
(http://www.sciencedirect.com/science/article/B6T5M-4KR3J45-1/2/7fedfc6dc7b3ba9142c49252f64868e9)

Abstract:

Airborne multispectral digital video imagery was evaluated as tool for surveying kaolin-treated cotton (Gossypium hirsutum L.) plots, with emphasis on decision support. Images of experimental plots were obtained on 12 June 2002 and 16 June 2004 with an electronic digital video imaging system acquiring blue (447-455 nm), green (555-565 nm), red (625-635 nm), near-infrared (814-826 nm), and mid-infrared (1631-1676 nm) imagery. We qualitatively and quantitatively evaluated the single band images and color and false color composite images to compare the image responses of treated plots with the image responses of untreated plots. Blue, green, and red imagery separated the treated plots from the untreated plots (Dunnett's test and t-test; P = 0.05), with the blue imagery being the most responsive to the treatment. Treated plots were readily differentiated from untreated plots with natural color and false color composite imagery. This separation was attributed to the images that were sensitive to some portion of the visible spectrum (i.e., blue, green, and red light). These results indicate that airborne electronic imaging systems have great potential as tools for surveying cotton fields treated with kaolin particle film, supporting application of the imagery as a decision support tool.

Keywords: Remote sensing; Surround wettable powder; Electronic digital video imagery; Multispectral

Yufeng Ge, J. Alex Thomasson, Ruixiu Sui, Cristine L.S. Morgan, A module-specific post-processing calibration method to improve cotton yield mapping,
Computers and Electronics in Agriculture, Volume 68, Issue 2, October 2009, Pages 161-167, ISSN 0168-1699, DOI: 10.1016/j.compag.2009.05.007.
(http://www.sciencedirect.com/science/article/B6T5M-4WP4BD5-1/2/093d7cada1d0f4e4f9ce095cb4815ecb)

Abstract:

Calibrating cotton yield monitor data is difficult, because there are many confounding factors, such as landscape, soil, ambient light and temperature, defoliation level, and variety that can cause sensor response to shift from field to field and even within a field. The conventional calibration method involves in situ weighing of basket loads, which is costly, logistically unfavorable, and not adequate to account for inconsistent performance of yield monitor sensors. In this work a module-specific post-processing method was used to calibrate cotton yield data. The method was enabled by a wireless communication and GPS based electronic system that can delineate the harvest location of each cotton module in the field during machine harvest. Module-specific correction coefficients were calculated as the ratio of module weight determined at the gin to the yield monitor based module weight integrated over the module harvest area. Module-specific lint turnout, also determined at the gin, was used to convert seed cotton yield to lint yield. The method was field tested on 16 cotton modules harvested from two study areas near College Station, TX. Results showed that yield monitor based weight deviated substantially from the actual weight for some modules, with errors ranging from -41.0% to +13.9%. Lint yield maps produced with module-specific post-processing calibration showed more reliable spatial patterns than maps produced with field-based post-processing. Combining the wireless communication and GPS system with the cotton yield monitor could greatly enhance the quality of cotton yield maps, making them more suitable for various precision agriculture applications.

Keywords: Cotton; Precision agriculture; Wireless communication; GPS; Yield calibration; Yield monitor

Ahsan Abdullah, Analysis of mealybug incidence on the cotton crop using ADSS-OLAP (Online Analytical Processing) tool,
Computers and Electronics in Agriculture, Volume 69, Issue 1, November 2009, Pages 59-72, ISSN 0168-1699, DOI: 10.1016/j.compag.2009.07.003.
(http://www.sciencedirect.com/science/article/B6T5M-4WXXV3J-1/2/454c54732429a95820dd291affd869e3)

Abstract:

Traditionally the agriculture expert's knowledge is descriptive and experimental, therefore, it is difficult to describe it mathematically and subsequently build agriculture Decision Support Systems (DSS). Furthermore, the corresponding data may be in such a raw form that it cannot be used in a DSS. The Agriculture Decision Support System (ADSS) is a 26-month project based on the Agro-met data from 2001 to 2006 of Punjab (the bread-basket of Pakistan), its ADSS-OLAP, i.e. Online Analytical Processing tool (www.agroict-olap.org) allows for quick analysis of all possible interesting aggregates of the ADSS data by employing drag-drop and mouse-click and is used in this paper to

identify the effective pesticide groups related to the mealybug incidence. Pakistan is the world's fifth-largest producer of cotton, but the emergence of the mealybug as a new cotton pest is likely to reduce the cotton yield by 1.3 million bales. The research work reported in this paper is based on the detailed pest-scouting data of 2300+ farmers of District Multan (cotton hub of Pakistan) for the years 2005 and 2006. This paper will also provide guidelines for the design and development of similar complex systems/tools and discusses the issues of agricultural data-quality management, particularly in the field of insect-pest management.

Keywords: Decision Support System; Agriculture; Data Warehouse; Mealybug; Pest; Cotton; Pesticide; Data quality; OLAP

Will G. Henderson, Ahmad Khalilian, Young J. Han, Jeremy K. Greene, David C. Degenhardt, Detecting stink bugs/damage in cotton utilizing a portable electronic nose, ***Computers and Electronics in Agriculture***, Volume 70, Issue 1, January 2010, Pages 157-162, ISSN 0168-1699, DOI: 10.1016/j.compag.2009.09.019.
(http://www.sciencedirect.com/science/article/B6T5M-4XMTFD5-1/2/9b65a5e49aa13e141043ac1fc7f7681c)

Abstract:

Current scouting techniques for stink bugs are variable, time-consuming, and costly. The overarching goal of this research was to develop effective and affordable tools for detecting stink bugs and damage induced by stink bugs in cotton. A commercially available electronic nose (Cyranose 320) comprising an array of 32 carbon-black composite sensors was used for this purpose and its performance was evaluated under laboratory and field conditions. Volatile compounds emitted by stink bugs were confirmed to be trans-2-decenal and trans-2-octenal. Four of 32 sensors responded to volatile chemicals produced by bugs and showed responses (smell-prints) to pure trans-2-decenal that were identical to those obtained from stink bugs. Under laboratory conditions, internal boll injury (interior walls of bolls and locks with raised callus growths or obvious damage to lint and seed) was predicted 95% of the time and the presence of stink bugs 100% of the time. There was a strong correlation (R2 = 0.95) between the number of stink bugs in a sample and the response of Cyranose sensors.

Keywords: Electronic nose; Stink bugs; Cotton; Volatiles; Precision agriculture

Ruixiu Sui, J. Alex Thomasson, James Hanks, James Wooten, Ground-based sensing system for weed mapping in cotton,
Computers and Electronics in Agriculture, Volume 60, Issue 1, January 2008, Pages 31-38, ISSN 0168-1699, DOI: 10.1016/j.compag.2007.06.002.
(http://www.sciencedirect.com/science/article/B6T5M-4P8R7BS-1/2/9df7b6ceeb785309c23a3e9c7855829b)

Abstract:

A ground-based weed mapping system was developed to measure weed intensity and distribution in a cotton field. The weed mapping system includes WeedSeeker(R) PhD600 sensor modules to indicate the presence of weeds between rows, a GPS receiver to provide spatial information, and a data acquisition and processing unit to collect and process the weed data and spatial information. The

PhD600 sensor module is a commercial product used as a component in this weed mapping system. A prototype of the weed mapping system was field evaluated for 2 years. The system performed well during the field evaluation. Weed intensity in the field was also estimated based on remotely sensed imagery, and these estimates were used to create weed maps. Development of the weed mapping system and its evaluation results are reported in this article.

Keywords: Precision agriculture; Weed mapping; Optical sensor; Remote sensing; Cotton

Jun-hua BAI, Shao-kun LI, Ke-ru WANG, Xue-yan SUI, Bing CHEN, Fang-yong WANG, Estimating Aboveground Fresh Biomass of Different Cotton Canopy Types with Homogeneity Models Based on Hyper Spectrum Parameters,
Agricultural Sciences in China, Volume 6, Issue 4, April 2007, Pages 437-445, ISSN 1671-2927, DOI: 10.1016/S1671-2927(07)60067-4.
(http://www.sciencedirect.com/science/article/B82XG-4NKBGKG-8/2/a073473ccd6e4dea2c7c1df8cd357378)

Abstract:

AGB (aboveground fresh biomass) is one of the most important parameters of the crop condition monitored with remote sensing. Hyper spectrum remote sensing with the fine spectrum information becomes the efficient method estimating the vegetation AGB. The research was conducted in Xinjiang, the largest cotton planting region of China. The paper analyzed the correlation between the cotton AGB and reflective spectrum and the first derivative spectrum, and the variation coefficient of the waveband reflectance. According to the analysis above, all of 23 parameters, including the hyper spectrum reflectance, the first derivative spectrum parameters and normalization vegetation indexes, were established. And then the estimation models on cotton AGB of relaxing and compact canopy type were established and tested respectively. The tested results showed that F901, [901, 502], [901, 629], [901, 672] among the reflective spectral parameters and D525, D956, D1019, D1751 among the first derivative spectral parameters had the homogenous effect on different cotton canopy types, and the determination coefficients of the models above all arrive at the significant level of 0.99 confidence interval. At last, the tested results of the homogeneity models for different canopy types indicated the parameters of [901, 502], [901, 629], [901, 672] have more satisfying veracity than others, and the relative errors are as low as 17.0, 16.3 and 16.7% correspondingly; in contrast, the estimation veracity of the first derivative spectrum parameters of single waveband is low.

Keywords: canopy types of cotton; AGB; hyperspectrum parameters; homogeneity estimation models

Li-Bin WEI, Hai-Yang ZHANG, Yong-Zhan ZHENG, Wang-Zhen GUO, Tian-Zhen ZHANG, Developing EST-Derived Microsatellites in Sesame (Sesamum indicum L.), ***Acta Agronomica Sinica***, Volume 34, Issue 12, December 2008, Pages 2077-2084, ISSN 1875-2780, DOI: 10.1016/S1875-2780(09)60019-5.
(http://www.sciencedirect.com/science/article/B94TW-4WBT18W-2/2/832b3205fe92700596770547457cae0c)

Abstract:

To accelerate the application of molecular markers in sesame (Sesamum indicum L.), expressed sequence tag-simple sequence repeat (EST-SSR) markers were developed using publicly available sesame EST data. A total of 1785 nonredundant EST sets were assembled among the 3328 identified sesame ESTs. One hundred and forty-eight microsatellite sequences containing 155 EST-SSRs were detected from these ESTs. The total length of the nonredundant EST sequences was 774.27 kb with an average of 4.99 kb. Among these EST-SSRs, dinucleotide AG/TC was the most abundant (occurring 58 times) with a frequency of 37.42%. Based on these EST sequences containing SSRs, 50 primer pairs were designed and tested with 36 sesame accessions, 2 cotton (Gossypium barbadense L. and G. hirsutum L.) accessions, 2 soybean (Glycine max Merr.) accessions, and 2 oil sunflower accessions (Helianthus annuus L.) to detect their polymorphism and transferability. A few SSRs were able to be transferred to PCR markers, including 2 for cotton, to PCR markers, including 2 for cotton, 3for soybean, and 4 for oil sunflower. Using 44 EST-SSRs, 108 loci were successfully amplified in sesame with an average of 2.45 loci per primer pair. Twenty-seven out of the 44 primer pairs, 27 (61.4%) were polymorphic in the 36 sesame accessions. Their average polymorphism information content (PIC) was 0.390, ranging from 0.105 to 0.844. In the Unweighted Pair Group Method of Arithmetic Mean (UPGMA) dendrogram based on genetic similarity coefficient from 91 polymorphic loci, 36 accessions were classified into 4 groups. No geographic distribution was observed in these accessions. The EST-SSRs developed from sesame are valuable for genetic analysis, linkage mapping, and transferability study among oil plants.

Keywords: Sesamum indicum L.; EST; SSR; PIC; Genetic diversity

J.M. McKinion, J.N. Jenkins, J.L. Willers, A. Zumanis, Spatially variable insecticide applications for early season control of cotton insect pests,
Computers and Electronics in Agriculture, Volume 67, Issues 1-2, June-July 2009, Pages 71-79, ISSN 0168-1699, DOI: 10.1016/j.compag.2009.03.004.
(http://www.sciencedirect.com/science/article/B6T5M-4W4BMCK-2/2/423b4a5fe029635af73f098e423840d3)

Abstract:

Our research has shown that cotton insect pests, specifically tarnished plant bugs, Lygus lineolaris (Palisot de Beauvois) (Heteroptera: Miridae) can be controlled early season in commercial cotton fields in Mississippi, USA, using spatially variable insecticide applications. Technology was developed for using GIS-based map scouting and a technique called the line-intercept method for obtaining low-level insect population counts in both rapidly growing areas of cotton and poorer growing areas. Using these population characteristics in combination with heuristic knowledge of the cotton fields and with the GIS maps, a spatially sensitive map could then be developed that could drive a spatially variable insecticide application for the control of the insect pest. We outline the steps needed to develop an automated technology for overcoming the time-sensitive events for early season control of cotton pests. This technology not only includes software systems for processing multispectral images to spatially variable insecticide application maps for spray controllers in the field but also high-speed wireless local area network (WLAN) technology for automated delivery of these

controller application maps and for acquisition of as-applied and harvest maps from the field.

Keywords: Multispectral; Imaging; Spatially variable; Automation; Insecticide; WLAN; Wireless; Network

Jeffrey L. Willers, George A. Milliken, Johnie N. Jenkins, Charles G. O'Hara, Patrick D. Gerard, Daniel B. Reynolds, Debbie L. Boykin, Paul V. Good, Kenneth B. Hood, Defining the experimental unit for the design and analysis of site-specific experiments in commercial cotton fields,

Agricultural Systems, Volume 96, Issues 1-3, March 2008, Pages 237-249, ISSN 0308-521X, DOI: 10.1016/j.agsy.2007.09.003.
(http://www.sciencedirect.com/science/article/B6T3W-4R5G8G6-1/2/3aeff5e4c2a03b4b72aa792fbad88d01)

Abstract:

Designing experiments involves several processes. The first process identifies the experimental units generated by conducting the experiment. The second process is the application of planned treatments to the experimental units. Other processes are the analysis of the experiment and interpretation of results. While traditional experimental small plot designs are useful for investigating many aspects of cotton production, on a large scale, like an entire commercial field, they are difficult to implement because of routine farming operations and topographical variability. As an alternative, by using the capabilities of a variable-rate controller, it is possible to intersect the swath width of the largest farm implement's boom (or tool bar) along its geo-referenced paths of travel with one or more geo-registered field zones to create experimental units having different shapes and sizes. Defining the experimental units in this manner establishes a site-specific experiment throughout the entire field. Spatial information recovered by Geographic Information System (GIS) processing from these asymmetrical experimental units, when coupled with general linear mixed model methodology, permits the assessment of effects on geo-referenced yield points due to topography, the site-specific and/or traditional farm management practices, and various interactions among them. In this paper, a general methodological approach for analyzing field-sized site-specific experiments is developed and described. An application is demonstrated by analyzing an unreplicated cotton variety trial that included a single site-specific application of a plant growth regulator.

Keywords: General linear mixed models; Geographic information systems; Precision agriculture; Site-specific management; On-farm research; Remote sensing; LiDAR

Alison C. McCarthy, Nigel H. Hancock, Steven R. Raine, VARIwise: A general-purpose adaptive control simulation framework for spatially and temporally varied irrigation at sub-field scale,

Computers and Electronics in Agriculture, Volume 70, Issue 1, January 2010, Pages 117-128, ISSN 0168-1699, DOI: 10.1016/j.compag.2009.09.011.
(http://www.sciencedirect.com/science/article/B6T5M-4XHT46Y-3/2/494a62cff49399c40d3cb3953b7eae76)

Abstract:

Irrigation control strategies may be used to improve the site-specific irrigation of cotton via lateral move and centre pivot irrigation machines. A simulation framework `VARIwise' has been created to aid the development, evaluation and management of spatially and temporally varied site-specific irrigation control strategies. VARIwise accommodates sub-field-scale variations in all input parameters using a 1 m2 cell size, and permits application of differing control strategies within the field, as well as differing irrigation amounts down to this scale.

In this paper the motivation and objectives for the creation of VARIwise are discussed, the structure of the software is outlined and an example of the use and utility of VARIwise is presented. Three irrigation control strategies have been simulated in VARIwise using a cotton model with a range of input parameters including spatially variable soil properties, non-uniform irrigation application, three weather profiles and two crop varieties. The simulated yield and water use efficiency were affected by the combination of input parameters and the control strategy implemented.

Keywords: Variable-rate irrigation; Centre pivot; Lateral move; Management; Automation

James R. Mahan, Warren Conaty, James Neilsen, Paxton Payton, Stephen B. Cox, Field performance in agricultural settings of a wireless temperature monitoring system based on a low-cost infrared sensor,

Computers and Electronics in Agriculture, Volume 71, Issue 2, May 2010, Pages 176-181, ISSN 0168-1699, DOI: 10.1016/j.compag.2010.01.005.

(http://www.sciencedirect.com/science/article/B6T5M-4YJ6MS2-1/2/8451b903b29f3c48f4ecec4a9fe329e5)

Abstract:

Continuous measurement of plant canopy temperature is useful in both research and production agriculture settings. Industrial-quality infrared thermometers which are often used for measurement of canopy temperatures, while reliable, are not always cost effective. For this study a relatively low-cost, consumer-quality infrared thermometer was incorporated into a wireless monitoring system intended for use in plant physiological studies and in agricultural production settings. The field performance of this low-cost wireless system was compared to that of a typical research system based on an industrial-quality infrared thermometer. Performance was evaluated in terms of: reliability of data acquisition, quality of seasonal temperature measurements, seasonal stability of the consumer-quality infrared sensor, and the equivalence of temperatures measured by the consumer-quality and industrial-quality temperature sensors. Results indicate that for many common uses of plant temperature data, the two sensors provide functionally equivalent results. The cost savings and ease of use associated with the low-cost wireless temperature monitoring system present advantages over the higher-cost industrial-quality sensors which may make them a viable alternative in many agricultural settings.

Keywords: Canopy temperature; Low-cost infrared thermometer; Wireless infrared thermometer; Cotton canopy temperature

J.M. McKinion, J.L. Willers, J.N. Jenkins, Spatial analyses to evaluate multi-crop yield stability for a field,
Computers and Electronics in Agriculture, Volume 70, Issue 1, January 2010, Pages 187-198, ISSN 0168-1699, DOI: 10.1016/j.compag.2009.10.005.
(http://www.sciencedirect.com/science/article/B6T5M-4XNMBRG-2/2/c152936bc68c19935da414edeba26d38)
Abstract:
This paper proposes that yield stability patterns exist for multiple crops planted on the same land area over a period of years that growers can use to their advantage in planning crop management strategies using precision agriculture technologies. This study examines the relationship of soil elevation, slope, aspect and curvature to crop yield stability using a digital elevation model of the study area derived from a precise light detection and ranging (LIDAR) image of the farming area and surroundings. Three crop years of cotton and two crop years of corn yields were used to evaluate this hypothesis. The interpolation methods of Inverse Distance Weighted (IDW), simple Kriging and Natural Neighbor found in ESRI's ARCGIS were used to produce crop yield maps. These methods were also compared in the analysis. Simple Kriging gave the best R2 estimates of yield as a function of elevation, slope, curvature and aspect. When the SAS FastCluster procedure was used to group yield points together using topographical features, the resulting regression analyses R2 values of yield as a function of elevation, aspect, curvature and slope by cluster number were improved.
Keywords: GIS; GPS; LIDAR; Precision agriculture; Yield monitor;
Digital elevation map; Spatial analysis; Cluster analysis;
Terrain features