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*Where X = the drive letter of the CD-ROM

june1	Introduction
june2	The Development of Transgenic Cotton Containing a Bt Gene for Control of Lepidopteran Pests
june3	Delta and Pine Land Company's Efforts with Transgenic Cotton
june4	Alternatives to Insecticides
june5	Fourth Meeting of the Latin American Association for Cotton Research and Development
june6	Short Notes
june7	A DIALOG Search from the AGRICOLA Database on Trash in Cotton

Introduction

This issue of *THE ICAC RECORDER* is devoted to the Fourth Meeting of the Latin American Association for Cotton Research and Development held in Girardot, Colombia from May 25-28, 1993. The meeting was organized by the Federación Nacional de Algodoneros (FEDERALGODON) of Colombia under the auspices of the International Cotton Advisory Committee. Dr. Guillermo Alvarez Alcaraz, Director, Technical Division of FEDERALGODON, served as coordinator of the meeting. The meeting was attended by delegates from Argentina, Brazil, Costa Rica, Guatemala, Nicaragua, Peru, Uruguay and a large number of participants from Colombia. This issue of *THE ICAC RECORDER* has a report on the meeting and three papers prepared for the meeting. The speakers from the Delta and Pine Land Company and Monsanto Company were unable to go to Colombia; however, their papers were distributed at the meeting. The theme of the meeting was "Integrated Pest Management in Cotton."

The paper on "The Development of Transgenic Cotton Containing a Bt Gene for Control of Lepidopteran Pests" notes that the insecticidal activity

of the Bt gene comes from a protein which is toxic and very specific to lepidopteran insects. The development of the utilization of the Bt gene, its transformation and induction into commercial varieties is reviewed. The Bt gene has been confirmed to be non-toxic to useful insects and does not carry any undesirable environmental effects. Trials conducted by Monsanto in six states on transgenic cotton during 1992 have shown than transgenic cotton tolerated lepidopteran insects as well as non-transgenic cotton sprayed every week. Monsanto is developing strategies to delay insect resistance to Bt protein in addition to other pest management strategies.

The paper, "Delta and Pine Land Company's Efforts with Transgenic Cotton," written by Dr. Tom Wofford, International Coordinator of Research, deals with seed production and quality maintenance activities. It is reported that Delta and Pine Land Company has the required facilities to produce high quality seed for planting. In 1992, Deltapine varieties were grown on 54% of the total area in the USA. While Deltapine breeding programs accord high priority to farmers' needs and market demand for particular types of cotton, resistance to diseases and insects is inducted into future varieties through conventional breeding methods as well as the lat-

est techniques. The paper reports that Delta and Pine Land Company, in cooperation with Monsanto is actively involved with Bt cotton resistance to lepidopteran insects and to the herbicide Roundup (Glyphosate). Delta and Pine Land Company is also collaborating with DuPont Chemical Company to incorporate resistance to Sulfonylurea (SU) in cotton.

The third paper of this issue is "Alternatives to Insecticides" presented by Dr. M. Rafiq Chaudhry of the ICAC Secretariat at the meeting in Colombia. Varietal resistance and biological control are safe and economical non-chemical means of insect control which have the potential to replace insecticides completely. Other alternatives include neem-based pesticides, biosoap, vegetable oil, viruses, bacteria, fungi and sex pheromones.

A brief report on the Fourth Meeting of the Latin American Association for Cotton Research and Development is also a part of this issue of *THE ICAC RECORDER*.

In addition, a DIALOG search of the AGRICOLA database on trash in cotton is included at the end of this issue.

The Development of Transgenic Cotton Containing a Bt Gene for Control of Lepidopteran Pests

Dr. R.E. Buehler, Monsanto Company, St. Louis, Missouri, USA

Monsanto Co., based in St. Louis, Missouri, US, is currently developing new cotton lines which resist damage from lepidopteran pests. The source of resistance is a protein produced by *Bacillus thuringiensis*. The protein is generally referred to as Bt.

The Bt protein was discovered approximately 80 years ago. The insecticidal activity was related to a protein in the 1950s. The protein is a stomach toxin which is specific for certain insects. This specificity accounts for a considerable portion of the value since the protein is toxic to certain insect pests, but will not harm beneficial insects. Its half life is only 2 to 3 days, so it will not persist in the environment. Also, it is safe for both humans and animals.

The first commercial insecticidal products were produced in the early 1960s and have been used to a limited extent for the last 30 years. Recently, considerable research effort has focused on Bt. This renewed interest is due to three major reasons, First, improved bacterial strains have been discovered which are more efficient at producing the Bt protein. Second, improved pesticidal formulations have increased the efficacy and persistence of the product. Finally, recent developments in biotechnology have provided an improved delivery system for the Bt. With genetic engineering, the gene which produces the Bt protein can be added to plants. Once a plant has this gene incorporated into its DNA, the plant will then produce the protein itself.

Having the Bt protein produced within the plant provides several advantages over topical applications of formulations of Bt insecticides. Since the Bt protein is produced in the plant throughout the growing season, full season lepidopteran pest control is achieved. Also, since the plants produce the protein, this will provide cost effective lepidopteran control. In addition to those benefits, Bt produced within the plants still maintains the specificity of control (no harm to beneficials) and the safety of topical applications.

The first stage in development of Bt cotton lines is to isolate and develop the gene so that it will function properly in cotton. Then, the gene is introduced into cotton using tissue cultures of cotton with transformation mediated by a common soil bacteria, *Agrobacterium tumefaciens*. Several hundred cotton lines are then screened to identify those lines which are suitable from an insect control and an agronomic standpoint. The most efficacious lines are then backcrossed into commercially useful varieties. Additional testing confirms the safety of the product and the optimum systems for utilization of the technology.

The data presented is from one set of trials conducted in the United States in 1992. The objectives of these trials were to identify the Bt lines with the best insect control and to obtain an initial assessment of commercial potential of the best lines. Other studies, which will not be discussed, involved optimizing resistance management strategies, determining economic thresholds, and analyzing the effect on other, non-lepidopteran, insect pests.

Tests were conducted in 6 locations in the southern United States and covered the entire US cotton belt. These tests were conducted in the following

states: Georgia, Alabama, Mississippi, Louisiana, Texas and Arizona. All tests, with the exception of the Alabama site, were done with academic co-operators.

Results from all sites demonstrate that certain Bt cotton lines provided season-long protection of squares and bolls. The primary pests were *Heliothis zea* and *Heliothis virescens*. The Arizona site was infested with *Pectinophora gossypiella*. The protection from lepidopteran damage afforded by the Bt lines, which were not treated with chemical insecticides for lepidopteran control, was at least as effective as, and generally more effective than, the protection provided by weekly applications of insecticides. Control of these pests was consistent throughout the growing season. The square and boll protection provided by the Bt protein also translated into yield protection; the Bt lines yielded the same whether or not they were sprayed with chemical insecticides or left untreated.

The 1992 results confirmed the results of earlier trials. Transgenic cotton lines have been identified which provide protection for *Heliothis* species and *P. gossypiella*. All flower and fruiting structures of the Bt lines were

protected throughout the growing season at all test sites and this also resulted in yield protection.

In addition to these trials, Monsanto is actively developing strategies to delay the development of resistance by these insect pests to the Bt protein. The strategies include, but are not limited to:

- Refugia, whereby sources of non-Bt cotton are grown with or near the Bt cotton to supply an alternate food source for the insects.
- The development of other Bt genes with different sites of action.
- The development of non-Bt proteins with insecticidal activity. The various strategies are being investigated prior to commercialization and will be implemented in stages after commercialization.

Delta and Pine Land Company's Efforts with Transgenic Cotton

Dr. Tom Wofford, Delta and Pine Land Company, Scott, Mississippi, USA

Delta and Pine Land Company was founded in 1911 in the heart of the Mississippi Delta. Its purpose was to provide the British mills with an additional source of cotton fiber. At one time, Delta and Pine Land Company owned and operated the largest cotton plantation in the world. The company occupied about 15,000 hectares of land.

In 1915, the company hired its first cotton plant breeder. Historically, this was one of the first modern, scientific efforts at cotton plant breeding.

Today the company is privately owned by American investors. Delta and Pine Land Company is solely a seed company. Deltapine varieties are grown on about 54% of the cotton acreage in the US. Deltapine 50 is the number one variety in the US. It is grown on more acreage than the total acreage planted to Deltapine's nearest competitor.

In recent years, Deltapine has placed a big emphasis on international markets. Deltapine varieties are being sold, grown and evaluated in more than 24 countries.

Quality control is seen as a key ingredient in the success of Deltapine seeds. The company has an extensive program to insure that only top quality seed is placed in a Deltapine bag.

The program begins when a Deltapine cotton breeder releases a variety to the Foundation Seed Department for increase. The variety is increased on a small acreage and rogued to insure physical and varietal purity. A portion of this original breeder seed increase is placed in cold storage. This seed will be used for future seed increases. This process helps to insure the variety is maintained true to the characteristics for which it was selected.

Cotton seed stocks are often produced under the auspices of various state seed improvement associations in the US. Seed certification regulations are strictly adhered to. These regulations often require one variety farms and gins. This insures the highest possible level of varietal and physical purity.

Deltapine originator seed is generally produced from foundation level seed stocks. Specific lots are assigned to Deltapine seed growers and fields are inspected throughout the growing season. All planting, harvesting, and ginning equipment is inspected and approved before use.

Once the seed is ginned, Deltapine's extensive laboratory testing begins. Seeds are tested for physical purity, temperature, moisture content, free fatty acid content, mechanical damage, standard germination and the Texas Cool Test. Fuzzy seed that meets Deltapine's quality standards are accepted and placed in bulk storage warehouses. Bulk seed in the warehouses are sampled and again tested through the rigorous Quality Assurance Laboratory before being released for delinting.

Delta and Pine Land Company currently owns four acid delinting plants. Deltapine has the capacity to condition more cotton seed for planting than any other company in the world. The delinting and conditioning process is also monitored by quality control personnel. Each finished lot of cottonseed is again subjected to a battery of tests to insure the final product meets or exceeds the Deltapine standards and our customers' expectations.

Deltapine has six cotton breeding programs. Five of these are in the US and one is in Australia. Deltapine plant breeders are involved throughout the world in cotton testing and evaluation. The six main research stations allow plant breeding work to be done in unique, distinct climates. At these various stations Deltapine is breeding for a wide range of environments. Some locations have rain grown cotton and others are one hundred percent irrigated. Deltapine is breeding cottons for different soil types. Deltapine is breeding in relatively low yielding environments and in environments with the highest yields in the world. Deltapine plant breeders are also breeding for resistance to a host of insect and disease pests.

Yield is the main selection criterion. Farmers around the world are paid for the amount of lint or seed cotton they produce. In addition to yield, tremendous importance is placed on breeding for improved fiber characteristics.

Delta and Pine Land Company has its own HVI laboratory. The Deltapine plant breeders send samples of fibers to this lab for analysis. The samples are analyzed and the data sent back to the researcher. This information is used as a selection criterion in the development of new cotton varieties.

The Deltapine HVI lab evaluates between fifty and sixty thousand samples per year.

Deltapine has very close contact with cotton spinning mills and textile people. Many mills in the US contract directly with growers and specify Deltapine varieties. Deltapine is trying to stay current with new spinning technology. The goal is to develop new varieties that will be in demand by the mills.

Several agronomic characteristics are of importance in Deltapine's conventional breeding program. Most of the Deltapine cotton varieties are smooth leaf. This is important in mechanically picked cotton. The smooth leaf characteristic results in higher grades of lint because the leaf trash from smooth leaf varieties does not adhere as much to the lint as much as it does on hairy leafed varieties.

Early maturity is a major consideration in many places where cotton is produced. In many areas, early maturity is necessary to escape plant pests, to reduce the number of irrigations and/or to avoid inclement weather at harvest.

Deltapine's conventional programs are breeding for resistance to several diseases. Deltapine is actively selecting new experimental lines that are resistant to Verticillium wilt. This selection work is going on in several parts of the world. All the Deltapine varieties have some level of tolerance to Verticillium wilt. Deltapine Acala 90 has excellent tolerance. Additionally, Deltapine is breeding varieties that are tolerant to Fusarium wilt and root knot nematodes. Deltapine's plant breeders in Australia are incorporating resistance to bacterial blight (*Xanthomonas campestris*) into current and future Deltapine varieties.

Artificial cross pollination is used to create genetic diversity. A large pool of genetic material is maintained and available to the Deltapine plant breeders.

Delta and Pine Land Company is very involved in biotechnology. Biotechnology can be defined as the introduction of a foreign gene (from a non-related organism) into the genetic material of a crop plant using sophisticated laboratory techniques. Deltapine is collaborating with several major companies that specialize in biotechnology.

Delta and Pine Land Company is working in cooperation with Monsanto on cottons containing the "Bt" gene. Bt is an abbreviation for the delta-endotoxin proteins derived from the common soil microbe *Bacillus thuringiensis* var. *kurstaki*. The genes from this microbe were isolated, modified and inserted into cotton plants by Monsanto.

Plants containing this gene produce small quantities of the endotoxin protein that is highly effective in controlling some lepidopteran caterpillar insects. These proteins initially inhibit insect feeding and subsequently lead to the death of the insect pest.

There are many potential benefits of Bt cotton. Many researchers feel that Bt is the world's safest insecticide. The Bt protein makes up less than 1% of the total plant protein. It is biodegradable and breaks down in exactly the same fashion as any other protein in the environment. Bt is very specific in its toxicity to lepidopteran insects. Bt is non-toxic to humans, animals, fish, avian species, and other insects.

The insect pests targeted for control by the Bt gene are very serious pests of cotton. Included in this group are *Heliothis*, *Heliocoverpa*, and *Pectino-*

phora gossypiella. Commercial cotton production requires extensive use of chemical insecticides to control these pests. It is hoped that Bt cotton will substantially reduce the amount of topically applied chemical insecticides needed in commercial cotton production.

Deltapine has been working with Bt cottons for several years. We are currently backcrossing the gene into varieties that are on the market today. In addition, we are incorporating the gene into potential new varieties. Deltapine has an extensive program working with Bt in cotton. Transgenic material is being grown in the greenhouse, a winter nursery is being utilized to advance the material, and field evaluations are being conducted.

Another area of work with transgenic cotton involves plants resistant to Roundup (Glyphosate). Glyphosate is a broad spectrum, non-selective, post emergence herbicide. It is very effective in controlling many annual and biennial weeds. It is effective against grasses and broadleaf weeds. Glyphosate has the added benefit of being very "environmentally friendly." It has no soil residual and minimal leaching.

The insertion of this gene into Deltapine cottons will allow farmers to spray Roundup over the top of the cotton with no deleterious effect on the cotton crop. Monsanto's goal is to have at least a "3X" safety margin. In other words, three times the highest recommended application rate can be sprayed on the cotton with no reduction in yield.

Roundup resistant cottons are being evaluated in the field this year. Incorporation of the gene for tolerance is proceeding as quickly as possible.

Delta and Pine Land Company is collaborating with DuPont Chemical Company on the incorporation of sulfonylurea (SU) resistance in cotton. There are several SU herbicides on the market in the US and around the world. These are primarily labelled for use on small grains and oil seed crops. Sulfonylureas are a family of chemicals that require very low dosages and are environmentally friendly. Herbicides with this chemistry have some residual activity and can be applied preplant incorporated, preemergence or postemergence.

The gene for SU tolerance has been incorporated into the current commercial Deltapine varieties. This genetic material is being grown in field tests

this year in the US. New cotton varieties could be ready for release within two years.

Many other areas are being investigated through biotechnology. There are possible ways, through biotechnology, to modify fiber characteristics in ways that can not be done through conventional plant breeding. It is possible that the nutritional value of the seed will be improved through biotechnology. Additionally, there are some potential new ways to create hybrid seed through biotechnology. Salt and drought tolerance are two other avenues through which biotechnology may improve cotton production. These and many other areas are being investigated by various companies involved in biotechnology. Deltapine is trying to stay at the forefront of these new technologies.

Alternatives to Insecticides

Presented by Dr. M. Rafiq Chaudhry, Head, Technical Information Section, International Cotton Advisory Committee

It was not long ago when insecticide use was advocated to the extent that it was heavily subsidized by governments. While insecticides are still on the list of many cotton producing countries as an important subsidized agricultural input, others are trying to eliminate them. There is no doubt that insecticides are the most efficient and effective means of controlling insects. Insects must be controlled and insecticides will continue to be used unless feasible alternatives to insecticides are found and adopted. No emphasis is needed on the fact that insecticides are harmful to beneficial insects, pollute the environment, create resistance problems and also are very expensive, out of reach for small farmers in many cotton producing countries.

Those who started using insecticides earlier than others are now leading the way to end the use of these toxic compounds. The objective is to protect the crop not with insecticides, but with chemicals and materials which

are safer to use and have equally high efficacy. Such promising alternatives will be discussed in this paper.

In the US, studies by the National Academy of Sciences, the Natural Resources Defense Council and others concluded that farmers could substitute up to 50% of their pesticides with off-the-shelf, non-toxic alternatives without affecting their crop yield. Pesticide reduction plans in the Netherlands, Denmark and Sweden call for a 50% reduction in insecticide use by the year 2000. The current trend of gradually increasing regulations for registering new insecticides and, in certain cases, re-registering insecticides is causing a decline in the market for these products. Safer ways and means of control need to be explored and economically utilized against insect pests and diseases.

Varietal resistance and biological control of insects have long been recognized as means to decrease the use of insecticides. They have been used extensively, but were unable to eliminate insecticide use completely. Similarly, other components of integrated pest management, some of which are easy to apply, have only contributed in decreasing the use of pesti-

cides. I will concentrate on those means of insect control which have the potential to take the place of insecticides.

Plant Materials

Neem-based Pesticides

Neem has long been known to have insecticidal effect. The neem leaves have been used in different forms to prevent infections. Although based on hypothetical considerations, neem has shown results and its use has continued. It has also been used as an insecticide on cotton in the absence of resources to buy expensive insecticides or due to psychological opposition to insecticides. Now the use of neem for making insecticides has been commercialized. W.R. Grace & Co. of Florida, USA, and P.J. Margo Private Limited based in Karnataka, India, have announced the founding of the world's first commercial-scale facility specially designed for neem-based, natural pesticide production. Initial capacity of the plant is 20 tons per day. The extracts of the Indian neem tree include the pesticide Azadirachtin which is capable of attacking over 200 types of insect pests, as well as some species of mites and nematodes. Presently, the neem-based

products marketed as Margosan-O and BioNeem have extensive use in horticulture, but carry a great potential to be used commercially on cotton. The neem-based extracts are harmless to birds, mammals and beneficial insects.

Biosoap

Whitefly is a worldwide pest of cotton with the potential ability to develop resistance to insecticides. The importance of this pest has increased world-wide in the last decade, particularly in the US. In the US, a sudden shift in the population from "A" to "B" biotype enhanced the host range, providing more opportunities to multiply at a higher rate. Looking at the large scale losses in vegetables, fruits and cotton crops during 1991 in Arizona, California, Florida and Texas, the US Government has prepared a Five Year Research and Action Plan for management and control methodology of whitefly. The Nursery Crops Laboratory in Maryland, USA, has developed a product called Biosoap which has great potential as an insecticide against whitefly. Biosoap is made form the extracts of tobacco plants and is environmentally safe. It successfully killed sweetpotato whitefly in the green house and small scale field trials. Biosoap kills an immature whitefly

by weakening the waxy protective coating on its body covering, causing it to dry out and ultimately die. While Biosoap killed all the whiteflies in the green house, it killed 94% of the whiteflies in one trial and 78% in another trial under field conditions compared to un-sprayed control plots. The additional advantages of Biosoap include safety to beneficial insects and delayed resistance to insecticides.

Vegetable Oils

Vegetable oils are used as alternatives to neuro-toxic insecticides. There are tremendous advantages to the use of this type of control agent: There are few human hazards; it is simple to use and generally inexpensive; and insects and mites do not develop resistance to oils. Oils primarily act by physical action, but also as behavior modifiers in the control of insects. Efficacy of an oil for combined activities of behavior modification and lethal effect has to be ascertained before it is used as an insecticide. Variation in the physio-chemical properties of the base oil, or the mode by which the oil is formulated, determines a marked difference in its performance. Moreover, chemical characteristics of the base-oil, such as unsaturation and fatty acid composition, can be related to the bioactivity and chemical stabil-

ity of the crop oil. Optimization of the formulation application is a prerequisite for consistency of field performance. The International Cotton Advisory Committee has recently approved a project for consideration by the Common Fund which will work along the above lines to develop novel insecticides for the control of whitefly. The principle products considered will be vegetable oils; however, detergents will also be tried.

Microbial Insecticides

Bacteria, fungi, nematodes, protozoa and viruses can be used as insecticides to control selected target insect pests. Viruses, bacteria and nematodes have been used extensively in a number of countries. Registered bioinsecticides for commercial use are available, though not popular for cotton.

Viruses

The insecticidal effect of viruses is well known, but it has not been fully utilized. Among the naturally occurring insect pathogenic viruses, baculoviruses have shown the greatest potential from the point of view of safety

and effectiveness. The pathogenic viruses have been found to attack more than 12 major insect pests of cotton. The only mode of infection is host ingestion, followed by incorporation in mid-gut cells and later by other susceptible cells causing lysis, liberation of viral products and eventually organ disruption, leading to death of the insects. The virus impregnated larvae/insects continue feeding and moving until they die. A baculovirus Elcar was developed in the early 1980s and showed effective control against *Heliothis* on cotton in many countries, which favored its registration as a commercial product. Unfortunately, the release of Elcar coincided with the introduction of pyrethroid insecticides, which were certainly much more efficient and effective compared with Elcar. As a result, Elcar could not gain a market share and had to be withdrawn. Problems with the baculoviruses include the condition of ingestion by the target host, a slow rate of effect, rapid inactivation by ultraviolet light, long term storage disadvantages and sometimes higher cost of production. These problems have to be overcome if these entomopathogens are to be used as insecticides on a commercial scale.

The interest in controlling insects with entomopathogens has grown in the last few years. Among viruses, nuclear polyhedrosis viruses (NPV) and

granulosis viruses have the unique characteristic of producing a large pseudo-crystalline protein matrix known as the inclusion body. The mature viruses are embedded in the inclusion body which provides shelter in the field until the viruses are ingested by the host. The baculoviruses have been tried in as many as 19 countries, mainly against lepidoptera. They have been found to be more effective against *H. zea* and *H. virescens* in the US. In Australia, *H. armigera* has been controlled successfully. In China, NPV has been extensively used to control cotton bollworm, *H. armigera*. But the most successful use of baculovirus against cotton pests has been in Colombia where the application of NPV was so effective in controlling *Trichoplusia ni* larvae that it replaced all other pest control measures.

NPVs have been successfully used against *Spodoptera* spp. in Egypt. Attempts to use viruses against pink bollworm, *Pectinophora gossypiella*, have not been very successful. Probably more research is required to identify suitable viruses or other types of biopesticides for the control of this insect.

The concept of multi-pest killing viruses is also becoming popular. Recently it has been confirmed that the celery looper virus could be purified, packed and sold as a new, environmentally safe insecticide against a variety of insects on cotton, alfalfa, tomato and other vegetable, Sandoz, with the collaboration of the USDA, has upcoming experiments for controlling insects in cotton, in addition to broccoli, cabbage, tomatoes, alfalfa and soybeans. Improving the marketability of viral insecticides is a big challenge for researchers and a crucial point for the companies involved in this business. Extensive work is also going on at the USDA laboratories and American Cyanamid Company to develop compounds which could bolster the deadly effects of insect viruses. Preliminary results show that the addition of certain chemicals can enhance the effectiveness of the viruses by 100 to 1000 times.

Bacteria

The only bacteria used for insect pest control belong to the group *Bacilli*. Within this group, the main species used is *Bacillus thuringiensis*. This group contains a protein crystal in the bacterial spores which provides the insecticidal properties for this microbe. Upon ingestion, the protein crystals

are released in the midgut cells of the insect causing paralysis and ultimately death. Unlike the viruses, the effect is immediate and soon after ingestion of the bacterial spores, the insect stops feeding, hence the damage to the plant is stopped soon after treatment.

Most bacteria are lethal to lepidoptera insects, but recently species of bacteria which attack other varieties of insects have bee identified. *B. thuringiensis* has been reported to kill 21 species of insects and is used in 19 countries. Low efficacy against some important groups of insects like *Spodoptera* limits its extensive use. Although the overall use of this microbe constitutes 80-90% of the microbial insecticides, new species lethal to a wide range of insect species could be identified, produced and used on cotton. Large scale use of *B. thuringiensis* has been reported in the Central Asian Republics of the Commonwealth of Independent States. It is also registered in the US for control of *Heliothis* spp. on cotton.

Fungus

In the US during 1991, whitefly caused huge yield losses in vegetables and fruits, in addition to deterioration in cotton quality. The pest appeared late at almost boll opening stage of cotton, yet the losses to agricultural

crops were estimated at over 200 million US dollars in the affected states. As it was feared that the whitefly might cause damage in 1992, the whitefly wasp, *Eretmocerus mundus* was released in abundance in September 1992 to control the pest. The whitefly population remained under control, and there have been no reports of any significant damage. Recently, it has been observed that a fungus epidemic may also provide a solution to the whitefly problem. Scientists at the USDA in Weslaco, Texas, noticed a natural outbreak of a fuzzy white fungus in broccoli fields. Entomologists claim that the fungus could be a promising new way to control whiteflies. The fungus, *Paecilomyces farinosus*, was noticed causing damage to whitefly in 1991, but this time it occurred in epidemic form at the right time in farmers' fields in Texas.

The fungus, upon contact with the whitefly, penetrates its body and starts producing spores inside the pest. Thus, the infection is spread throughout the body, resulting ultimately in death of the insect in four to five days. The fungus has the capability to enter and kill adults as well as nymphs of whiteflies. It is known to attack whitefly in cabbage, cantaloupe and cotton fields. It is said to be safe to humans and wildlife, but its effects on other insects are not yet known. USDA researchers are planning to undertake

joint studies with the private company Mycotech Corporation to test the fungus' potential as a natural, non-chemical method of whitefly control.

Sex Pheromones

Sex pheromones are chemicals which are used to influence the behavior of organisms. They produce a scent similar to that produced by females to attract males for the purpose of mating. The scent is produced in such a large quantity in the field that the males are confused and unable to locate females for mating. Thus, mating is disturbed resulting in reduced multiplication of the population. The pheromones have been successfully used in cotton on a number of insect pests in many cotton producing countries. They are very species specific and safe for beneficial insects. Pheromones have the following three main uses:

- Monitoring the insect population with pheromone baited traps
- Controlling insect population by using traps on a large scale
- Confusing the males and disturbing the mating process to check multiplication of the insect

Pheromones are available in several formulations. Hollow fibers and laminate flakes have to be applied with glue in special applicators to ensure adherence to the cotton leaves. Microcapsules are water-based suspensions and can be sprayed with conventional applicators. Pheromones in the form of twist-tie and PVC dispensers are labor intensive as they must be individually tied to the plant stem by hand. The important advantage of pheromones is their long lasting effect; they are applied only once each season.

Pheromones have generally been successful against pink bollworm, perhaps because of much greater persistence of twist-tie PVC resin formulations. Pheromones have been used in the US since 1978 in Arizona and southern California. Results have shown that pheromones can reduce insecticide use by almost 40%. The limiting factor in their use is hand application, which offsets part of the lower cost of insecticides.

Pheromones have also been tried in China, Egypt, India, Israel and Pakistan. Pheromone treated fields gave comparable yields and preserved beneficial insects. The use of pheromones has remained restricted due to high cost of the product, labor intensive method of application, persistence for a shorter time and prevalence of more than one species of insects at

the same time. The problem of higher persistency has been overcome, but still only those countries in which labor cost is low can afford hand application. Use on a larger area and on pests with limited migratory habits best shows the impact of pheromones. It is generally concluded that pheromones can be successfully integrated with broad spectrum insecticides to have season-long control of insects. However, if pheromones are used on large areas continuously for years, they have the potential to eliminate the need for insecticides. The impact of the pheromones is evident, but that is required is an increase in the spectrum, so that one product can be used against a variety of insects, and improved application methodology, so that they could be sprayed like conventional insecticides and only once for the crop period. Other uses of pheromones, particularly trap monitoring, could be expanded to improve the correlation of trap catches with field infestation.

Fourth Meeting of the Latin American Association for Cotton Research and Development

Girardot, Colombia, May 25-28, 1993

The Fourth Meeting of the Latin American Association for Cotton Research and Development (Asociación Latinoamericana de Investigación y Desarrollo del Algodón-ALIDA) was held in Girardot, Colombia, May 25-28, 1993, on the theme of integrated pest management in cotton. Earlier meetings had been held in Argentina (1986), Peru (1988) and Brazil (1991). The meeting was hosted by the Federación Nacional de Algondoneros (FEDERALGODON) of Colombia. As coordinator of the meeting, Dr. Guillermo Alvarez Alcaraz, Director, Division Tecnica, FEDERALGODON, made the local arrangements. The meeting was attended by delegates from Argentina, Brazil, Costa Rica, Guatemala, Nicaragua, Peru and Uruguay, in addition to a large number of local participants and two representatives from Stoneville Pedigree Seed Company, USA. ICAC was rep-

resented by Dr. M. Rafiq Chaudhry, Head, Technical Information Section. A list of participants is attached.

The meeting was formally inaugurated by Mr. Antonia Abello Roca, Director General, FEDERALGODON; Mr. Moises Brochero, representative of the Government of Colombia; Mr. Adolfo Monzaleano Gardoz, representative of the mayor of Girardot; Dr. Raimundo Braga, President of ALIDA; Dr. Chaudhry, ICAC; and Dr. Alvarez.

Dr. Alberto Murillo from the Group for Integrated Insecticide Management (GIMP) presented a paper on the activities of his group. He mentioned that, on average, 85% of sprays are used against boll weevil. One of the outcomes of heavy spraying against boll weevil, which was ignored while selecting insecticides to control boll weevil, is resistance in *Heliothis*. He commented that GIMP has been working since 1988 to determine and grade resistance to various pyrethroids and carbamates. The group, which is comprised o researchers from Instituto Colombiano Agropecuario, pesticide companies and farmer cooperatives, is working to establish strategies for the reduction of the cost of insect control, the preservation of beneficial insects and the rational use of insecticides. Concrete recommendations on

selective insecticides and critical periods for spraying are still to come from GIMP. The group currently works only on cotton but might expand to other crops and commercial flowers in the next few years.

Dr. Fernando Agudelo Silva, FAS Technologies, USA, in his presentation traced the history of the boll weevil in the USA and referred to the ecological approach to IPM adopted in the USA. He strongly supported the use of bait sticks for the control of boll weevil,. He said that the key elements in the use of bait sticks are concentration, formulation and speed of liberation of pheromone. He proposed that area-wide management programs should be launched in cooperation with extension people to have an effective control of the insect. He also suggested identifying local predators and planning control measures based on the ecological situation.

Dr. Ingeborg Zenner de Polania from the Instituto Colombiano Agropecuario made a presentation on the management of aphids, *Heliothis virescens* and *Spodoptera frugiperda* in Colombia. She reported that resistance to organophosphate insecticides has been noted in aphids in Colombia. Efforts are being made to manage this resistance through the augmentation and conservation of naturally occurring parasites and preda-

tors during the first 60 days after planting. *H. virescens*, which has confirmed resistance to pyrethroids, is managed by the weekly release of *Trichogramma* species. *S. frugiperda*, which has confirmed resistance to methomyl, clorpyrophos and cypermethrin in several cotton growing areas of Colombia, can be managed through diflurbenzuron of *Bacillus thuringiensis*. She mentioned that special emphasis is given to preservation of useful insects for the first 60 days, destruction of stalks after final picking, a longer host-free period, specific weed management and selective insecticides.

Mr. Guy Pauly from CIRAD-CA (formerly IRCT), presently working in Costa Rica, gave a presentation on "Experimentation with IPM Techniques on Cotton in Central America: Primary Results Obtained at the Level of Small Farmers in Honduras." The trials were conducted in 1991/92 to control boll weevil and whitefly in cooperation with the Cooperativa Algodonera del Sur Ltda. Cutting and incorporation of plant residues, isolation of cotton plots, sowing dates, varieties with special plant characters (okra leaf, nectariless, frego bract) and pheromone traps for the control of boll weevil were tried. Mr. Pauly reported that with the use of these techniques, insecticide spraying was delayed by 30 days (started 55 days after plant-

ing) and the number of applications was reduced from 15 to only 8. Okra leaf (TX-ORSBO) and frego bract (IG 1600) varieties showed very low infestation of boll weevil and whitefly in comparison with DPL-41. Compared with DPL-20, DPL-41 and Stoneville 213, U 80 from Nicaragua and P 288 from Paraguay demonstrated high tolerance to viruses transmitted by whitefly.

Ms. Maria Graciela Arias de Lavalle (Argentina) and Mr. Horacio Villavicencio (Guatemala) reported on IPM strategies in their countries. Mr. Villavicencio stated that area in Guatemala is decreasing due to the high cost of production. He also listed varieties grown, important recommended insecticides and their doses of application.

Dr. Francisco Rendon of FEDERALGODON, Colombia, presented a paper on boll weevil control in Colombia. He talked about the spread of boll weevil, its alternate host plants, its physical characters and their relationship to spreading the pest. A thorough report on IPM in Colombia was also presented by Dr. Alvarez.

Dr. George Rea Walker, Director, International Marketing, Stoneville Pedigree Seed Company, USA, attended the meeting along with an agronomist from the company. Dr. Walker, talking about his experience with cotton in many countries of the world, emphasized the role of efficient crop management in achieving higher productivity. He observed that only a good manager can be a successful farmer. Regarding Bt cotton, he noted that Stoneville Pedigree Seed Company is working on genetically-engineered cotton resistant to bromoxynil herbicide. He hoped that varieties with herbicide resistance will be released by Stoneville in 1994 or 1995. These varieties will be very useful for countries like Argentina and Greece where broad leaf weeds are a major problem. He said that Bt cotton resistant to *Heliothis* will be available to farmers in 4 to 5 years. He was of the view that, since the resistant gene will always be present, there are more chances for *Heliothis* to develop resistance to transgenic cotton. He further said that the benefits of transgenic cotton with Bt gene resistant to *Heliothis* cannot be utilized where the crop is attacked by other bollworms along with *Heliothis*. He recommended that new varieties be adopted only after at least 2 to 3 years of testing in their own countries.

Ing. Luis Gimenez from Uruguay gave an overview of cotton production and insect control in his country.

Mr. Jose Infantozzi, El Salvador, reported on strategies for the control of whitefly in El Salvador. He said that insect control consumes a major part of production inputs. Nitrogen doses, varietal resistance and sowing date are crucial for the control of whitefly in El Salvador. Completion of sowing by June 25 is recommended in order to get high yield and avoid heavy insect attack. He reported that, though area under cotton decreased in 1992/93, average yield and total production has increased. He noted that 90% of the 1992/93 produce was not contaminated from whitefly.

Ing. Bayardo Ruiz and Mr. Julio Bustillo Caceres from Nicaragua talked about IPM in Nicaragua. They reported that as a result of better management of insect control strategies in their country, it was possible to curtail the cost of insect control by almost 30% over 1989/90. In 1989/90, the average number of sprays was 26 which cost roughly US$600/ha. In 1992/93, the average number of sprays decreased to 14, thus reducing insect control costs to US$389/ha. Of the US$600, roughly US$395 had been spent on controlling boll weevil, which has now decreased to

US$107/ha. Accordingly, in three years, the total cost of production has decreased from US$1,200 to US$700/ha. This reduction has been possible only through an integrated approach to pest management. They said that area under cotton is decreasing in many countries of the region mainly due to the high cost of insect control. This decline can only be checked by the adoption of less expensive pest control measures. Use of bait sticks on an experimental basis was also recommended.

Mr. Juan Gonzalez Bachini from Peru presented a report on IPM in Peru. In Peru, he said, there is no scarcity of inputs, including water, but farmers do not have money to buy inputs. Hence, cotton is suffering and unfortunately, there is no government program to encourage cotton cultivation. He reported that the average cost of production in Peru is US$1,429/ha of which 20% is spent on insect control, the largest component of the cost of production. Average farm size in Peru is 4 ha; thus, farmers are encouraged to form cooperatives. Mr. Bachini said that the cotton production conditions are different in Peru from other countries. There is no boll weevil or *Heliothis*. The Peruvian boll weevil, *Anthonomus vestitus* Boheman, does appear in cotton, but the population remains below the threshold level. Important components of IPM are seed treatment with Aldrin to control suck-

ing insects, use of Arsentiano for the control of *Alabama* spp., collection of infested squares carrying insect larvae, low doses of pyrethroids on perennial cotton, use of pheromones like gossypliar and short season cotton. As some cases of aphid resistance have been reported in the past few years, there is an urgent need for a new strategy other than chemicals to control *Aphis gossypii*.

Dr. Raimundo Braga Sobrinho from Brazil spoke about management of boll weevil in Brazil. He was of the view that sufficient scientific information is available to control boll weevil effectively and efficiently. What is needed is the implementation of research findings in cooperation with extension workers. Talking about the production regions in Brazil and their characteristics, he highlighted the importance of agronomic practices which, according to him, are the most important tool for boll weevil control. He said that picking and destroying of shed buds which carry eggs and early stage larvae of boll weevil are very important to minimize the population of boll weevils.

Field Visit

May 28, 1993, was devoted to a field visit. The participants were taken to cotton fields around Espinal, Tolima, in Magdalena Valley of Colombia. At one farmer's field, where 475 hectares of cotton, mainly under DPL 61, were grown, the participants were informed that the average number of sprays per season is 10-12, of which usually 6 or more are against boll weevil. *Spodoptera* is also a problem of this area. Colombian pink bollworm, *Sacadodes pyralis*, though it appears at the end of the season, is a major pest and sometimes causes huge losses. Aphids are not a regular pest of this area. Whitefly was also observed in the field but probably below the threshold level for treatment. The crop, grown at row-to-row distance of 95 centimeters with a seeding rate of 12 kgs/ha and 75 kg nitrogen/ha, looked very healthy. It was a peak-boll formation stage.

The participants were also taken to two demonstration plots maintained by GIMP. The major pest at both the sites was *Alabama argillacea*. The variety grown was DPL 61, and all the agronomic treatments except plant protection operations were applied by the grower on the demonstration plots. GIMP was testing its integrated insecticide management techniques. Con-

trol of *A. argillacea* was attempted through the release of *Trichogramma* at the rate of 40 inches/week during the period 30 days to 100 days after planting. This technique helped to delay the initiation of spraying in the treated plots. The treated plots had 1-2 fewer sprays compared with farmers' check plots. GIMP used only selective insecticides. Various types of other beneficial insects (chrysopa, aranas, cicloneda and scymnus) were also recorded.

The field trip also included a visit to a demonstration plot of new varieties grown by Deltacol. Deltacol is a sister company of Delta and Pine Land Company which performs varietal trials to establish the best performing variety before it is promoted among growers. At one of the demonstration plots the participants were shown, Deltacol had grown four varieties: DPL 51, DPL 5415, DPL 5590 and DPL 5614. The crop was very clean and healthy, and it seemed as if DPL 5415 will out-yield the other varieties.

Administrative Issues

An exclusive meeting of the delegates to the conference was held on May 27, 1993, to elect a new president of ALIDA, decide the site of the Fifth

Meeting of ALIDA, decide the theme of the next meeting and resolve funding problems. The outgoing president of ALIDA, Dr. Braga, briefed delegates about the activities of ALIDA in the last two years. He said that the association's activities were affected by constraints of funds. In the absence of funds at his disposal for the association work, he had difficulties approaching the member countries by telephone or fax. Secondly, the responses from the member countries were also not encouraging. He was of the view that if these difficulties are overcome, member countries could be served better by the association.

Dr. Braga proposed generating a continuous source of funding for ALIDA's secretariat by levying some kind of contribution for each member country. The possibility was discussed at length but was not agreed. The delegates were of the view that ICAC should provide funds on a permanent basis to meet the miscellaneous expenditures of ALIDA. Dr. Chaudhry agreed with the delegates that there is a need for such funds but informed the delegates that ICAC does not have any provision in its budget to provide funds on a permanent basis. He noted the example of the Mediterranean region where it was decided that only those persons who are able to meet the necessary costs of the network from their own resources should accept re-

sponsibilities. However, he said that ICAC can help with the process of keeping communications open among members of ALIDA. He also proposed that, on behalf of the ALIDA, ICAC approach the FAO and seek their support for future activities.

Dr. Guillermo Alvarez Alcaraz was elected as the next president of ALIDA for a period of two years.

The possibility of holding the next meeting in El Salvador or Nicaragua was considered, but nothing could be decided as both countries wanted to consult the concerned authorities in their countries before making a commitment. It was agreed that they will inform the president of ALIDA or their decisions by September 1993.

There was discussion on the theme of the next meeting. All delegates admitted that a subject of broad scope, relating to all member countries, should be selected. It was finally agreed that the theme of the next meeting will be "Management of Varieties with Emphasis on Fiber Quality."

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Short Notes

- The USA, the largest exporter of raw cotton in the world, is an exporter as well as importer of textile machinery. More than 40% of the textile machinery produced in the USA is exported. Mexico, Canada, Germany, China, Japan, Britain, Thailand and Argentina consume about 50% of the total exports. In 1992, textile machinery exports in terms of value remained at the level of 1991. However, the import of textile machinery to the USA increased by 13% in the same period. Imports in 1992 represented more than 60% of total textile machinery purchases in the USA, with more than 75% of the textile machinery imports manufactured in Germany, Japan, Italy and Switzerland. The US Department of Commerce is hopeful that textile machinery exports will improve by 3% in 1993 over last year. It is also expected that textile machinery exports will maintain a growth level of 2.9% form 1993 to 1997 because of stronger demand for electronic control machinery produced by the US. (Source: "Machine-builders set to advance," *Textile Asia*, February 1993)

- One of the main disadvantages of stripper picking is a high proportion of trash. Leaf trash can be removed during ginning with the help of pre- and post- cleaners. However, it is desirable to take the least contaminated cotton as possible to the gin because delays in the cleaning process generally result in poor and increased cost of cleaning. During handling in the field and in the gin, trash particles become smaller in size and become more entangled with cotton fibers. While it is unavoidable to pick trash along with cotton, it should be removed as early as possible. With the same objective, CASE IH has developed a Burr Extractor attachment which can remove burrs before the stripped cotton is pushed into the basket of the picker. The Burr Extractor can be ordered factory-installed in new machines. It can also be easily fitted on preciously manufactured 1800 Cotton Harvesters. Installation of the Burr Extractor has the following advantages:

    - Lower harvest cost due to fewer basket unloadings per day or per hectare
    - Lower module cost and more bales per module because of less trash
    - Faster and easier ginning
    - Improved cotton grade due to less trash before the cotton is compacted
    - Uniform distribution of burrs in the field

Cotton after picking is directly delivered to the Burr Extractor which is located between the harvesting row units. Cleaning begins as the cotton is dropped onto a row of beater bars. The beater bars break up the cotton bolls and uniformly distribute the cotton over the saws located directly beneath. Cotton is retained by the saws in two stages, While burrs and trash are thrown out between the grid bars by centrifugal force. Following the cleaning process, burrs are dropped on the ground in an even distribution, and the cleaned cotton is pushed into the basic air system of the machine and carried to the basket. All other features of the 1800 Cotton Harvester have been retained. The monitoring system of the Burr Extractor consists of a single pressure gauge. As the cotton volume increases, the operating pressure increases and the gauge warns of a possible overload, allowing the operator to reduce cotton flow.

In the tests conducted during 1992/93, almost 50% of the trash was removed from the cotton passed through the Burr Extractor. Ginning cost was lower by US$16.10 per bale of cotton. No data are available on the

impact of burr removal on fiber characteristics (Source: *The Cotton Gin and Oil Mill Press*, March 20, 1993)

- Boll weevil, *Anthonomus grandis* Boheman, is an old and very destructive pest of cotton in the USA. A three-day "Centennial Symposium on the Boll Weevil: The Insect, the People and the Current State of Technology for Areawide Management and Suppression" was held from April 5-7, 1993, in San Antonio, Texas. Origin, dispersal, genetics, nutrition, population dynamics, cultural control and genetic control were discussed at the meeting. New work on biological control of the boll weevil was reported. The Subtropical Agricultural Research Laboratory in Weslaco, Texas, has shown that a wasp *Catolaccus grandis*, an exotic parasitoid of the boll weevil, has potential to be used on a commercial scale. *C. grandis* females lay eggs on cotton buds shed by the plant as a result of infestation by the boll weevil. After hatching, the adult wasp oviposits on the third instar and pupae of the boll weevil, thus killing boll weevils at immature stages. The ability of the wasp to lay eggs close to the boll weevil eggs enhances the utilization of the wasp as a potential biological control method. In 1992, the USDA-ARS Weslaco researchers released female wasps of *C. grandis* in cotton fields to investigate their effectiveness in controlling the boll

weevil. These small test plots showed 100 percent control of young boll weevils. The wasp appears harmless to other insects, people and animals. The development of an *in vivo* rearing system for *C. grandis* has been one of the central objectives of research in the past few years. Now, *C. grandis* can be produced and released in sufficient numbers to equal or surpass the boll weevil population in the field. Encouraged with the 1992 trials, ARS, Weslaco has planned three-year field trials. In May of 1993, USDA intends to begin releasing 500,000 insects on 16 acres of research plots in Weslaco and about 50 acres of commercial cotton fields in Alabama. It appears that commercial utilization of the wasp would require release of 200-250 female wasps per acre per week for 3-4 weeks.

A DIALOG Search from the AGRICOLA Database on Trash in Cotton

The DIALOG search was conducted on the papers published from 1980 to 1993 on the subject of trash in cotton. The key words used in search are **Cotton** and **Trash**. 90 references given here deal with trash measurement, elimination of trash and possible uses of trash.

91068769 93012792 Holding Library: AGL
Field evaluation of color/trash meters
Anthony, W.S.
U.S. Cotton Ginning Laboratory, USDA-ARS, Stoneville, MS
Applied engineering in agriculture. May 1992. v. 8 (3) p. 293-302.
St. Joseph, Mich.: American Society of Agricultural Engineers.
ISSN: 0883-8542
DNAL CALL NO: S671 A66
Language: English
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

91061535 93007272 Holding Library: AGL

Significance of trash and dust tests in the production of high quality rotor yarns

Faerber, C.

W. Schlafhorst, AG & Co., Moenchengladbach, Germany

Proceedings - Beltwide Cotton Conferences. 1992. v. 3. p 1439-1444.

Memphis Tenn. : National Cotton Council of America. CODEN: BCOPB

DNAL CALL NO: SB249.N6

Language: English

Paper presented at the joint meeting of the Cotton Textile Processing and Cotton Quality Measurement Conferences, 1992.

Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);

Document Type: Article

91061531 93007268 Holding Library: AGL

Effects of lint cleaning on pepper trash

Baker, R.V.; Bashears, A.D.; Lalor, W.F.

USDA, ARS, Cotton Production and Processing Research Unit, Lubbock, TX

Proceedings - Beltwide Cotton Conferences. 1992. v. 3 p. 1417-1419.

Memphis, Tenn. : National Cotton Council of America. CODEN: COPB

DNAL CALL NO: SB249.N6

Language English

Paper presented at the joint meeting of the Cotton Engineering-systems Conference and the Cotton Ginning Conference, 1992.

Includes references.

Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

91061525 93007262 Holding Library: AGL
Potential for oil absorption of gin by-products
Anthony, W.S.
U.S. Cotton Ginning Laboratory, Stoneville, MS
Proceedings - Beltwide Cotton Conferences. 1992. v. 3. p. 1400-1402.
Memphis, Tenn. : National Cotton Council of America. CODEN: BCOPB
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Paper presented at the join meeting of the Cotton Engineering-systems Conference and the Cotton Ginning Conference, 1992.
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

91061520 93007287 Holding Library: AGL
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You, F.: Mailander, M.; Sistler, F.
LSU, Baton Rouge, LA
Proceedings - Beltwide Cotton Conferences. 1992. v. 3. p. 1382-1386.
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Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

91061488 93007225 Holding Library: AGL
A through the mill study of neps, trash, and short fiber content
Galyon, M.E.; Shofner, F.M.
Zellweger Uster, Inc., Knoxville, TN
Proceedings - Beltwide Cotton Conferences. 1992. v. 3 p. 1253-1257.
Memphis, Tenn. : National Cottton Council of America. CODEN: BCOPB
DNAL CALL NO: SB249.N6
Language: English
Paper presented at the special session "Cotton Textile Processing 1992."
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

91057745 93003220 Holding Library: AGL
Analysis of seed cotton cleaning efficiency using GINQUAL
Barker, G.L.
UDSA-ARS, Cotton Production and Proceessing Research Unit, Lubbock, TX
Applied engineering in agriculture. Nov 1991. v. 7 (6) p. 66-672.

St. Joseph, Mich.: American Society of Agricultural Engineers.
ISSN: 0883-8542
DNAL CALL NO: S671.A66
Language: English
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

91051900 92077836 Holding Library: AGL
Recalibration interval for color-trash meters in cotton gins
Thomasson, J.A.
USDA, ARS, Cotton Ginning Laboratory, Stoneville, MS
Applied engineering in agriculture. Mar 1992. v. 8 (2) p. 147-151.
St. Joseph, Mich. : American Society of Agricultural Engineers
ISSN: 0883-8542
DNAL CALL NO: S671.A66
Language: English
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

91049492 92989436 Holding Library: IRU; AGL
Survey of cotton gin and oil seed trash disposal practices and preferences in the western US.

Cohen, Timothy M., Lansford, Robert R.
New Mexico State University, Agricultural Experiment Station.
Las Cruces, N.M. 1992
Technical report 12. 10 p. ; 28 cm.
DNAL CALL NO: S93.T42 no.12
Language: Enlish
Cover title.; "October 1992."
Includes bibliographical references (p. 9-10).
Place of Publication: New Mexico
Government Source: State/Provincial
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76); 1;
Document Type: Monograph; Bibliographies

91048086 92075977 Holding Library: AGL
On-line trashmetering for cotton cleaning
Senn, D.L.; Crowley, J.E.
Qualteo, Inc., Knoxville, TN
Proceedings - Beltwide Cotton Conferences. 1992. v. 2 p. 989-990.
Memphis, Tenn. : National Cotton Council of America.
CODEN: BCOPB
DNAL CALL NO: SB249.N6
Language: English
Includes references.

Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

91048085 92075976 Holding Library: AGL

A comparison of AFIS T counting and sizing of trash and dust particles with other methods

Townes, M.G.; Baldwin, J.C.

Zellweger Uster, Inc., Knoxville, TN

Proceedings - Beltwide Cotton Conferences. 1992. v. 2 p. 985-988.

Memphis, Tenn. : National Cotton Council of America. CODEN: BCOPB

DNAL CALL NO: SB249.N6

Language: English

Includes references.

Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

91048083 92075974 Holding Library: AGL

Improving trash detection accuracy

You, F.: Mailander, M,; Sistler, F.

Louisiana State University, Baton Rouge, LA

Proceedings - Beltwide Cotton Conferences. 1992. v. 2 p. 975-980.

Memphis, Tenn. : National Cotton Council of America. CODEN: BCOPB

DNAL CALL NO: SB249.N6

Language: English

Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

91026347 92059032 Holding Library: AGL
Effect of early season insecticide use and square removal on fruiting patterns and fiber quality of cotton
Terry, L.I.
University of Arizona, Tucson, AZ
Journal of Economic Entomology. Aug 1992. v. 85 (4) p. 1402-1412.
Lanham, Md. : Entomological Society of America. ISSN: 0022-0493
CODEN: JEENAI
DNAL CALL NO: 421 J822
Language: English
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

91019508 92056309 Holding Library: AGL
Pearl millet versus gin trash mulches for increasing soil water and cotton yields in a semiarid region
Bibro, J.D.; Fryrear, D.W.
Cropping Systems Research Laboratory, ARS, USDA, Big Springs, TX
Journal of soil and water conservation. Jan 1991. v. 46 (1) p. 66-60.

Ankeny, Iowa : Soil and Water Conservation Society of America.
ISSN: 0022:4561 CODEN: JSWCA3
DNAL CALL NO: 56.8 J822
Language: English
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

90128594 92028145 Holding Library: AGL
A review of cotton gin trash disposal and utilization
Thomasson, J.A.
USDA, ARS, Cotton Ginning Laboratory, Stoneville, MS
Proceedings - Beltwide Cotton Production Research Conferences. 1990. p. 689-705.
Memphis, Tenn. : National Cotton Council of America. CODEN: BCOPB
DNAL CALL NO: S249.N6
Language: English
Meeting held January 9-14, 1990, Las Vegas, Nevada.: Literature review.
Includes references.
Subfile: ENE (ENERGY IN AGRICULTURE:EXPANDED); OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article; Survey of Literature

90128561 92028112 Holding Library: AGL
Bark removal in textile processing

Simpson, C.L.; Bragg, C.K.
USDA, ARS, Clemson, SC
Proceedings - Beltwide Cotton Production Research Conferences. 1990. p. 568-570.
Memphis, Tenn. : National Cotton Council of America. CODEN: BCOPB
DNAL CALL NO: S249.N6
Language: English
Meeting held January 9-14, 1990, Las Vegas, Nevada.
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

90128560 92028111 Holding Library: AGL
Video trashmeters in grading cotton
Mullins, F.S.
USDA, AMS, Cotton Division, Memphis, TN
Proceedings - Beltwide Cotton Production Research Conferences. 1990. p. 566-568.
Memphis, Tenn. : National Cotton Council of America. CODEN: BCOPB
DNAL CALL NO: S249.N6
Language: English
Meeting held January 9-14, 1990, Las Vegas, Nevada.
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

90128413 92027964 Holding Library: AGL

Activated carbon production and quality from thermal gasification of cotton gin trash

Capareda, S.C.; Parnell, C.B. Jr.; LePori, W.A.

Texas A&M University, College Station, TX

Proceedings - Beltwide Cotton Production Research Conferences. 1990. p. 115-119.

Memphis, Tenn. : National Cotton Council of America. CODEN: BCOPB

DNAL CALL NO: SB249.N6

Language: English

Meeting held January 9-14, 1990, Las Vegas, Nevada.

Includes references.

Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);

Document Type: Article

90121169 92022984 Holding Library: AGL

Reducing NO_2 emissions of cotton gin trash derived gas by staged combustion

Cabrera-Sixto, J.M.; Parnell, C.B. Jr.; LePori, W.A.

Texas A&M University, College Station, TX

Paper - American Society of Agricultural Engineers. Winter 1989. (89-6575) 22.

St. Joseph, Mich. : The Society. ISSN: 0149-9890 CODEN: AAEPC

DNAL CALL NO: 290.9 AM32P

Language: English

Paper presented at the International Winter Meeting, December 12-15, 1989.

Includes references.

Subfile: ENE (ENERGY IN AGRICULTURE: EXPANDED); OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

90110011 92014749 Holding Library: AGL
Genetic trait effects on nonlint trash of cotton
Novick, R.G.; Jones, J.E.; Anthony, W.S.; Aguillard, W.; Dickson, J.I.
I.N.T.A., S. Pena Exp. Stat., Argentina
Crop science. July/Aug 1991. v. 31 (4) p. 1029-1034.
Madison, Wis. : Crop Science Society of America. ISSN: 0011-183X
CODEN: CRPSAY
DNAL CALL NO; 64.8 C883
Language: English
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

90105556 92010081 Holding Library: AGL
Characteristics of char produced from thermal gasification of cotton gin trash
Capareda, S.C.; LePori, W.A.; Parnell, C.B. Jr.
Texas A&M University, College Station, TX
Paper - American Society of Agricultural Engineers. Summer 1989. (89-1015) 17 p.
St. Joseph, Mich.: The Society. ISSN: 0149-9890 CODEN: AAEPC
DNAL CALL NO: 2909 AM32P

Language: English
Paper presented at the 1989 International Summer Meeting, June 25-2, 1989, Quebec, PQ, Canada.
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

9005165 92009072 Holding Library: AGL
Survey of cotton gin trash disposal practices and preferences in the midsouth
Thomasson, J.A.; Anthony, W.S.; Columbus, E.P.
ARS, USDA, Stoneville, MS
Proceedings - Beltwide Cotton Conferences. 1991. v. 2 p. 993-996.
Memphis, Tenn. : National Cotton Council of America. CODEN: BCOPB
DNAL CALL NO: SB249.N6
Language: English
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

90105158 92009065 Holding Library: AGL
Converting cotton gin trash into useable energy--technical and economical considerations
Parnell, C.B. Jr.; LePori, W.A.; Capareda, S.C.
Texas A&M University

Proceedings - Beltwide Cotton Conferences. 1991. v. 2 p. 969-972.
Memphis, Tenn. : National Cotton Council of America.
CODEN: BCOPB
DNAL CALL NO: SB249.N6
Language: English
Includes references.
Subfile: ENE (ENERGY IN AGRICULTURE:EXPANDED); OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

90105128 92009035 Holding Library: AGL
Categorizing cotton trash shapes using video imagery
Lieberman, M.A.; Zhao, Z.Y.
USDA, ARS, Mesilla Park, NM
Proceedings - Beltwide Cotton Conferences. 1991. v. 2 p. 854-858.
Memphis, Tenn. : National Cotton Council of America. CODEN: BCOPB
DNAL CALL NO: SB249.N6
Language: English
Paper presented at the "Cotton Quality Measurement Conference," 1991, San Antonio, Texas.
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

90096137 92003345 Holding Library: AGl
Measurement of trash in cotton gins with video cameras
Anthony, W.S.
ARS, USDA, Stoneville, MS
Proceedings - Beltwide Cotton Conferences. 1991. (Book 2) p. 603-605.
Memphis, Tenn. : National Cotton Council of America. CODEN: BCOPB
DNAL CALL NO: SB249.N6
Language: English
Meeting held January 2-7, 1989, Nashville, Tennessee.
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

90096136 92003344 Holding Library: AGl
Cotton trash analysis and modern imaging techniques
Lieberman, M.A.
Proceedings - Beltwide Cotton Conferences. 1989. (Book 2) p. 591-602.
Memphis, Tenn. : National Cotton Council of America.
CODEN: BCOPB
DNAL CALL NO: SB249.N6
Language: English
Meeting held January 2-7, 1989, Nashville, Tennessee.
Includes references.

Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

90096135 92003343 Holding Library: AGL
Video scan trashmeter area calibration
Taylor, R.A.; Godbey, L.C.
Proceedings - Beltwide Cotton Conferences. 1989. (Book 2) p. 586-591.
Memphis, Tenn. : National Cotton Council of America. CODEN: BCOPB
DNAL CALL NO: SB249.N6
Language: English
Meeting held January 2-7, 1989, Nashville, Tennessee.
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

90096134 92003342 Holding Library: AGL
Evaluation of trashmeters in cotton classing
Ramey, H.H. Jr.
USDA, AMS, Memphis, TN
Proceedings - Beltwide Cotton Conferences. 1989. (Book 2) p. 585-586.
Memphis, Tenn. : National Cotton Council of America. CODEN: BCOPB
DNAL CALL NO: SB249.N6
Language: English
Meeting held January 2-7, 1989, Nashville, Tennessee.

Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

90096010 92003218 Holding Library: AGL
Utilization of activated carbon produced from thermal gasification of cotton gin trash
Capareda, S.C.: Parnell, C.B. Jr.; LePori, W.A.
Texas A&M University, College Station, TX
Proceedings - Beltwide Cotton Conferences. 1989. (Book 1) p. 159-163.
Memphis, Tenn. : National Cotton Council of America. CODEN: BCOPB
DNAL CALL NO: SB249.N6
Language: English
Meeting held January 2-7, 1989, Nashville, Tennessee.
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

90084922 91053586 Holding Library: AGL
Using gin trash in composted soil ingredients
Shumack, R.L.; Eakes, D.J.; Gilliam, C.H.; Donald, J.O.
Auburn University, Alabama
Proceedings - Beltwide Cotton Conferences. 1991. v. 1 p. 498-499.
Memphis, Tenn. : National Cotton Council of America. CODEN: BCOPB

DNAL CALL NO: SB249.N6
Language: English
Paper presented at the "Cotton Ginning Conference," 1991, San Antonio, Texas.
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

90084921 91053585 Holding Library: AGL
Gin trash utilization: What are the options?
Mayfield, W.; Cotton Mechanization and Ginning Extension Service, USDA
Memphis, TN
Proceedings - Beltwide Cotton Conferences. 1991. v. 1 p. 496-497.
Memphis, Tenn. : National Cotton Council of America. CODEN: BCOPB
DNAL CALL NO: SB249.N6
Language: English
Paper presented at the "Cotton Ginning Conference," 1991, San Antonio, Texas.
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

900730 91019069 Holding Library: AGL
Multistage trash extractor for cotton gins
Baker, R.V.; Laor, W.F.
USDA-ARS, Cotton Production and Processing Research Unit, Lubbock, TX

Transactions of the ASAE. Sept/Oct 1990. v. 33 (5) p. 1457-1463. ill.
St. Joseph, Mich. : American Society of Agricultural Engineers.
ISSN: 0001-2351 CODEN: TAAEA
DNAL CALL NO: 290.9 AM32T
Language: English
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

Seedcotton cleanability and non-lint trash at the gin as affected by morpological traits

Jones. J.E.; Novick, R.G.; Anthony, W.S.; Aguillard, W.; Dickson, J.I.

La. Agr. Exp. Sta., Baton Rouge
Report of projects - Louisiana Agricultural Experiment Station.
Department of Agronomy. 1989. p. 26-28.
Baton Rouge, La. : The Department.
ISSN: 0456-5959
DNAL CALL NO: 100 L936
Language: English
Includes references.
Subfile: EXP STN (STATE EXPER. STN);
Document Type: Article

9002538 91016037 Holding Library: AGL
Composting gin trash reduces waste disposal and pollution problems
Pessarakli, M.
The University of Arizona, Tucson, AZ
Journal of Environmental Science and Earth: Part A : Environmental science and engineering. 1990. v. 25 (8) p. 1037-1047.
New York, N.Y. : Marcel Dekker. ISSN: 0360-1226 CODEN: JESEDU
DNAL CALL NO: TD172.J6
Language: English
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

8947636 90060378 Holding Library: AGL
Video scan trashmeter area calibration
Taylor, R.A., Godbey, L.
USDA, ARS, Cotton Quality Research Station, Clemson, SC
Textile research journal. Nov 1990. v. 60 (11) p. 646-653. ill.
Princeton, N.J. : Textile Research Institute.
ISSN: 0040-515
CODEN: TROA9
DNAL CALL NO: 304.8 T293
Language: English
Includes references.

Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

89146437 90059176 Holding Library: AGL
Wind erosion control with cotton gin trash
Fryrear, D.W.; Armbrust, D.V.
PR - Texas Agricultural Experiment Station. Nov. 1968. (2621) p. 12-13.
College Station, Tex. " The Station. ISSN: 0099-5142
DNAL CALL NO: 10 T31P
Language: English
Subfile: EXP STN (STAT EXPER. STN);
Document Type: Article

89146184 90058923 Holding Library: AG
Estimating the size of cotton trash with video images
Taylor, R.A.
USDA, ARS, Cotton Quality Research Station, Clemson, SC
Textile research journal. Apr 1990. 60 (4) p. 185-193. ill.
Princeton, N.J. : Textile Research Institute.
ISSN 0040-5175
CODEN: TRJOA9
DNAL CALL NO: 304.8 T293
Language: English
Includes references.

Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

89137986 90052204 Holding Library: AGL
Effects of gin cleaning and mill opening on fiber quality
Columbus, E.P.; Bel, P.D.; Bagg, C.K.
Cotton Ginning Laboratory, USDA, ARS, Stoneville, MS
Transactions of the AAE. Mar/Apr 1990. v. 33 (2) p. 405-411.
St. Joseph, Mich : Amercan Society of Agricultural Engineers.
ISSN: 0001-2351 CODEN: TAAEA
DNAL CALL NO: 290.9 AM32T
Language: English
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

89130862 90047168 Holding Library: AGL
Validation of cotton quality model: GINQUAL
Barker, G.L.; Baker, R.V.; Laird, J.W.
American Society of Agricultural Engineers (Microfiche collection). 1988. (fiche no. 88-1619) 13 p. ill.
St. Joseph, Mich. : The Society.
DNAL CALL NO: FICHE S-72
Language: English

Paper presented at the 1988 Winter Meeting of the American Society of Agricultural Engineers. Available for purchase from: The American Society of Agricultural Engineers, Order Dept, 2950 Niles Road, St. Joseph, Michigan 49085. Telephone the Order Dept. at (616) 429-0300 for information and prices.
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

89086149 90014753 Holding Library: AGL
Digestibility of cotton plant by-product diets for sheep at two levels of intake
Cann, M.A.; Craddock, B.F.; Preston, R.L.; Ramsey, C.B.
Texas Tech University, Lubbuck
Journal of animal science. Feb 1990. v. 68 (2) p. 285-295.
Champaign, Ill.: American Society of Animal Science. ISSN: 002-812
CODEN: JANSAG
DNAL CALL NO: 49 J82
Language: English
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

8907819 9000943 Holding Library: AGL
The effects of gin compost on cotton production
Millhollon, E.P.; Barker, G.; Rasbury, G.

Red River Research Station
Annual research report - Red River Research Station. 1984. p. 33-36.
Bossier City, La.: The Station. ISSN: 0886-4500
DNAL CALL NO: 100 L9333
Language: English
Includes statistical data.
Subfile: EXP STN (STATE EXPER SN);
Document Type: Article; Statistics

89077898 90009118 Holding Library: AGL
On station cotton fertilization research
Melville, D.R.; Barker, F.; Brubacker, R.H.
Red River Valley Agricultural Experiment Station
Annual research report - Red River Valley Agricultural Experiment Station. 1982. p. 67-91.
Bossier City, La.: The Station. ISSN: 0886-4500
DNAL CALL NO: 100 L9333
Language: English
Includes statistical data.
Subfile: EXP TN (STATE EXER. TN);
Document Type: Article; Statistics

89064297 89057487 Holding Library: AGL
Effects of gin cleaning and mill opening on fiber quality

Columbus, E.P.; Bel, P.D.; Bragg, C.K.

American Society of Agricultural Engineers (Microgiche collection). 1988. (fiche no. 88-1052) 9 p. ill. St. Joseph, Mich. : The Society.

DNAL CALL NO: FICHE S-72

Language: English

Paper presented at the 1988 Summer Meeting of the American Society of Agricultural Engineers. Available for purchase from: The American Society of Agricultural Engineers, Order Dept., 2950 Niles Road, St. Joseph, Michigan 49085. Telephone the Order Dept. at (616) 429-0300 for information and price.

Includes references.

Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);

Document Type: Article

8906429 89057485 Holding Library: AGL

On-line assessment of foreign matter in cotton during ginning

Anthony, W.S.;

American Society of Agricultural Engineers (Microfiche collection). 1988. (fiche no. 88-1050) 16 p. ill.

St. Joseph, Mich. : The Society.

DNAL CALL NO: FICHE S-72

Language: English

Paper presented at the 1988 Summer Meeting of the American Society of Agricultural Engineers. Available for purchase from: The American Society of Agricultural Engineers,

Order Dept., 2950 Niles Road, St. Joseph, Michigan 49085. Telephone the Order Dept. at (616) 429-0300 for information and price.
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

89045101 89054296 Holding Library: AGL
Relationship of byssinosis to the generation of oxygen radicals by bract tissues of cotton plants
Jacks, T.J.; Hinojosa, O.; Buck, M.G.; Wall, J.H.; Lillehoj, E.B.
Southern Regional Research Center, New Orleans, LA
Molecular and cellular biochemistry. Aug 15 1989. v. 89 (1) p. 15-19.
Hingam, Mass. : Kluwer Academic Publishers. ISSN: 0300-8177
CODEN: MCBIB
DNAL CALL NO: QD501.M63
Language: English
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

88127338 89006761 Holding Library: AGL
Use of cotton gin trash in the diets of growing dairy heifers
Whiting, F.M.; Schuh, J.D.

Proceedings, annual meeting - Western Section, American Society of Animal Science. 1988. v. 39 p. 399-401.
[S.1.] : The Society. ISSN: 056-7832 CODEN: PMWSA
DNAL CALL NO: 389.9 AM31
Language: English
Meeting held on June 15th-17th, 1988, Pomona, California.
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

88107966 88037561 Holding Library: AGL
Effects of lint cleaning on spotted and light spotted cotton
Baker, R.V.
Proceedings - Beltwide Cotton Production Research Conferences. 1988. p. 538-539.
Memphis, Tenn.: National Cotton Council and The Cotton Foundation.
CODEN: BCOP
DNAL CALL NO: SB249.N6
Language: English
Conference held in January 3-8, 1988, New Orleans, Louisiana.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

88107835 8837430 Holding Library: AGL
Update on cotton quality process in model: GINQUAL

Barker, G.L.; Baker, R.V.; Lair, J.W.
Proceedings - Beltwide Cotton Production Research Conferences. 1988. p. 159-160.
Memphis, Tenn.: National Cotton Council and The Cotton Foundation.
CODEN: BCOP
DNAL CALL NO: SB249.N6
Language: English
Conference held in January 3-8, 1988, New Orleans, Louisiana.
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

8810781 88037414 Holding Library: AGL
Effects of leaf shape, bract type and leaf pubescence on non-lint trash and nep content of upland cotton
Novick, R.G.; Jones, J.; Dickson, J.I.; Aguillard, W.; Anthony, W.S.
Proceedings - Beltwide Cotton Production Research Conferences. 1988. p. 126-131.
Memphis, Tenn.: National Cotton Council and The Cotton Foundation.
CODEN: BCOP
DNAL CALL NO: SB249.N6
Language: English
Conference held in January 3-8, 1988, New Orleans, Louisiana.
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

88085689 88039629 Holding Library: AGL

Comparison of video color/trash meters for measurements on cotton

Anthony, W.S.

American Society of Agricultural Engineers (Microfiche collection). 1987. (fiche no. 87-1509) 22 p. St. Joseph, Mich.: The Society.

DNAL CALL NO: FICHE S-2

Language: English

Paper presented at the 1987 Winter Meeting of the American Society of Agricultrual Engineers. Available for purchase from: The American Society of Agricultural Engineers, Order Dept., 2950 Niles Road, St. Joseph, Michigan 49085. Telephone the Order Dept. at (616) 429-0300 for information and prices.

Includes references.

Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);

Document Type: Article

88084003 8803714 Holding Library: AGL

An inventory of organic wastes produced by cotton gins and agricultural processing plants in New Mexico.

Lansford, R.R.; Mapel, C.L.; Creel, B.J.; Lucht, K.A.

Research report - New Mexico University, College of Agricultrue and Home Economics, Agricultural Experiment Station. Oct 1984. (549) 9 p. maps.

Las Cruces, N.M. : The Station. ISSN 0548-5967 CODEN: NEXRA

DNAL CALL NO: 100 N45R

Language: English

Includes statistical data.
Includes references.
Subfile: EXP STN (STATE EXPER. STN);
Document Type: Article; Statistics

88067427 88026152 Holding Library: AGL
Evaluation of video trash meters for gin control
Anthony, W.S.
American Society of Agricultural Engineers (Microfiche collection). 1987. (fiche no. 87-1088) 4 p. ill.
St. Joseph, Mich. : The Society.
DNAL CALL: FICHE S-72
Language: English
Paper presented at the 1987 Summer Meeting of the American Society of Agricultrual Engineers. Available for purchase from: The American Society of Agricultural Engineers, Order Dept., 2950 Niles Road, St. Joseph, Michigan 49085. Telephone the Order Dept. at (616) 429-0300 for information and prices.
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

88051888 88014100 Holding Library: AGL
Effects of certain morphological traits on seedcotton cleanability, non-lint trash, and nep content of upland cotton

Novick, R.G.; Jones, J.E.; Dickson, J.I.; Aguilard, W.; Anthony, W.S.; Caldwell, W.D.; Holoubek, B.B.; Marshall, J.G.; Burris, E.; Boquet, D.J.
Report of projects - Louisiana Agricultural Experiment Station,
Department of Agronomy. 1987. p. 1-4.
Baton Rouge : The Department.
DNAL CALL NO: 100 L936
Language: English
Includes statistical data.
Subfile: EXP STN (STATE EXPER. STN)
Document Type: Article; Statistics

88015580 87098919 Holding Library: AGL
On the potential for use of cotton gin trash in the hydrolysis industry
Drnovih, A.V.; Priz, L.A.
Hydrolysis and wood chemistry USSR. 1987. (6) p. 58-59.
New York, N.Y.: Allerton Press. ISSN: 0730-8124
DNAL CALL NO: TS920.H8
Language: English; Russian
Translate from: Gidroliznaia i lesokhimicheskaia promyshlennost', (6), 1987, p. 25-26. (301.8 G36).
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

8712370 87069253 Holding Library: AGL

Utilization alternatives for activated carbon produced from gasified cotton gin trash

Siebold, W.J.; Parnell, C.B. Jr.; LePori, W.A.

American Society of Agricultural Engineers (Microfiche collection). 1986. (fiche no. 86-1564) 23 p. ill.

St. Joseph, Mich. : The Society.

DNAL CALL NO: FICHE S-72

Language: English

Paper presented at the 1986 Winter Meeting of the American Society of Agricultural Engineers. Available for purchase from: The American Society of Agricultural Engineers. Available for purchase from: The American Society of Agricultural Engineers, Order Dept., 2950 Niles Road, St. Joseph, Michigan 49085. Telephone the Order Dept. at (616) 429-0300 for information and prices.

Includes references.

Subfile: ENE (ENERGY IN AGRICULTURE: EXPANDED); OTHER US (NOT EXP TN, EXT, USDA; SINCE 12/76);

Document Type: Article

87101135 87052671 Holding Library: AGL

Evolution of the microdust and trash monitor for cotton classification

Shofner, F.M.; Williams, G.F.

Textile Research Journal. Feb 1986. v. 56 (2) p. 150-156. ill.

Princeton, N.J. : Textile Research Institute. ISSN: 0040-5175

CODEN: TRJOA9
DNAL CALL NO: 304.8 T293
Language: English
Includes references.
Subfile: OTHER S (NOT E STN, EXT USDA; SINCE 12/76);
Document Type: Article

87091539 87044906 Holding Library: AGL
Gasification of cotton gin trash
Parnell, C.B.; LePori, W.A.; Siebold, W.J.
Proceedings - Beltwide Cotton Production Research Conferences. 1987. p. 511-513.
Memphis, Tenn. : National Cotton Council and The Cotton Foundation.
CODEN BCOPB
DNAL CALL NO: SB249.N6
Language: English
Includes references.
Subfile: ENE (ENERGY IN AGRICULTURE:EXPANDED): OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

87075432 8730436 Holding Library: AGL
Determining dust and trash contents of cottons with the cotton particulates analyzer. II. Evaluation of respirable dust measuring machines and methods
Deluca, L.B.

Textile research journal. Jan 1987. v. 57 (1) p. 1-6.
Princeton, N.J. : Textile Research Institute. ISSN: 0040-5175
CODEN: TRJOA9
DNAL CALL NO: 304.8 T293
Language: English
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

87072678 87027261 Holding Library: AGL
Determining dust and trash contents of cottons with the cotton particulates analyzer. I. Development of equations relating dust and trash fractions
Deluca, L.B.
Textile Research Journal. Dec 1986. v. 56 (12) p. 734-740. ill.
Princeton, N.J. : Textile Research Institute. ISSN: 0040-5175
CODEN: TRJOA9
DNAL CALL NO: 304.8 T293
Language: English
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

87071653 87026234 Holding Library: AGL
Cotton gin trash--fuel for a cogeneration power plant

Parnell, C.B. Jr.; LePori, W.A.
The Cotton gin and oil mill press. Oct 25, 1986. v. 87 (22) p. 16-19, 22.
Mesquite, Tex.: Haughton Publishing Co. ISSN: 0010-9800 CODEN: CTGPA
DNAL CALL NO: 304.8 C822
Language: English
Includes references.
Subfile: ENE (ENERGY IN AGRICULTURE:EXPANDED); OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

87039918 87007729 Holding Library: AGL
Chemical residues during screening, composting, and soil incorporation of cotton gin waste
Winterlin, W.L.; McChesney, M.M.; Schoen, S.R.; Seiber, J.N.
Journal of environmental science and health. Part B. Pesticides, food contaminants, and agricultural wastes. 1986. v. 21 (6) p. 507-528.
New York, N.Y. : Marcel Dekker.
ISSN: 0360-1234 CODEN: JPFCD
DNAL CALL NO: TD172.J61
Language: English
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

87039506 87007316 Holding Library: AGL

Advances in cotton gin trash energy conversion

Rutherford, R.D.; Parnell, C.B. Jr.; Finch, S.F.; Siebold, W.J.; LePori, W.A.

American Society of Agricultural Engineers (Microfiche collection). 1985. (fiche no. 85-1573) 19 p. ill.

St. Joseph, Mich. : The Society.

DNAL CALL NO: FICHE S-72

Language: English

Paper presented at the 1985 Winter Meeting of the American Society of Agricultural Engineers. Available for purchase from: The American Society of Agricultural Engineers. Available for purchase from: The American Society of Agricultural Engineers, Order Dept., 2950 Niles Road, St. Joseph, Michigan 49085. Telephone the Order Dept. at (616) 429-0300 for information and prices.

Includes references.

Subfile: ENE (ENERGY IN AGRICULTURE:EXPAND); OTHER US (NOT EXP ST EXT, USDA; SINCE 12/76);

Document Type: Article

86123962 86043134 Holding Library: AGL

Ginning for maximum grade without excessive short fibers, neps, and trash

Anthony, W.S.; Baker, R.V.; Hughs, S.E.

Proceedings - Beltwide Cotton Production Research Conferences. 1986. p. 413-416.

Memphis, Tenn. : National Cotton Council and The Cotton Foundation.

CODEN: BCOPB

DNAL CALL NO: SB249.N6
Language: English
Paper presented at the "Beltwide Cotton Production Research Conferences." January 4-9, 1986, Las Vegas, Nevada.
Includes 19 references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

86109040 86032181 Holding Library: AGL
Conservation tillage for wind erosion control in the Southern High Plains
Fryrear, D.W.; Bilbro, J.D.
Publication - Great Plains Agricultural Council. 1984. (110) p. 217-226.
Bozeman, Mont.: Montana State University, Cooperative Extension Service.
DNAL CALL NO: S27.A3
Language: English
Paper presented at the "Great Plains Conservation Tillage Symposium," Aug 21-23, 1984, North Platte, Nebraska.
Includes 8 references.
Subfile: EXT (STATE EXTEN. SERVICE);
Document Type: Article

86109915 86006694 Holding Library: AGL
Apparatus to extract fine trash and dust during high-velocity discharging of cotton from opener cleaner

Brown, R.S.; Shepard, C.L.; Richard, L.J.
United States Patent - United States Patent Office. Oct 30, 1984. (4,479,286) 1 p.
Washington, D.C. : The Office.
DNAL CALL NO: NO CALL NO. (PAT)
Language: English
Copies of USDA patents are available for a fee from the Commissioner of Patents and Trademarks, U.S. Patents and Trademarks Office, Washington, D.C. 20231.;
Inclludes abstract.
Includes 9 references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

86064585 85077852 Holding Library: AGL
Feeding cotton gintrash to wintering pregnant beef cows
Sagebiel, J.A.; Cisse, N.
Proceedings of the annual meeting - American Society of Animal Science. Western Section 1984. v. 35 p. 130-133.
[S.1.] : The Society. ISSN: 0569-7832 CODEN: PMWSA
DNAL CALL NO: 389.9 AM31
Language: English
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

86047425 85062579 Holding Library: AGL
Future holds more efficient cotton ginning
Duca, N.; Comis, D.
Agricultural research - U.S. Department of Agriculture, Agricultural Research Service. Sept 1985. v. 33 (8) p. 15.
Washington, D.C.: The Administration
ISSN: 0002-161X CODEN: AGREA
DNAL CALL NO: 1.98 AG84
Language: English
Subfile: USDA (US DEPT. AGR);
Document Type: Article

86021685 85040412 Holding Library: AGL
Cotton gin trash
Pessarakli, M.; Tucker, T.C.
BioCycle. Nov/Dec 1984. v. 25 (8) p. 43-45.
Emmaus, Pa. : J.G. Press.
ISSN 0276-5055 CODEN: COMPA
DNAL CALL NO: 57.8 C34
Language: English
Includes references
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

85118454 84130575 Holding Library: AGL

Improved energy management in cotton farming (Computer water management, gin trash as biomass fuel)

Dunn, J.R.; Hirsch, M.; Tobias, R.F.

Paper - American Society of Agricultural Engineers (Microfiche collection). 1984. (fiche no. 84-3036), 1984. 1 microfiche : St. Joseph, Mich. : The Society.

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Language: English

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Includes references.

Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76)

Document Type: Article

85101750 84111544 Holding Library: AGL

Comments on definitions and measurement of foreign matter in cotton (Microdust and trash monitor)

Shofner, F.M.; Williams, G.F.; Lalor, W.F.

Proceedings - Beltwide Cotton Production Research Conferences. Jan 9/10 1984. (8th), p. 186-189.

Memphis, Tenn. : National Cotton Council and The Cotton Foundation.

NAL: SB249.N6

Language: English
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

85097770 83010076 Holding Library: AGL
Process steam production from cotton gin trash
LePori, W.A.; Carney, D.B.; Lalk, T.R.; Anton, R.G.
Paper - American Society of Agricultural Engineers (Microfiche collection). 1981. (fiche no. 81-3594), 1981. 1 microfiche : ill.
St. Joseph, Mich. : The Society.
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Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

85097648 83007761 Holding Library: AGL
A simulation model for use in cotton gin trash as a cattle feed supplement (Cost estimates, Texas)
Williams, G.F.; Piumsomboon, P.; Hickman, P.D.; Parnell, C.B.

Paper - American Society of Agricultural Engineers (Microfiche collection). 1982. (fiche no. 82-5025), 1982. 1 microfiche : ill.

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NAL: FICHE S-72

Langauge: English

Paper presented at the 1982 Summer Meeting of the American Society of Agricultural Engineers. Available for purchase from: The American Society of Agricultural Engineers, Order Dept., 2950 Niles Road, St. Joseph, Michigan 49085. Telephone the Order Dept. at (616) 429-0300 for information and prices.

Includes references.

Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);

Document Type: Article

85097368 83004270 Holding Library: AGL

A systems engineering model for cotton gin trash utilization (Biomass energy source, Texas)

Williams, G.F.; Piumsomboon, P.; Parnell, C.B.

Paper - American Society of Agricultural Engineers (Microfiche collection). 1981. (fiche no. 81-3065), 1981. 1 microfiche : ill.

St. Joseph, Mich. : The Society.

NAL: FICHE S-72

Langauge: English

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Order Dept., 2950 Niles Road, St. Joseph, Michigan 49085. Telephone the Order Dept. at (616) 429-0300 for information and prices.
Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

85097367 83004269 Holding Library: AGL
Modification of pneumatic fractionator to collect bur cotton fine material
Barshears, A.D.
Paper - American Society of Agricultural Engineers (Microfiche collection). 1981. (fiche no. 81-3064), 1981. 1 microfiche : ill.
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Includes references.
Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

85022281 8405399 Holding Library: AGL

Biodegradation of lignocelluloses from cotton-gin trash by Pycnoporus cinnabarinus (Fungi)

Sutherland, J.B.

Mycologia. v. 76 (2), Mar/Apr 1984. p. 369-372

Bronx, N.Y. : The New York Botanical Garden. ISSN: 0027-5514

NAL: 450 M99

Language: English

Includes references.

Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);

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84046283 83091262 Holding Library: AGL

Economic implications of cotton gin trash and sorghum residues as alternative energy sources (On-farm cost of gasification, Texas)

Masud, S.M.; Lacewell, R.D.; Hiler, E.A.

Energy in agriculture. v. 1 (3, Feb 1983. p. 267-280).

Amsterdam : , Elsevier Scientific. ISSN: 0167-5826

NAL: TJ163.5.A37E5

Language: English

Includes references.

Subfile: ENE (ENERGY IN AGRICULTURE:EXPANDED); OTHER FOREIGN;

Document Type: Article

84011600 83060840 Holding Library: AGL

Feeding value of cleaned and uncleaned cotton gin trash (for ruminants)

Axe, D. PMWSA; Addis, D.; Clark, J.; Dunbar, .; Garrett, W.

Proceedings of the annual meeting - American Society of Animal Science. Western Section. v. 33, 1982. p. 57-59.

(s.l.) : The Society. ISSN: 0569-7832

NAL: 389.9 AM31

Language: English

Includes references.

Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);

Document Type: Article

84010359 83059599 Holding Library: AGL

A new method for microdust and trash measurement in bale or processed fiber (Cotton, aeromechanical release and separation and electro-optical sensing)

Shofner, F.M. TRJOA; Lalor, W.F.; Hanley, J.H.

Textile research journal. v. 53 (3), Mar 1983. p. 78-89. ill.

Princeton, N.J.: Textile Research Institute.

ISSN: 0040-5175

NAL: 304.8 T293

Language: English

Paper presented at the Fifth Annual Natural Fibers Textile Conference, September 14-16, 1982, Charlotte, North Carolina.

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Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

83140902 83040423 Holding Library: AGL
A method of measuring the rate at which heat is generated by aerobic composting of wastes (Cotton gin trash, dairy manure, rice hulls)
Griffin, C.L.; Mote, C.R.
Report series - Kansas Agricultural Experiment Station. Nov 1982.275), Nov 1982. 10 p.
Fayetteville : The Station. ISSN: 0097-5370
NAL: 100 AR42R
Language: English
Includes references.
Subfile: EXP (STATE EXPER. STN);
Document Type: Article

83109238 83013597 Holding Library: AGL
Botanical trash and gram-negative bacteria contents of materials utilized by the cotton industry (Byssinosis)
Morey, P. ACSMC; Tylander, R.
ACS Symposium series - American Chemical Society. 1982. p. 245-257.
Washington, D.C. : The Society. ISSN: 0097-6156
NAL: QD1.A
Language: English
19 ref.

Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

83109228 8301587 Holding Library: AGL

Cotton trash and dust contents and airborne dust concentration. Feasibility of predicting by nondestructive light reflectance

Montlavo, J.G. Jr. ACSMC; Rousselle, M.A.; Baril, A. Jr.; Watkins, T.A.

ACS Symposium series - American Chemical Society. 1982. (189), 1982. p. 67-84.

Washington, D.C. : The Society. ISSN: 0097-6156

NAL: QD1.A45

Language: English

12 ref.

Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

83044016 82078572 Holding Library: AGL

A systems engineering model for cotton gin trash utilization

Williams, G.F.; Piumsomboon, P.; Parnell, C.B.

Transactios of the ASAE - American Society of Agricultural Engineers. v. 25 (3), May/June 1982. p. 802-805, 810. ill.

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Language: English

5 ref.

Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

82130453 82023736 Holding Library: AGL
The effect of rotor fiber groove design on trash accumulation, end breakage, and yarn properties (Cotton spinning)
Simpon, J.
Textile research journal. v. 52(1), Jan 1982. p. 52-59. ill.
Princeton, N.J. : Textile Research Institute. ISSN: 0040-5175
NAL: 304.8 T293
Language: English
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Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

82130447 82023730 Holding Library: AGL
Modeling total particulate measurement in cotton (Content of non-lint trash plus dust)
Montalvo, J.G. Jr.; Rousselle, M.A.
Textile research journal. v. 52 (1), Jan 1982. p. 10-19. ill.
Princeton, N.J.: Textile Research Institute. ISSN: 0040-5175
NAL: 304.8 T293
Language: English
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Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

82101408 82919180 Holding Library: AGL
Calcot recycles trash, earns $3 million in return
Farmer cooperatives - U.S. Dept. of Agriculture, Agricultural Cooperative Service. v. 48 (5), Aug 1981. p. 16.
Washington, D.C.: The Service. ISSN: 0028-9035
Local Call No: 166.2 N47
Language: English
Subfile: AGE (AG ECON USA); USDA (US DEPT. AGR);
Document Type: Article

81145550 81038271 Holding Library: AGL
Chromatographic separation of the cotton-gin trash, bract, sisal, and jute antigens into two fractions (Ginning process, cotton dust, byssinosis).
Mares, T.; Sekul, A.A.; Ory, R.L.
Textile research journal. v. 51 (2), Feb 1981. p. 114-119. ill.
Princeton, N.J.: Textile Research Institute.
ISSN: 0040-5175
NAL: 304.8 T293
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Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);
Document Type: Article

81139603 81033802 Holding Library: AGL

Water management for sustaining the composting process in windrows of cotton ign trash

Mote, C.R.; Griffis, C.L.

Report series - Arkansas Agricultural Experiment Station. Nov 1980. (256), Nov 1980. 20 p. ill.

Fayetteville, Ark., The Station. ISSN: 0097-5370

NAL: 100 AR42R

Subfile: EXP STN (STATE EXPER. STN);

Document Type: Article

81071193 80122665 Holding Library: AGL

Analytical methods for nonlint trash and dust in cotton

Montalvo, J.G.; DeLuca, L.B.; Segal, L.

AR-SRRC

Special Session on Cotton Dust Research, St. Louis 1980

Proceedings - Beltwide Cotton Production Research Conference. 1980. p. 70-71.

Memphis, Tenn., National Cotton Council.

NAL: SB249.N6

Language: English

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Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);

Document Type: Article

81071188 80122660 Holding Library: AGL

Reduction in bract trash in lint through the development of small normal bract and frego bract genotypes (Cotton breeding).

Weaver, J.B. Jr.; Wofford, T.

Special Session on Cotton Dust Research, St. Louis 1980

Proceedings - Beltwide Cotton Production Research Conference. 1980. p. 62-3.

Memphis, Tenn., National Cotton Council.

NAL: SB249.N6

Language: English

Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);

Document Type: Article

81049819 80104330 Holding Library: AGL

Cotton gin trash: can it be safely utilized (compost for use as a nursery material or for land return)?

Parnell, C.B., Emino, E.R.; Grubaugh, E.K.

Agricultural engineering. v. 61 (8), Aug 1980. p. 21-22. ill.

St. Joseph, Mich., American Society of Agricultural Engineers.

ISSN: 0002-1458

NAL: 58.8 AG83

Language: English

Subfile: OTHER US (NOT EXP STN, EXT, USDA; SINCE 12/76);

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