

Reducing pesticide use—a key challenge for cotton research



Damage due to an *Amrasca biguttula* infestation in Thailand.
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A varied and destructive insect pest complex

More than 1 300 cotton pest species have been identified, including around 500 on the African continent alone. They are responsible for considerable crop losses and depreciate the technological quality of cotton fibre.



Helicoverpa armigera destroying a young boll.
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Cotton farmers are often accused of overusing pesticides, but they sometimes do not have access to enough information on alternative methods to improve their daily cropping practices and thus reduce some pest damage to their crops. CIRAD is conducting development-oriented research to benefit African cotton smallholders—through participative methods, scientists and farmers are implementing a range of agricultural practices to enhance sustainable pest management.

From irrational use of pesticides...

Chemicals, especially pesticides, were widely promoted as a cure-all just after World War II. For two decades, pest problems were unquestionably managed with the available range of commercial pesticides. Then the American writer Rachel Carson published *Silent Spring* in 1962, which reflected the growing public awareness on the unintentional detrimental health and environmental impacts of chemical treatments.

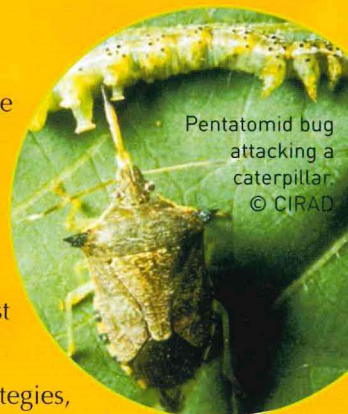
Meanwhile insect resistance to pesticides was rising. There was an irrational concomitant increase in treatments, which forced farmers to give up cotton cultivation in some countries like Mexico, Nicaragua and Thailand.

...to sustainable pest management

Since then, different methods have been developed to reduce the dependency on pesticides in agriculture, and particularly in cotton cropping systems. These methods use thresholds as a basis for pesticide control management. Progressive farmers make decisions according to a tolerance threshold, which is reached when the plant is no longer able to offset losses due to insect infestations, and an economic threshold, which takes the costs directly and indirectly associated with crop pest control treatments into account.

It is now considered that, as a complement to chemical treatment strategies, pest control sustainability could be improved by implementing a range of techniques. These were initially referred to as 'integrated pest control' and then extended to include the integrated crop management concept. This management is based on:

- nurturing the rich natural insect fauna. Diseases and insects that attack cotton pests are found in cotton fields. These beneficials should be identified and taken into account when establishing treatment thresholds. They could even be propagated and mass released in cotton fields;

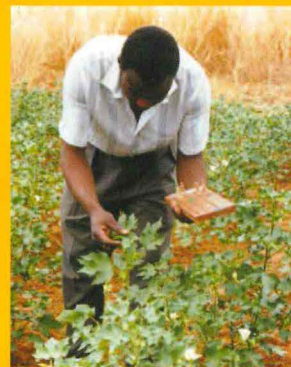


Pentatomid bug attacking a caterpillar.
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Industrial production of the bacterium *Bacillus thuringiensis*, an insect pathogen.
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- using resistance traits in cotton plants, i.e. naturally occurring or inserted in new varieties by biotechnological procedures. Wild cotton species have morphological (leaf shape and hairiness) and biochemical (high tannin and phenolic compound contents) traits that can be transferred to crop varieties to reduce the development of some pests. Genetic engineering currently facilitates the transfer of genes from the bacterium *Bacillus thuringiensis* into cultivated cotton varieties, and the resulting plants produce insecticide proteins. This technology could markedly reduce the need for chemical treatments to control bollworms;
- adopting cropping practices that enhance plant health. It is essential to focus on creating the best conditions for plants to thrive and produce cotton. The right choice of sowing date, seed quality, balanced fertilization and weed control would thus help cotton plants to effectively avert pest attacks;
- implementing a rational approach to chemical pesticide use. Treatments are only necessary when pests have overcome these impediments and are threatening cotton yields and quality, and thus farmers' income. In such cases, farmers should conduct a pesticide treatment using an active ingredient that is selected on the basis of its efficacy and specificity against the target pest insect.



Pest and disease assessment in a cotton field in Cameroon.
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A participative scientist-farmer approach

In Africa and South America, CIRAD and national partners have developed participative methods through farmer field schools (based on the FAO model) for knowledge transfer to users. This approach also boosts scientists' awareness on local know-how, which they can subsequently take into consideration when drawing up technical recommendations on pest control techniques.



Discussion around a pegboard about the pest infestation level in the field in Mali.
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For further information

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Partners

Africa: INRAB, Institut national des recherches agricoles du Benin • IRAD, Institut de la recherche agricole pour le développement, Cameroon
• IER, Institut d'économie rurale, Mali

South America: PIEA, Programa de Investigación y Experimentación Algodonera, and Arasy, a NGO, Paraguay
• EMBRAPA, Empresa Brasileira de Pesquisa Agropecuária; and COODETEC, Brazil



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