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Cotons®-Simbad— modelling to reduce pesticide use

Pest insect infestations damage cotton crops in all cotton-growing regions. For both economic and environmental reasons, the cotton sector is constantly striving to find alternative ways for managing these infestations with less reliance on pesticides. Sustainable management of pest insect populations is possible through well adapted agricultural practices. CIRAD and PRASAC (a research centre promoting savanna development in Central Africa) thus developed Cotons®-Simbad, a decision-support model for cotton crop protection.

Prospects

The Coton®-Simbad model is currently being validated. Once the prediction accuracy has been assessed, CIRAD will use this model to identify relevant decision criteria for pesticide treatments—decisions will be based on factors such as the crop stage, fertilization level and expected rainfall. These criteria will then be checked in the field.



Graphic image of a cotton plant
obtained by Cotons®-Simbad.

Economic threshold—a criterion to reduce pesticide use

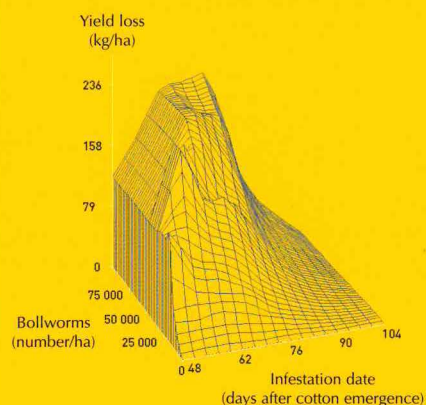
For sustainable pest management (often called integrated pest management), pesticide treatments should only be carried out when the pest density is high enough to induce a harvest loss whose cost would exceed the potential treatment cost. The economic threshold helps farmers decide whether or not a treatment is warranted. This threshold is determined on the basis of counts of insects or symptoms they induce. Treatments are unnecessary when the field counts are lower than the threshold, but spraying may be required when it has been surpassed. By this technique, only worthwhile treatments are conducted, thus reducing the overall number of treatments as compared to calendar-based treatment strategies.



Bollworm destroying a young cotton boll.
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Determining treatment thresholds—a complex approach

Treatment thresholds are established by correlating the number of insects in a plot with resulting crop yield losses. This correlation is, however, hard to determine with cotton. When squares and young bolls are destroyed by insects, the plant reacts by producing new bolls or by reducing



Modelling yield losses according to bollworm density and infestation date.
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'natural' shedding of excess bolls. The efficiency of this so-called compensation phenomenon depends on the physiological status of the plant, along with other factors such as mineral nutrition and water supply. The extent of harvest loss induced by an insect population can thus vary according to the cropping conditions. Cotton cropping conditions in sub-Saharan Africa sometimes differ markedly with respect to the environmental factors (soils, rainfall, etc.) and agricultural practices (sowing date, fertilizer application, etc.). Models can be used to investigate the effects of this diversity on plant-pest interactions.

Graphic image of cotton plants simulated by the Cotons®-Simbad model. A cotton plant damaged by an early bollworm infestation (left) and a non-infested cotton plant (right).
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Cotons®-Simbad—a unique system combining plant and insect models

Cotons®-Simbad is a computer-based model that combines a cotton growth model (Cotons®) and a cotton bollworm feeding behaviour model (Simbad). It is used to estimate the number and type of bolls attacked and the impact of this damage on the harvest. Cotons®-Simbad was developed on the basis of several years of laboratory and field observations and experiments undertaken to describe the feeding behaviour of the four main bollworm species found in Africa.

For further information

Nibouche S., Martin P., Crétenet M., Jallas E., Turner S., 2003. Cotons®-Simbad system: modeling feeding behavior of cotton bollworms for evaluation of crop pest interactions. *In* Proceedings of the Beltwide Cotton Conferences: 2002-2003 full papers, cotton pest loss database [CD-ROM]. Beltwide Cotton Conferences, Nashville, USA, 2003-01-06/2003-01-10, NCC (Memphis, USA), The Cotton Foundation (Memphis, USA).

Nibouche S., Beyo J., Brévault T., Crétenet M., Gozé E., Jallas E., Martin P., Moussa A.A., 2003. Cotton bollworm economic injury levels based on crop model predictions: another use of the COTONS model. *In* Proceedings of the third World Cotton Research Conference: cotton production for the new millennium, Cape Town, South Africa, 2003 March 9-13, pp. 1 291-1 296 [CD-ROM].

Nibouche S., Beyo J., Brévault T., Crétenet M., Gozé E., Jallas E., Martin P., Moussa A.A. 2002. Cotons®-Simbad: a tool for establishing cotton bollworm economic damage thresholds. *In* Villalobos F.J., Testi L. (eds.) VII Congress of the European Society for Agronomy: Consejería de agricultura y pesca, Cordoba, Spain, 15-18 July 2002, Junta de Andalucía, Seville, ESA, pp. 307-308. ISBN 84-8474-059-5.

Partners

Africa: PRASAC, Pôle de recherche appliquée au développement des savanes d'Afrique Centrale, Chad • IRAD, Institut de recherche agricole pour le développement, Cameroon

France: MAE, Ministère français des Affaires étrangères • PVBMT, Plant Communities and Biological Invaders in Tropical Environments, Université de La Réunion, CIRAD, Réunion



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