

Integrated Pest Management for Sustainable Management of Natural Resources

Research Activities at ICRISAT

**International Crops Research Institute for the Semi-Arid Tropics
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ICRISAT's mandate encompasses improving the production and productivity of its crops such as sorghum, pearl millet, chickpea, pigeonpea, and groundnut; and natural resource management, including IPM, in the semi-arid tropics in Asia, Africa and Latin America.

There is an urgent need to address the problem of food security and poverty. Insect pests, diseases, and *Striga* are serious constraints to increase production, productivity, and utilization of ICRISAT mandate crops (sorghum, pearl millet, chickpea, pigeonpea, and groundnut) in the semi-arid tropics (SAT). Crop losses due to these pests have been estimated at over US\$ 7.4 billion annually. While *Helicoverpa* control is heavily based on insecticides, chemical control of shoot and panicle feeding insects on cereals is beyond the reach of resource poor farmers in the SAT regions in Asia, Africa, and Latin America. For many diseases and *Striga*, cost effective technologies are yet to be worked out. Current sensitivities about environmental pollution, human health, and pest resurgence are a consequence of improper use of synthetic pesticides. Host-plant resistance, natural plant products, bio-pesticides, natural enemies, and agronomic practices offer a potentially viable option for integrated pest management (IPM). They are relatively safe for the non-target organisms and human beings. Modern biotechnological tools such as marker assisted selection, genetic transformation, and wide hybridization to develop crop cultivars with resistance to insect pests and diseases will have a great bearing on future pest management programs. Insect and disease modeling, decision support systems, and remote sensing would contribute to up scaling and dissemination of the IPM technologies. Robust IPM technologies need to be tested and promoted to the farming communities in the SAT. Current research projects in biotechnology, crop improvement, and natural resource management focus on the major pests such as pod borers (*Helicoverpa*, *Maruca*, and *Melanagromyza*), Fusarium wilt, and sterility mosaic in pigeonpea; *Helicoverpa*, Wilt, and Botrytis gray mold in chickpea; Rossette virus, foliar diseases, Aflatoxins, and leaf miner in groundnut; *Striga*, grain molds, shoot fly, stem borers, midge, and head bugs in sorghum; and downy mildew, stem borer and head miner in pearl millet. IPM promotion and capacity building are significant components of research at ICRISAT. The outputs from this research will lead to sustainable management of insect pests and diseases of cereals and legumes based cropping systems, thereby improving the livelihoods of poor people in SAT.

IPM Research Activities at ICRISAT

- Development of crop cultivars resistant to insect pests (mainly shoot fly, stem borers and midge in sorghum, and *Helicoverpa* in chickpea and pigeonpea) and diseases (mainly downy mildew in pearl millet, grain molds and leaf diseases in sorghum, wilt and sterility mosaic in pigeonpea, and wilt, Aschochyta blight and botrytis gray mold in chickpea, and Aflatoxins, early and late leaf spots, clump, rosette and stem necrosis viruses in peanut).
- Bio-control of crop pests through rational deployment of natural enemies (mainly stem borers, midge, *Maruca* and *Helicoverpa*), biopesticides (*Bacillus thuringiensis*, NPV,

Trichoderma, *Pseudomonas*, etc.) natural plant products (neem, custard apple, *Pongamia*, etc.), and crop management practices (intercropping, trap cropping, bird perches, tillage, etc.) for insect pest and disease management.

- Develop for packages for the management of insect pests and diseases in the context of resource management in the semi-arid tropics in Asia and Africa.
- On-farm testing of IPM packages for insect pest and disease management.
- IPM strategies for management of termites and white grubs.
- Role of transgenics (particularly cotton, chickpea and pigeonpea with Bt genes) in IPM, and their effect on the non-target organisms.