



IAPPS NEWSLETTER

Number III Volume 20

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ICIPE DEVELOPS SAFE NEW METHODS FOR CONTROLLING STEM BORERS, TERMITES AND STRIGA

A simple method based on careful intercropping developed by the Nairobi-based International Centre of Insect Physiology and Ecology (ICIPE) is one of three new approaches being introduced to dramatically reduce losses in maize from stem borers, termites and the parasitic weed striga without the use of chemical pesticides. Maize is the most important crop in eastern and southern Africa, but losses from stem borers run to 15-40 % in the region, and from striga (*Striga hermonthica*) another 10-20%. When these two pests occur together, farmers can lose their entire crop. By preventing such losses, an additional 6-8 million people in the region could be fed.

A TRIPLE WINNER WITH 'PUSH-PULL'.

Working in collaboration with the Kenya Agricultural Research Institute (KARI) and Ministry of Agriculture and IACR-Rothamsted (UK), ICIPE has developed a "habitat management" system which uses two kinds of crops that are planted together with maize: a plant that repels the borers (the push) and another that attracts (pulls) them. Called "push-pull", this habitat management system based on the ages-old African practice of mixed cropping, helps restore the balance of nature that humankind has disturbed by improper agricultural practices such as over-intensive monoculture, misuse of pesticides, and soil depletion.

The push-pull system has been tested on farms in six districts of Kenya and has now been released for use by the national extension systems in East Africa. Participating farmers in Kenya's breadbasket region of Trans Nzoia are reporting a 15-20 percent increase in maize yield. In the semi-arid Suba District, plagued by both stem borers and striga, a substantial increase in milk yield has occurred in the last 4 years, with farmers now being able to support grade cows on the fodder produced. When farmers plant maize, napier grass and desmodium together, a return of US \$2.30 for every \$1.00 invested is made, as compared to only \$1.40 obtained by planting maize as a monocrop. All of this is being accomplished right now, using the conventional hybrid seeds presently available, and without the need for expensive inputs such as synthetic pesticides and fertilizers or genetically modified (GM) seeds.

Two of the most useful trap crops that pull in the borers' natural enemies are Napier grass (*Pennisetum purpureum*) and Sudan grass (*Sorghum vulgare sudanese*), both important fodder plants; these are planted in a border around the maize. Two excellent borer-repelling crops, planted between the rows of maize, are molasses grass (*Melinis minutifolia*), which also repels ticks, and the leguminous silverleaf (*Desmodium uncinatum*). Desmodium has proved to be winner with a triple action: when intercropped with maize, it can suppress striga by a factor of 40 compared to maize monocrop; its N-fixing ability increases soil fertility; and it is an excellent forage. As an added bonus, sale of desmodium seed is proving to be a new income-generating opportunity for women in the project areas.

The ICIPE project, led by Principal Scientist Dr Zeyaur Khan, has also identified over 30 wild grasses (Gramineae) that can serve as the wild hosts of stem borers, and which might also prove to be candidates for use as trap plants in the push-pull tactic. The project's results demonstrate the importance of maintaining part of the wild habitat for future ecological benefits and agricultural sustainability. They also stress the value of keeping wild germplasm free from genetic pollution, as might occur with the use of certain GM crops. The underlying mechanism and chemistry of the attractive odors given off by the trap plants is being investigated for possible use in odour-baited traps for the borers.

The work on stemborers and striga is being funded by the Gatsby Charitable Foundation, UK and the Rockefeller Foundation.

ICIFE has worked closely with local institutions throughout the project. The maize varieties used for planting were developed by KARI and are the kind of improved hybrid seeds that ICIFE will continue to use until the Centre is convinced that Bt-engineered maize is safe and provides additional benefits. Dr Hans R. Herren, Director General of ICIFE and Dr Perry Atkinson of Texas A & M University, both winners of the prestigious World Food Prize for their contributions to world food security, share the belief that long-term food security relies, among other factors, on the health of the soil biota and maintaining the land's biodiversity.

In this regard, amid the growing concern about the introduction of Bt maize and other genetically modified crops without adequate information on their long-term impact (e.g. their effects on non-target organisms, pest resistance, and gene flow into other plants), ICIFE will be addressing some of these issues in its research agenda on the environmental impact of GM crop deployment. The need for more basic research before GM crops are deployed has been stressed in a recent report (Genetically Modified Pest-Protected Plants: Science and Regulation, ed. P. Atkinson, National Academy Press, 2000) of the US National Academy of Sciences on genetically engineered food.

COTESIA FLAVIPES - AN EFFECTIVE LITTLE WEAPON IN THE BATTLE OF THE BORERS.

The spotted stemborer (*Chilo partellus*) is probably the most damaging of the five stemborers that occur in Kenya. *Chilo* eats more than the other borers, and since its introduction into Africa in the early 20th century, is slowly displacing the native stemborers. Because it is a foreign or 'exotic' species, it has no effective natural enemies in Africa. In 1993, ICIFE introduced a small parasitic wasp called *Cotesia flavipes* from the borer's native home in Asia to biologically control the pest. The wasp kills the borers by searching out the larvae deep inside the stem and laying its eggs in the pests; the wasp eggs then hatch out and consume the borer from within. ICIFE is working closely with national programmes in Kenya, Uganda, Somalia, Ethiopia, Mozambique, Malawi, Zambia, Zimbabwe and Zanzibar, to release *Cotesia* in these countries.

Dr William A. Overholt, the Programme Leader, reports that following its initial releases in three locations in Kenya's Kwale and Kilifi districts, the wasp has now spread across the southern part of the country from the Indian Ocean to the shores of Lake Victoria. In the 4-year period after its release, the wasp density remained low, but from 1997 onwards has been noticeably reducing the stemborer populations in the coastal area and some parts of Eastern Province. The little wasp is already cutting the borer populations by as much as half in Kwale and Kilifi districts. When used together with other stemborer control tactics in an IPM strategy, this classical biological control effort will result in increased maize yields. This is being done at no cost to the region's farmers through the assistance of ICIFE's donors: the Netherlands Government, USAID, and the Rockefeller Foundation.

TERMITE CONTROL IN MAIZE.

Termites are becoming a serious threat to maize in many areas of eastern and southern Africa. Growers in parts of Uganda and at the Kenya coast report 100% losses in some fields following the introduction of improved maize varieties that lack natural resistance. Plants are attacked at all stages, but particularly when the crop is more mature. With support from ICIFE's Core Donors (Sweden, Norway, Finland, Switzerland, and Denmark), the Centre has developed a fungal product to control termites within their mounds and in crops. Unlike the commercial chemical pesticides used to control termites, this product is harmless to humans and other animals and can be prepared locally at a fraction of the cost. Dr Nguya Maniania, the Congolese scientist working for ICIFE who isolated the *Metarhizium* fungal strain and developed the product, reports that preliminary trials in termite-infested fields in Uganda have shown a 70% increase in maize yields when the soil is treated with the fungus. Moreover, the effect on the termite population lasts more than one season, which makes the product more convenient and affordable to use. Private partners are being sought to fund large-scale production of the product.

CAPACITY BUILDING.

An important part of ICIFE's mandate is the building of the region's human and institutional capacity to carry out its own research and pest management programmes. The Centre has thus far trained over 130 African scientists at PhD level through its ARPPIS Programme in collaboration with 27 of the continent's universities. A further 6000 people have been trained through short courses, training workshops and other programmes.

By working in multidisciplinary teams of scientists and in close collaboration with national partners, other international research organisations, universities and the communities themselves, ICIFE is introducing efficient and sustainable pest management tactics that are harmless to the environment, and are within reach of Africa's poorest farmers.

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The British Crop Protection Council 2000 Meeting at Brighton, England - Pest and Disease

This year's meeting not only provided information on several new insecticides and fungicides, but also had a variety of symposia topics. The program opened with a brief presentation by the new president of the BCPC and former president of the UK Farmers Union, Sir David Naish. The president emphasized the past promotions to expand agriculture in the western world; however, the current atmosphere is focused on sustainability. The opening lecture (Fredrick Bawden Lecture) was given by David Evans, the new head of research and technology at Syngenta. His presentation focused on the estimation that by the year 2025 the world population will be 8 billion people; all of our technology will be needed to feed those people.

Symposia included:

- Human Exposure to Pesticide Residues, Natural Toxins and GMO's - Real and Perceived Risks. This symposium provided a historical review of pesticide development and regulations and some of the considerations made in their use and approval.
- Who Controls Crop Protection Programs? This symposium had a variety of papers outlining the different regulatory aspects in Europe. These included the European retailers (EUREP) and their responsibilities in meeting certain standards on products supplied globally.
- Organophosphate Insecticides (OPs). This symposium gave a history of OPs and some of the benefits they provide. Global use of OPs is the highest among all insecticides at 36%, and the OP with greatest use is chlorpyrifos.
- Pesticides Available on Minor Crops. In many of the EU countries the growers rely on "off-label" uses at their own risk. One program that may help increase minor use registrations is The Minor Use Recognition "Voluntary Mutual Recognition" (VMR). This program requests data from one EU country be used to support the use in another. If this program is not successful, each country will have to continue developing their own data; this requires extensive resources.

Several new chemistries of insecticides and fungicides were presented including these insecticides:

- Thiacloprid, Bayer's second-generation neonicotinoid that controls sucking insects with *Aphis gossypii*, potato beetle as the specific pest of interest.
- ANS -118 (Chromafenozide), a novel insecticide by Nippon - Kayaka and Sankyo, for control of lepidopteron insects.
- DBI - 3204(Bistriflural), benzolphenyl urea insecticide, IGR, chitin synthesis inhibitor. Controls lepidopteron insects, beetles, whiteflies, beet armyworm and diamondback moth.
- *Bacillus thuringiensis* (BF), good activity in tomatoes grown in nematode infested soils. Evaluated a "total green" approach that included solarization/BF only. Compared to methyl bromide treated tomatoes, yields were slightly lower
- BAJ 2740 (Spirodiclofen tetrionic acid), novel broad spectrum acaricide (mites) by Bayer. Controls at all stages, long lasting activity and good plant compatibility.
- IKI-220- from ISK (Ishihara Sangyo Kaisha), controls aphids. Rapid and strong anti-feeding activity, long residual.

and these fungicides:

- Picoxystrobin from Syngenta, broad-spectrum disease control, curative abilities, redistribution within the plant through the xylem and vapor activity, and is generally more active than azoxystrobin.
- BAS 500F (Pyraclostrobin) from BASF, has excellent crop safety, except concord grapes. Locally systemic with excellent translaminar activity. Curative against grape downy mildew. Controls diseases caused by four classes of fungi.
- SYP-L190, introduced by Shenyan Research Institute of Chemical Industry in the People's Republic of China. Active against plant diseases caused by Oomycetes. Fluorine -containing analog of dimethomorph (Acrobat) that has better curative and anti-sporulant activity than dimethomorph. Approximately twice as active on cucumber downy mildew as dimethomorph.
- Simeconazole F-155, introduced by Sankyo. Triazole fungicide that will be used as a seed-treatment. First triazole shown to be able to control rice sheath blight, caused by *Thenatephorus cucumeris*. Broad spectrum activity and especially active against Basidiomycetes. Systemic in the plant and will be available as a controlled release formulation that gives activity on powdery mildew of cereals to growth stage 75. Will initially be developed as a seed-treatment for cereals and then other crops.

The IAPPS Newsletter is published by the International Association for the Plant Protection Sciences and distributed in Crop Protection to members and other subscribers. Crop Protection, published by Elsevier, is the Official Journal of

IAPPS.

IAAPS Mission: to provide a global forum for the purpose of identifying, evaluating, integrating, and promoting plant protection concepts, technologies, and policies that are economically, environmentally, and socially acceptable.

It seeks to provide a global umbrella for the plant protection sciences to facilitate and promote the application of the Integrated Pest Management (IPM) approach to a the world's crop and forest ecosystems.

The *IAPPS Newsletter* welcomes news, letters, and other items of interest from individuals and organizations. Address correspondence and information to:

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