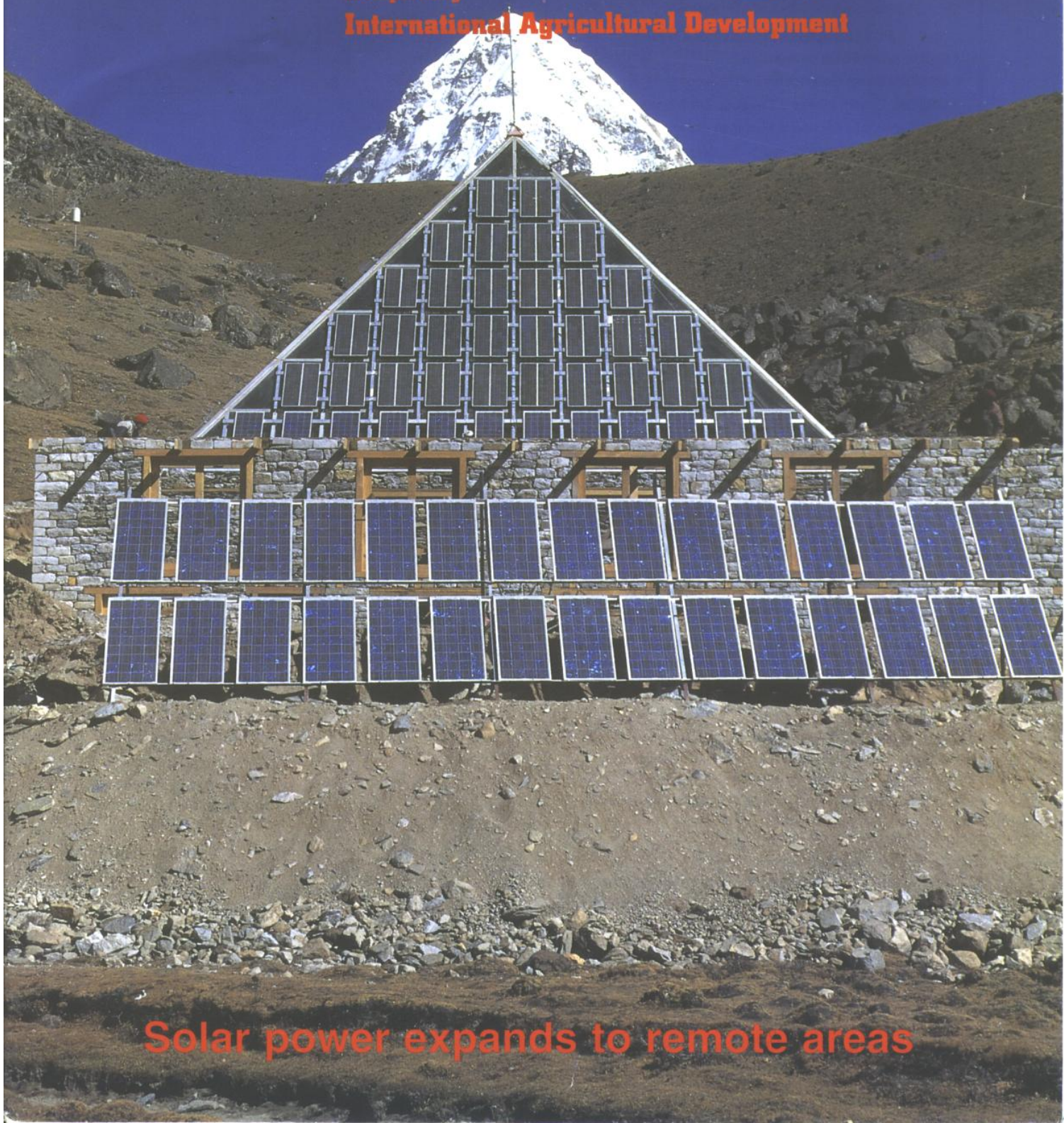


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Appropriate Technology

Incorporating
International Agricultural Development



Solar power expands to remote areas

Pests are 'pushed and pulled' out of maize crops

Maize is the most important food crop in eastern and southern Africa, but losses from pests and parasitic weeds can be substantial. Tervil Okoko reports on three novel approaches developed by the Kenyan-based International Centre of Insect Physiology and Ecology (ICIPE) to dramatically reduce these losses.



A field using the 'push-pull' strategy for controlling stem-borers. Rows of maize with desmodium - the repellent plant - planted between the rows, and the trap plant - Napier grass - planted on the field border. A maize field using this push-pull strategy can control both stemborers and striga weed and yield more maize.

Intercropping maize with plants that repel or push pests onto more attractive grasses grown on field boundaries is one of the strategies helping Kenyan farmers to increase yields.

Stem-borers, which can reduce maize yields by nearly 50 per cent, don't like forage plants like molasses grass (*Melinis minutiflora*) or desmodium (*Desmodium uncinatum*). Planting them between rows of maize drives or pushes the pest away to napier grass (*Pennisetum purpureum*) on the field boundary. Napier grass lures or pulls the stem-borers because it produces an attractive sticky substance, which eventually traps and kills them.

Desmodium has another useful trait: it exudes some sort of chemical that the parasitic weed striga (*Striga hermonthica*) doesn't like. Striga can reduce yields by 10-20 per cent.

"When these two pests occur together, farmers can lose their entire crop. By preventing such losses, an additional six to eight million people in the

region could be fed," says Dr. Zeyaur Khan who leads the stem-borer push-pull research project.

Working in collaboration with the Kenya Agricultural Research Institute (KARI), ministry of agriculture and IACR-Rothamsted of UK, ICIPE has developed the "push-pull" system. This habitat management system is based on the ages old African practice of mixed cropping and 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.

Sudan grass (*Sorghum vulgare* sudanese) can also be planted on field edges to pull the pests away from maize, and like napier grass has other uses such as fodder for cattle. Desmodium is also a useful fodder plant.

"Desmodium has proved to be a winner with a triple action: when inter-cropped with maize, it can suppress striga by a factor of 40 compared to maize monocrop. Its nitrogen-fixing ability in-

creases soil fertility; and it is an excellent forage," says Dr. Khan.

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 has also identified over 30 wild grasses 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.

According to ICIPE's information officer, Ms Annalee Mengech, the "push-pull" system has been tested on farms in six districts of Kenya and has now been released for uptake by the national extension systems in East Africa.

Participating farmers in Kenya's breadbasket region of Trans Nzoia district are reporting a 15 to 20 percent increase in maize yield.

In the semi-arid Suba District (on the shores of Lake Victoria) - plagued by both stem-borers and striga weed - a substantial increase in milk yield has occurred in the last four years, with farmers now being able to support grade cows on the fodder produced, says Ms Mengech.

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, she adds.

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 fertilisers or genetically modified (GM) seeds.

The ICIPE scientists say 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 odours given off by the trap plants is being investigated for possible use in odour-baited traps for the borers. The work on stem-borers and striga is being funded by the Gatsby Charitable Foundation, UK and the Rockefeller Foundation.

ICIPE 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 ICIPE 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 ICIPE 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 and maintaining the land's biodiversity.

Parasitic wasp

The spotted stem-borer (*Chilo partellus*) is probably the most damaging of the five stem-borers 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 stem-borers.

Because it is a foreign or 'exotic' species, says Dr. Khan, it has no effective natural enemies here in Africa. In 1993, ICIPE 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



Mrs. Ouso, a farmer in the Suba District of Kenya, standing next to her maize crop, which is protected from stem-borers by the desmodium growing beside the maize and the napier grass growing to her left. In 1998 she adopted the push-pull strategy developed by ICIPE. Now she is one of the 450 happy farmers who can grow more maize, feed their family and send their children to school. On a plot 30m by 30m, Mrs. Ouso grows 500 kilograms of maize, and sells napier grass and desmodium for Ksh 4,500 (\$60) per year. She uses this money to send her children to school.

Credit: ICIPE

wasp eggs then hatch out and consume the borer from within.

ICIPE is working closely with national programmes in Kenya, Uganda, Somalia, Ethiopia, Mozambique, Ma-

lawi, Zambia, Zimbabwe and Zanzibar, to release *Cotesia* in these countries.

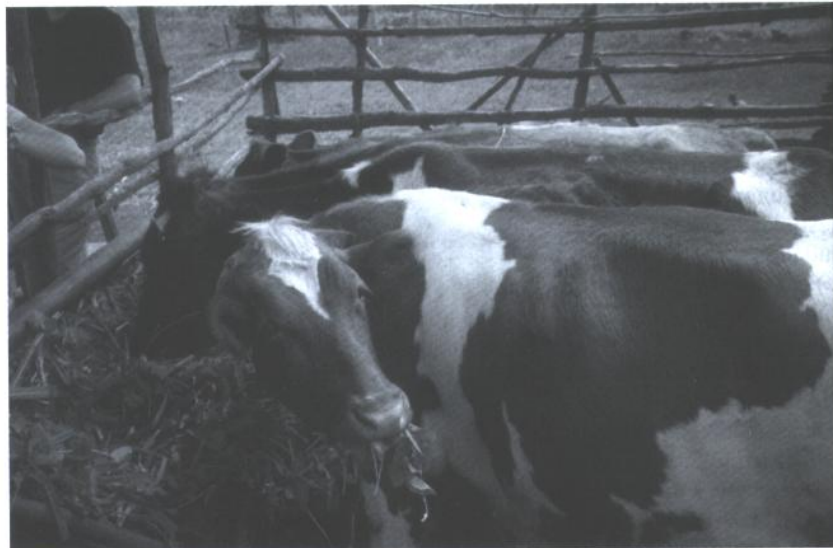
Dr William A. Overholt, the wasp programme leader, reports that following its initial releases in three locations

'Push-pull' strategy increases milk production

Mrs. Omulo, a farmer in Lambwe, Kenya uses napier grass and desmodium from the push-pull strategy to feed her grade cows. Mrs. Omulo never had any improved cows before 1998 when she adopted the push-pull strategies. Now she has 4 improved cows. Her family gets enough milk to drink and she makes money by selling milk. She calls herself a happy farmer.

Mrs. Omulo's improved dairy cows enjoying a feed of desmodium and napier grass.

Credit: ICIPE



Lambwe is in the Suba District of Kenya, which is a milk-deficit region. It produces only 7 million litres of milk, far short of the estimated annual demand of 13 million litres, and has mostly indigenous livestock (zebu).

In this district, a major constraint to keeping improved dairy cattle for milk production is the unstable availability and seasonality of feed, often of low quality. 'Push-Pull' strategies, adopted by 150 farmers in this district, have enhanced livestock feed supply and milk production by allowing the number of improved dairy cattle to increase from 4 in 1997 to 270 in 2000.

It is expected that with this rate of growth in improved dairy cattle, the district will be self sufficient in milk production by 2005.

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 four-year period after its release, the wasp density remained low, but from 1997 onwards it has been noticeably reducing the stem-borer populations in the coastal area and some parts of Eastern Province, says Dr. Overholt.

The little wasp is already cutting the borer populations by as much as half in Kwale and Kilifi districts. When used together with other stem-borer control tactics, this classical biological control effort will result in increased maize yields, says the scientist.

"This is being done at no cost to the region's farmers through the assistance of ICIPE's donors- the Netherlands government, United States Agency for

International Development (USAID), and the Rockefeller Foundation.

Termites

But as scientists battle the stem-borer across the globe, 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 lacking natural resistance. Plants are attacked at all stages, but particularly when the crop is mature.

Besides the stem-borer project, ICIPE scientists, with support from Sweden, Norway, Finland, Switzerland, and Denmark, 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, who isolated the *Metarhizium* fungal strain and developed the product, reports that preliminary trials in termite-infested fields in Uganda have shown a 70 per cent 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, says Dr. Maniania.

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EU Senegalese fisheries bid alarms WWF



The European Union's bid for an increase in fishing rights in Senegalese waters threatens the survival and sustainability of these fishermen.

The European Union's bid for a 60% increase in fishing access rights in already overexploited Senegalese waters, threatens the survival and sustainability of these fisheries, and contradicts proposed EU policy, says

WWF International.

"The European Commission knows first-hand the devastating effect ill-managed fisheries have had in its own waters," said Dr Claude Martin, Director-General of WWF International

in an open letter to EU Fisheries Commissioner Franz Fischler opposing the EU's plans. "It is inconceivable to think the Commission would use taxpayers' money to export this unsustainable fishing practice to threatened coastal states in West Africa."

With Africa's fisheries increasingly under pressure from highly-subsidised foreign fishing fleets, and lack of resources hampering the monitoring systems of most governments, reports that the EU is seeking to increase its access to fisheries in upcoming talks with Senegal also signals the urgent need to create national and regional fisheries' management plans.

Every year, the EU spends about 270 million Euro to purchase access to fisheries' resources in other countries, the majority of which are in Africa. While this brings in much-needed foreign-currency to these countries, the payments are often way below the real market value.

WWF believes that the European Union should match its words with action. There is potential for both West Africa and Europe to benefit from sustainable and equitable fisheries co-operation, but this is not what is being offered.

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