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Striga: taming the maize monster

[Technology Survey Article]

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1 INTRODUCTION

Maize is one of the most important food crops in Sub-Saharan Africa, accounting for nearly 40% of total cereals production in the continent. Besides human food, maize is also a major source of feed for livestock, especially cattle and poultry. Therefore, shortages of this important commodity are invariably accompanied by strongly negative ripple effects on food and feed markets, which could ignite social unrest as witnessed in several countries in the recent past.

Despite the importance of maize in Africa, average yields are low at 1.5 ton/ha which compares poorly to the >8 ton/ha in developed countries. Several factors are responsible for these low yields, and one of the major production constraints is the parasitic plant, Striga, also known as witchweed. This weed can reduce yields by up to 100%, leading to serious food shortages in affected areas. In western Kenya, for example, the weed is estimated to cover >210,000 ha of land under maize and is ranked as the major cause of hunger. Across Africa, Striga is estimated to cover over 2.5 million ha of land that is under maize production, with yield losses nearing two million tonnes with a market value of almost 0.5 Billion USD.

The rapid spread of Striga has been partly attribute to rapid and unchecked clearing of land for agriculture, which is associated with loss of plant species that might have naturally suppressed Striga population build up; and the increased introduction and cultivation of non-native and highly susceptible cereal crops, e.g. maize. Striga seed can also survive for long periods of time in the soil, germinating when conditions are favorable and suitable host plants present.

2 INNOVATION FOR STRIGA MANAGEMENT

In the recent past a highly effective technology for Striga management based on herbicide resistance has been developed. The technology was developed in a collaborative effort involving the International Maize and Wheat Improvement Center (CIMMYT), Weizmann Institute of Science (Israel), among other institutions and with funding from the Rockefeller Foundation. In Africa, herbicide resistance has been bred into maize at CIMMYT and at the International Institute of Tropical Agriculture (IITA), in collaboration with numerous NARS, while testing and validation of the technology has been spearheaded by the African Agricultural Technology Foundation (AATF). The germplasm upon which the Strigaway® initiative is built was provided by BASF, a multinational corporation that produces industrial and agrochemicals, among them Imazapyr, the herbicide at the center of the Striga management technology.

Initially, Imazapyr could be applied as a conventional spray with considerable success. However, this needed improvement to more precisely target the weed.

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3 HOW DOES THE TECHNOLOGY WORK?

Strigaway® maize is bred to be resistant to Imazapyr, a herbicide that is highly lethal to Striga. Previously, this herbicide was applied through conventional spraying to kill Striga. In the current technology, Strigaway® maize seed is coated with the herbicide. As the maize seed germinates, the maize plant imbibes the Imzapyr. As the maize plant grows, its roots exude compounds into the rhizosphere (soil zone around the roots). These compounds stimulate the Striga seeds nearby to germinate and produce specialized tubular structures (called haustoria) that attach and extend into the maize plants to suck and extract nutrients. The process of extracting nutrients is highly detrimental and retards growth of maize plants that are not resistant to the weed. However, when Striga attempts to extract nutrients from Strigaway® maize, the haustoria also take up the herbicide and transmit it further into the weed tissues, thus triggering death of Striga plants.

4 TESTING OF STRIGAWAY® MAIZE IN KENYA

In large-scale trials coordinated by AATF, Imazapyr resistant (IR) maize was tested in over 13,000 farms in western Kenya in 2005-2006. This was compared to other technologies including Striga resistant maize (KSTP94) from the Kenya Agricultural Research Institute (KARI); push-pull system developed by the International center for Insect Physiology and Ecology (ICIPE) and soil fertility management systems developed by the Tropical Soil Biology and Fertility Institute (TSBF) of CIAT. The study was facilitated through the Western Regional Alliance for Technology Evaluation (WeRATE) network comprising of over ten NGOs and several farmers organisations. In western Kenya, Strigaway® maize is called *Ua Kayongo* (kill striga) and this treatment was most found to be the most effective compared to others (Table 1).

Table 1: Comparison of Strigaway® maize to other technologies for Striga management in Western Kenya (*data from AATF Annual Report 2006*).

Treatment	Yield (ton/ha)	Net returns/season	Striga expression (stems/maize plant)
Strigaway® maize	2.6	371	0.5
H513 (susceptible)	1.58	228	2.6
Other treatments	2.29		0.9

It is nevertheless appreciated that the superior effectiveness of Strigaway® technology would be maintained and possibly enhanced by integrating other proven measures. These could incorporate cultivation of legumes that suppress Striga growth, e.g. groundnut and soybean. Such legumes are known that trick the weed to germinate in absence of a host to sustain it, thus committing suicidal germination. These legumes are highly valued since they are consumed in households or sold for cash, while the residues can be used as fodder. Desmodium, as demonstrated in the push-pull system, can be used to manage Striga and contribute to animal fodder. Other measures could be aggressive rouging of any surviving Striga plants before they flower, so as to continuously reduce the seed bank in the soil.

5 OTHER CONSIDERATIONS

For farmers in Sub-Saharan Africa to take up and benefit from the effectiveness of the Strigaway® technology, several issues need to be considered. The AATF-led initiative has identified the key issues as being those that touch on packaging (availability of products that embody the technology); scalability (what would enhance appeal of the technology in other locations that share similar constraints); and sustainability (the ability of the technology to achieve and maintain its own momentum, and to retain relevance and application even in absence of external support.

6 CHALLENGES

The trials in Kenya showed that the Strigaway® technology nearly doubled maize yields to 3 ton/ha and was highly effective in suppressing Striga. Although the maize seed was planned to be commercially available in Kenya from 2007, the anticipated supply could take a while to fulfill the expected demand. Therefore, strategies would be needed to considerably raise production of certified Strigaway® maize seed.

Collective action between farmers is also necessary for preventing weed spread or re-infection of clean fields. Other proposed action could include measures to limit runoff from infested fields and limiting livestock movement and human activity in infested areas. Community based initiatives are considered to have great potential towards effective Striga management.

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