A call to action by

The African Agricultural Technology Foundation

Empowering African Farmers to Eradicate *Striga* from Maize Croplands

better tools, better harvests, better lives

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ISBN 9966-775-02-1

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Acknowledgement

Much of the information about different *Striga* control practices and their accompanying photographs were provided by cooperators of the AATF *Striga* Management Project. Special thanks are due to Canon EN Savala (FORMAT, photos), John Maina (SACRED Africa, field data), Celestine Wekesa and Patrick Nekesa (Resource Projects Kenya, farmer impressions). The comments from five farmers combating *Striga* in west Kenya, Teresa Lubusi, Dick Morgan, John Kundu, Rose Katete and Ben Matumbo, are greatly appreciated.

Correct citation: AATF (2006) Empowering African farmers to eradicate *Striga* from maize croplands. The African Agricultural Technology Foundation. Nairobi, Kenya. 17 pp.

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Striga eradication from maize croplands: a call to action by The African Agricultural Technology Foundation

Summary

This booklet calls for a comprehensive campaign to eradicate *Striga* from Africa's maize croplands. *Striga* is a parasitic weed preying upon cereal crops that has infested 2.5 million hectares of maize. This biological invasion results in economic losses of over US $1 billion per year and is a leading cause of food insecurity and rural stagnation. For decades, Africa's small-scale farmers were powerless to control this menacing plant parasite but recent technological breakthroughs are now available to reverse this situation. These new technologies include the development of herbicide-resistant and *Striga*-tolerant maize varieties and the cultivation of companion legumes that suppress *Striga* and neutralise its seed in the soil. Past experience suggests that new technologies alone are insufficient to effect change but must rather be incorporated into a well coordinated effort that involves priority setting, capacity building, farmer empowerment and commercial investment.

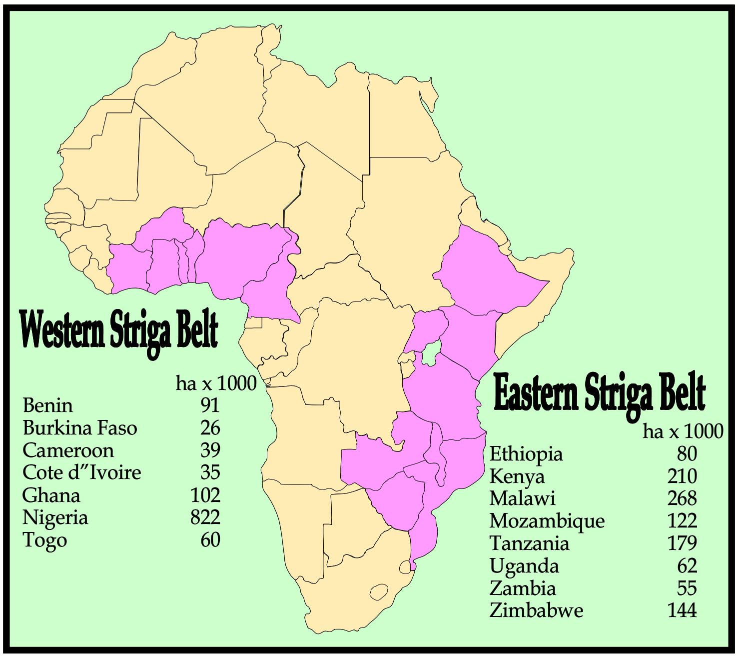
Guidelines for conducting *Striga* eradication in maize fields have been developed. We suggest it be first initiated in maize production areas of eastern, southern and western Africa because maize farmers there are best positioned to purchase necessary farm inputs and market resulting crop surpluses. National research systems must be assisted to better characterise, map and monitor *Striga* infestation and to adjust and validate introduced technical approaches. Extension information targeting grassroots organisations must be produced and distributed. National seed producers require assistance in obtaining speedy regulatory approval and licensing of necessary crop varieties. Stewardship programs that assure public acceptance, product quality and equitable returns must be installed. Moreover, it is essential that coercive measures, such as quarantines, penalties and mandatory field operations that proved successful in more developed settings are not imposed upon Africa's poor smallholders victimised by *Striga*, rather incentives must be provided so that households become ready adopters of new *Striga* eradication practices.

Striga eradication requires that very different partners work together toward a difficult common goal. Farmers must view themselves not as victims of *Striga* but rather as front-line cadres in the war against it. Rural households must be better positioned to assure acceptable returns to investment in new Striga management technologies. Farmer organisations are encouraged to voice their concerns about *Striga* and to train their members in the emerging opportunities for eradication. National agricultural research systems must assign greater importance and expertise to this problem. The private sector must appreciate the business opportunity for producing and distributing *Striga* control products. Policymakers must view the threat posed by *Striga* as a correctable situation and include *Striga* management within larger agendas for rural development. Donors should assign greater priority to the management of *Striga* in Africa and recognise that its eradication is consistent with other emerging paradigms for African economic recovery. Individuals and organisations committed to eradicate *Striga* are encouraged to contact AATF for more information on our planned eradication initiative (Email: aatf@aatf-africa.org. Website: www.aatf-africa.org).

The vision of *Striga* eradication

Striga is a parasitic weed that attacks important cereal crops throughout Sub-Saharan Africa. Two species of *Striga* parasitising Africa's cereals, *Striga hermonthica* and *Striga asiatica*, have infested an estimated 22 to 40 million hectares of farmland. The most deleterious effects occur under maize, where about 2.5 million hectares suffer grain losses of 30 to 80%, a setback valued at approximately US $1 billion per year. Clearly, *Striga* poses an ominous obstacle to a continent struggling with food insecurity and rural stagnation.

Fifteen countries of eastern, southern and western Africa account for 92% of the continent's *Striga* infested maize fields. For decades, agriculturalists advised maize farmers to combat *Striga* by careful weeding and burning but the parasite's infestation only continued to grow in size and severity. The efficacy of these practices is questionable because of the large numbers of seed produced by the parasite, between 50,000 and 200,000 per fully mature plant. These seeds remain dormant in the soil for 20 years, so routine field sanitation is insufficient to eradicate *Striga* once it becomes well established.



The Eastern and Western Striga *Belts, massive biological invasions of Striga into 2.3 million hectares of maize cropland.*

The agricultural community has responded to this threat by developing several new approaches to *Striga* control. These approaches involve crop resistance to systemic herbicides, *Striga* tolerant maize varieties, *Striga* suppression by non-hosts and trap cropping. Each of these approaches has demonstrated potential for adoption by small-scale farmers and isolated success stories have been documented. Now is the time to refine and integrate these control strategies into practices compatible with the operations familiar to small-scale farmers. Now is the time to deliver new opportunities for *Striga* control to farmers and empower them to overcome this sinister plant parasite. Now is the time to design and implement comprehensive campaigns to eradicate *Striga* from maize croplands. Now is the time to free rural households from the scourge of *Striga*!

Available *Striga* control technologies

It is indeed timely to deliver new *Striga* management technologies to hundreds of thousands of African farmers and to integrate this effort within larger national agendas for rural development. The most successful *Striga* management technologies are based upon inexpensive products and simple tools, and are readily combined into established field operations. Each control measure has specific advantages and disadvantages, suggesting opportunity for combination within locally-adapted *Striga* Eradication Initiatives

IR maize. This novel approach is based upon inherited resistance of maize to a systemic herbicide (imazapyr), a mechanism widely referred to as imazapyr resistance (IR). When IR maize seed is coated with the herbicide, germinated *Striga* seeds attempting to parasitise the resulting maize plant are destroyed. Imazapyr is marketed under the trade name *STRIGAWAY®*. Only 30 g of imazapyr coated onto seed is sufficient to protect one hectare of maize from *Striga* for six to eight weeks.

IR maize seed is coated with STRIGAWAY® to control Striga.

Push-pull. Push-pull is an agro-ecological approach to resist *Striga* by establishing a desmodium understorey beneath maize. Root exudates of desmodium induce dormant *Striga* seeds to germinate, a mechanism known as "suicidal germination". They also exude substances that are allelopathic (harmful) to *Striga* plants. This system recommends planting alternate rows of maize and desmodium and establishing napier grass around field margins to also lure stem borer insect pests away from maize.

Push-pull intercrops cereal with desmodium, a legume that suppresses Striga *and provides high quality livestock feed.*

Striga tolerant varieties. Several *Striga* tolerant maize varieties are available as either open pollinated or hybrid varieties. These lines both evade *Striga* by producing more roots below the parasite's seed bank distributed within the soil plow layer, and by expressing less phytotoxicity in response to *Striga* parasitism. While resistant varieties may yield better under moderate levels of *Striga* infestation, they do little to reduce *Striga* seed in the soil and may become overwhelmed under severe attack.

MBILI. MBILI was developed in west Kenya to improve the performance of maize-legume intercropping. It is based upon staggering every other maize row and growing legumes in the resultantly wider inter-row. This adjustment permits legume intercropping with legumes that suppress *Striga* through suicidal germination while also producing higher value pulse intercrops such as green gram, lablab, groundnut and soyabean.

Maize and lablab grown as staggered MBILI intercrops suppress Striga*.*

Legume Smother. The Legume Smother relies upon the suppressive effects of legume root exudates on *Striga.* Two grain legumes, groundnut and soyabean, are grown together in rotation with maize by planting them in alternating rows, allowing their roots to thoroughly explore the soil. As neither legume is a host of *Striga*, no parasitism is expressed but the *Striga* seed bank is decreased.

The Legume Smother grown in rotation with maize reduces Striga *seeds in the soil.*

Herbicides. The use of broadleaf herbicides, in both pre-emergent and post-emergent field application, is a valuable control measure of *Striga*, but one that is unfortunately beyond the investment abilities of most small-scale farmers. Herbicides (eg 2-4 D, Oxyfluorfen, WitchAway) were successfully employed against *Striga* in southern USA, and commercial cereal farms that are affected by *Striga* in Africa are encouraged to adopt similar programs. Many African farmers practice cereal-legume intercropping, a practice that is incompatible with field spraying. An intermediate technology applicable to small-scale farming may be the use of hand-held herbicide wicks to spot-treat *Striga* outbreaks but further technology and product development are required in this area.

Trap cropping. Trap cropping lures *Striga* to parasitise hosts prior to removal and disposal through rigorous field sanitation. Infested hosts are then removed early in the season, allowing the cultivation of a following crop grown under reduced pressure from *Striga*. Under no circumstances should the "trapped" *Striga* be allowed to mature, or the effort will prove counter-productive. Given the necessary investment in seed and labour, and the absence of direct returns, trap cropping is likely to be of minor importance within planned eradication initiatives.

Some maize varieties super-stimulate Striga *expression, a characteristic useful in trap cropping.*

No single *Striga* control practice is applicable to all situations, rather each has its comparative advantages and disadvantages (see table). Some practices are best suited to a particular agro-ecology while others are more readily adopted by better resource endowed households. Two general principles are useful, however, in the design of *Striga* control practices intended for use by small-scale farmers. First, different technologies may be combined. Herbicide resistant or *Striga*-tolerant maize varieties may be nested into agroecological approaches such as MBILI or push-pull.

Secondly, packages that "capture" a technology, or combination of technologies, may be assembled for site-specific distribution and marketing in *Striga*-infested areas. Innovative packaging of *Striga* control products can greatly facilitate the rapid evaluation and adoption of these new technologies. *Striga* eradication will always be knowledge intensive, and precautions that involve pre-packaged inputs accompanied by simplified or translated instructions can greatly reduce the burden and expectations placed upon poor farmers.

Striga *management technologies may be packaged for distribution within* Striga*-affected areas.*

Advantages and disadvantages of different *Striga* control technologies

Control	Advantages	Disadvantages
IR maize	Improves maize yield while reducing *Striga* biomass and seed bank in the soil	Proprietary germplasm requires negotiated access, seed must be coated with herbicide
Tolerant varieties	Maintains maize yield under modest *Striga* infestation	Does not reduce *Striga* infestation, overwhelmed under severe *Striga* infestation
Push-pull	Compatible with IR and tolerant varieties, reduces stem borer, lasts several seasons and provides livestock feed	Difficult and slow to establish, more difficult to weed, no opportunity for grain legume intercropping, lowers net return
MBILI	Compatible with IR and tolerant varieties, increases options for intercropped pulses	More difficult to plant and weed, requires several accompanying technologies
Legume Smother	Produces higher value oil seed, reduces *Striga* biomass and its seed bank in the soil	Requires large amounts of legume seed and maize must be grown in rotation, increases P requirement
Herbicide application	Compatible with IR and tolerant varieties, kills *Striga* shoots, suitable for different cereal crops	Expensive, seed bank unaffected, precludes legume intercropping, requires several accompanying tools and technologies
Trap cropping	Low cost, *Striga* lifecycle disrupted, seed banks reduced, provides livestock feed	Shortens crop growing season, larger labour requirement, little economic return

Principles of *Striga* eradication in Africa

Strategize. Formulate a *Striga* Eradication Initiative anchored within the country's rural development strategy. Map the distribution and severity of the *Striga* infestation within the country. Identify farmer associations and other institutions with interest and capacity to assist maize farmers to overcome *Striga* infestation and other production constraints. Assist farmers to better market their maize surpluses and form partnership among stakeholders in *Striga* eradication.

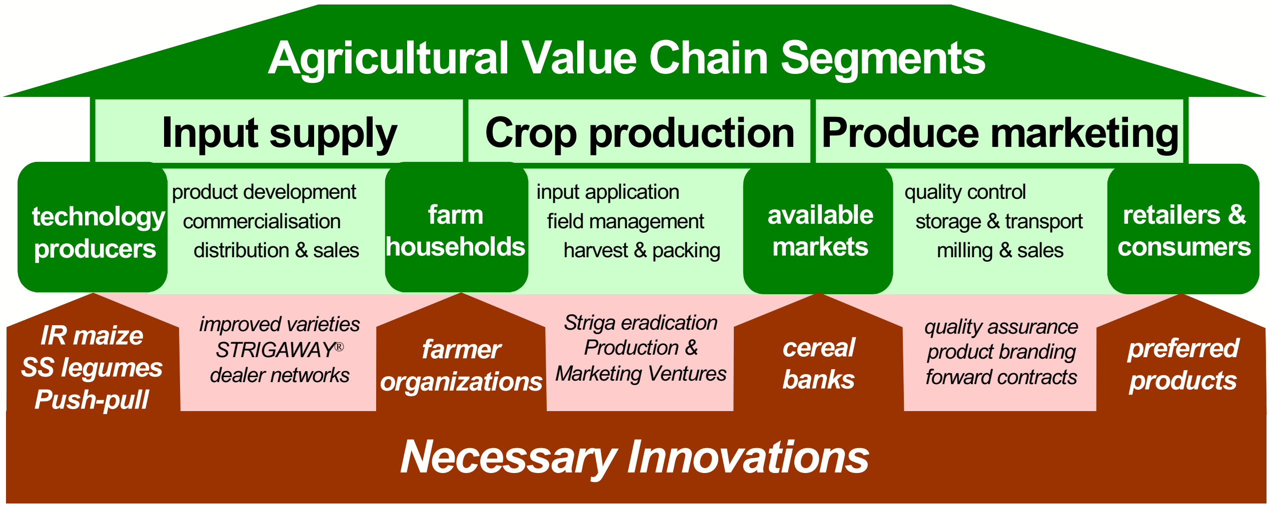
Advance imazapyr resistance. Focus technical efforts upon imazapyr resistant maize. Combine herbicide resistance with other proven *Striga*-suppressive technologies that reduce *Striga* biomass and seed banks in the soil. Encourage but do not rely upon the strategic use of post-emergent, broadleaf herbicide sprays.

Involve national scientists. Develop capacities for national research systems to characterise, map and monitor *Striga* infestation and validate new technical approaches. Introduce standardised methods so that results from different locations are better comparable. Involve national scientists in obtaining regulatory approval of new IR maize varieties. Transform appropriate *Striga* management technologies into field-tested input packages that are compatible with local farming practices.

Promote commercial opportunity. Assist national seed producers to acquire necessary regulatory approval and licensing for commercial release of locally adapted IR maize varieties. Facilitate registration of imazapyr by national regulatory agencies. Where appropriate, arrange for importation of treated IR maize from commercial suppliers in neighboring countries. Design stewardship programs to assure product quality, public acceptance and adoption of appropriate farm practices. Distribute IR and *Striga* tolerant maize varieties through input supply networks and innovative production and marketing ventures. Develop post-harvest handling procedures that match grain quality to the industry standards of top-end buyers.

Engage and empower *Striga* victims. Educate farmers on the threat of *Striga* and opportunities for its eradication. Involve farmers in the development of *Striga* management technologies through full participation in on-farm, pre-release field testing of "best-bet" *Striga* management technologies. Provide financial incentives for households to become early adopters of *Striga* eradication practices.

Disseminate through existing organisations. Facilitate product dissemination through collaboration with existing agricultural extension and NGO programs. Develop and distribute extension and information materials in local languages. Whenever possible, conduct field



Eradicating Striga *requires several innovations along the agricultural value chain.* Striga *control measures must become embodied within farm input products and promoted among small-scale farmers. Farm organisations must offer incentives for members to collectively adopt those products and fair markets must be secured to assure that the purchase and use of* Striga *control products remains profitable.*

campaigns through existing farmer associations by extending input packages to members on credit. Design and support integrated maize production and marketing ventures in *Striga*-affected areas.

Advance market-led paradigms. Market-led technology adoption relies upon the availability and profitable use of purchased farm inputs. Breakthrough technologies, including those that control *Striga*, must be transformed into products and commercialised. To beat *Striga*, farmers must purchase additional farm inputs and to do so requires that the resulting crop surpluses be profitably marketed. Agricultural value chain approaches recognise that no single technology or product stands alone, rather key farm inputs, new production technologies, post-harvest handling, processing and marketing represent a stepwise progression that offers opportunities to improve farm productivity, streamline field operations and increase household incomes.

Avoid coercive measures. *Striga* eradication measures that proved successful in more developed countries are not necessarily appropriate for Africa and its small-scale farmers. Legislating imposed quarantines of produce and equipment risks alienating farmers. To expect farmers to entirely abandon cereal cropping in favour of non-hosts, such as legumes or root crops, is unrealistic. Penalties for non-participation and failure must never be instituted upon the poor. Mandatory spraying of herbicides is fine in theory but unenforceable in practice. However, farmer organisations are well positioned to support some otherwise difficult measures through peer support and collective action.

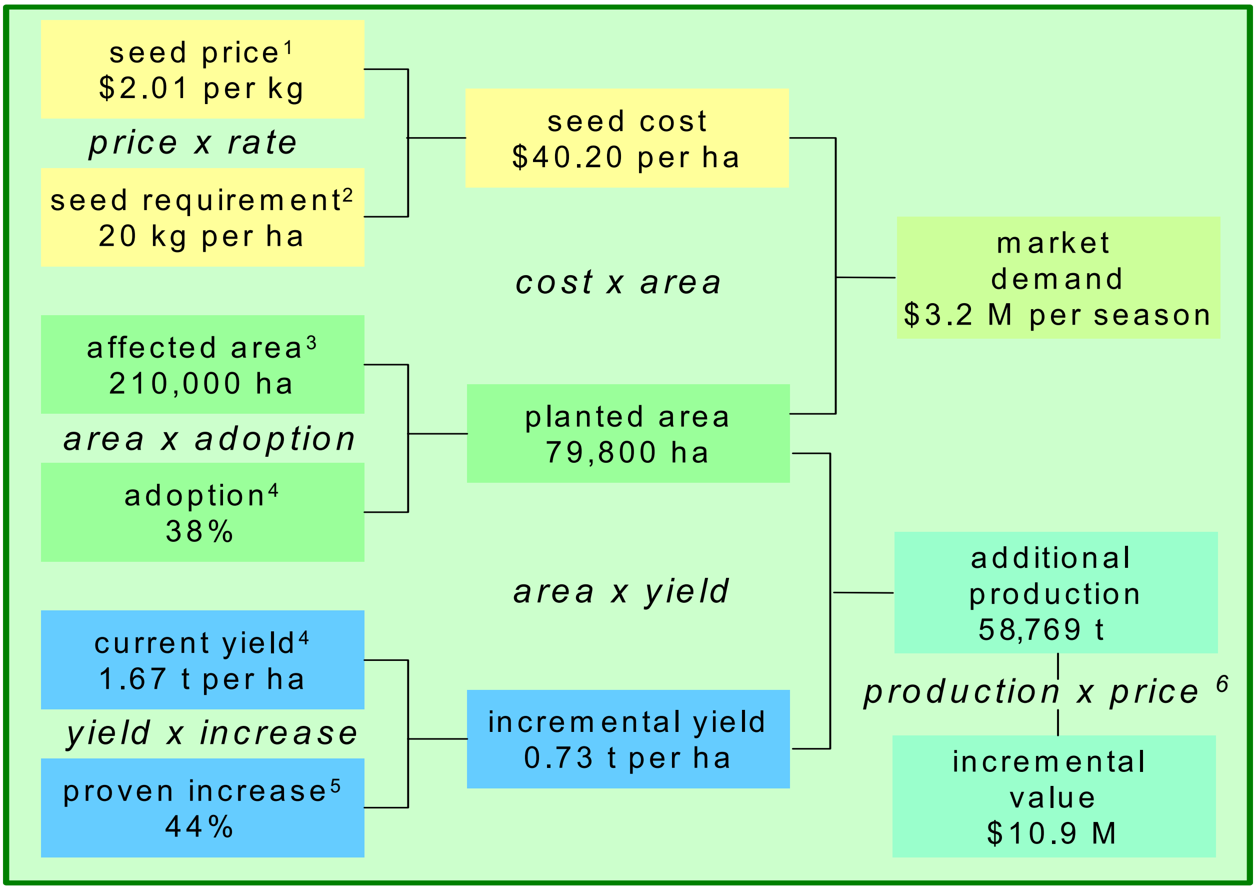
Striga reduction in west Kenya

Striga has infested over 210,000 ha of otherwise high potential cropland in west Kenya, driving households into extreme poverty and placing the nation's food security at risk. At the request of local farmer organisations in 2004, and with assistance from the Rockefeller Foundation and the African Agricultural Technology Foundation, national scientists and NGO partners developed a set of "best-bet" management options to combat *Striga*. By 2006, field tests were installed in over 9,400 farms. After only three seasons of intervention, impressive gains were being realised (see table below). All of the *Striga* control practices demonstrated potential benefits but IR maize resulted in the highest maize yield improvement and largest suppression of *Striga*. In general, better management of legume intercrops also resulted in greater economic return. Furthermore, the choice of *Striga* control measure may be adjusted for different agro-ecological and socio-economic settings. For example, maize-Legume Smother rotations are well suited to bimodal precipitation where weaker second rains jeopardise maize cropping while push-pull is best practised where farmers require additional feed for livestock. Clearly, the tools necessary to combat *Striga* are known, and adoptable by farmers. What remains to be accomplished is the integration of *Striga* management into broader rural development agendas in a manner that provides farmers with greater opportunity and incentive to eradicate the parasite from their fields.

Benefits obtained from *Striga* control practices compared to the recommended maize hybrid H513 over three seasons in west Kenya[1]

Striga control measure	maize yield improvement	economic return	*Striga* suppression
Imazapyr resistant maize	+44%	+50%	70%
Striga tolerant variety KSTP94	+41%	+61%	35%
Push-pull w/ WH502 & desmodium	+35%	-18%	41%
MBILI w/ WH502 & groundnut	+40%	+65%	41%
Legume Smother w/ soya & g'nut	na	+84%	na

[1] Compared to maize hybrid H513 intercropped with bean on 108 farms during 2005 and 2006. H513 average yield = 1.67 t ha^{-1}. H513 average net return $241 ha^{-1} $season^{-1}$. H513 average *Striga* infestation = 5.4 stems of *Striga* per maize plant



Calculated market demand for IR maize seed and incremental value of resulting maize harvest in west Kenya. Calculations follow: [1] KSh 290 per 2 kg bag at KSh 72 = US $1. [2] recommended planting rate for planting densities of 75 cm between and 30 cm within rows. [3] assumes 14% of Kenya's 1,502,000 ha of maize is affected by Striga. [4] based upon 88 striga-affected households surveyed by FM Mwaura in 2005. [5] baseline and IR maize yields of 108 farms over three seasons (2005-2006). [6] based upon KSh 1,200 per 90 kg bag at KSh 72 = US $1.

A key test for the commercialisation of a new crop or variety is the potential demand for its seed. For example, the value of this demand is related to the cost per unit area of planting IR maize and the total area planted. Based upon recent information collected in Kenya, the potential market demand for hybrid IR maize seed is 1,600 tons worth US $3.2 million per season (see figure and calculations above). Field investigations over the past two years suggest that planting IR maize in *Striga* infested fields rather than the currently recommended, but *Striga* susceptible Hybrid 513, improves yield by 44%. Based upon the expected proportion of farmers adopting IR maize in the *Striga*-affected area of west Kenya, maize production is expected to increase by 58,250 tons, worth about US $11 million. This analysis suggests that IR maize could become an important product among Kenyan seed producers and that the maize surpluses resulting from planting IR maize can greatly contribute to the rural economy of west Kenya.

Farmers' voices

IR maize (left) permitted Teresa Lubusi to re-establish maize on her *Striga*-infested smallhold in Vihiga.

Perhaps the most promising indicators of success come from farmers participating in the *Striga* management field tests of west Kenya over the past two years.

Teresa Lubusi, Vihiga. *I stopped growing maize for three years because of poor yields resulting from* Striga. *Before that time, I would harvest only 60 kg of maize from my 1.5 acre plot causing my family to endure severe food shortages. Since the introduction of IR maize, I now produce enough maize to feed my family. Last season, I harvested 135 kg of maize from only one kg of seed planted on one-tenth acre* (400 m^2)*. My neighbours were very curious about the sudden improvement in my farm and I encouraged them to plant IR maize too.*

Dick Morgan, Sabatia. *In our village,* Striga *weed poisons both maize and the soil. Farmers have named the new IR maize seed as "saviour". It is drought tolerant, fast maturing and performs better than any other maize where* Striga *is a problem. The best part about IR maize is that it seems to kill* Striga *in the soil.*

John Kundu's farm was transformed from a negative to a positive example of *Striga* management using IR maize.

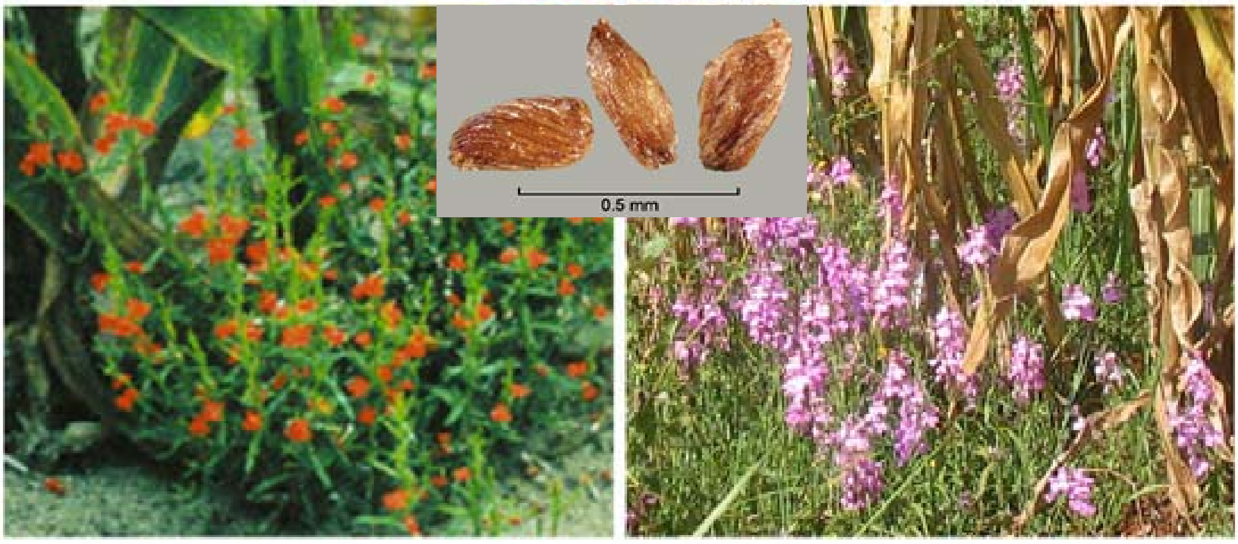
John Kundu, Bungoma. *An extension officer visited my farm in 2004 and was shocked by the extent of* Striga *damage to my maize and since then many farmers came to witness that problem. That was before I planted IR maize to fight* Striga. *Now, I invite the same farmers to see the improvement. Everyone in this area wants to buy IR maize now and we hope it becomes better available in the market soon.*

Striga-infested (foreground) and IR maize (background) at Rose Katete's farm in Angurai, Teso.

Rose Katete, Teso. *I pulled and buried Striga on my 5 acre farm for the past 17 years and the problem only grew worse. During a farmer field day we learned about herbicide-treated seeds and I was one of the first farmers in the community to receive the new IR maize seed. Ua Kayongo* (the first IR maize hybrid released in Kenya) *has provided the best crop of maize that I have ever grown!*

Ben Mutambo, Siritanyi. Striga *has been a problem in my farm since 1973 and no solution was available until I received* Ua Kayongo *(IR) maize from the* Striga *Network. IR maize withstands* Striga *and grows to the normal height even where Striga is very severe. Other maize hybrids are always overcome by* Striga *but not* Ua Kayongo *even though it looks weak at the beginning (a reference to the "yellow flush" observed as the imazapyr enters the maize seedling). I have been advising my fellow farmers who have the same problem with* Striga *to try it. I believe that I can clear the problem of* Striga *on my farm within three years if I continue planting* Ua Kayongo *maize and practice good weeding.*

Striga*-resistant maize overwhelmed by* Striga *(left) and the "yellow flush" signaling the translocation of imazapyr to the roots of IR maize seedling (right).*



Two species of Striga *are major pests of cereals in Africa,* Striga asiatica *(left) and* Striga hermonthica *(right).* Striga *spreads through the dispersal of its tiny seed (center), often through careless human activity.*

Frequently asked questions on *Striga* and its control

What is *Striga*? It is a parasitic weed that invades farms and infests cereals. It damages crop plants by attaching itself to their roots and feeding on their nutrients, causing the crops to be stunted, discoloured and twisted. It has invaded an estimated 22 to 40 million hectares of African cropland, causing damage in excess of US $3 billion per year. *Striga* is a major cause of food insecurity and rural stagnation in Africa.

Which crops and areas are affected by *Striga*? There are 40 species of *Striga* worldwide and 28 species in Africa. Two of these species are major pests of cereals, attacking maize, millet, sorghum, upland rice, sugarcane and Napier grass throughout Sub-Saharan Africa. *Striga hermonthica* is most common in western Africa and the Great Lakes Region while *Striga asiatica* invaded the eastern coastline and southern Africa (see photographs above).

What are other names for *Striga*? It is also called witchweed (Eng) because of the twisted, discolored growth of affected plants. Local names for *Striga* include buta (Kiswahili), kayongo (Luo), oluyongo (Luyha), imoto (Teso), wublum (Gushiegu), rooiblom (Africaans) and onime (Oshiwambu).

How does *Striga* spread? *Striga* seeds are very small (see photograph above) and easily carried on shoes or field tools, by livestock or in run-off and eroded soil. It is also possible to spread *Striga* through contaminated host seed. Severely infested cropland can contain 250,000 *Striga* plants and over 600 million dormant seeds per hectare. *Striga* seeds may remain dormant in the soil for 20 years leading to long-term infestation unless eradication measures are undertaken.

What have Africa's farmers done to fight *Striga* in the past? For many years, farmers were required by local authorities to weed *Striga* and pile it for burning or burial but this practice was largely abandoned as ineffective against well-established *Striga*. Largescale, integrated *Striga* eradication programs that succeeded elsewhere were never initiated in Africa.

What are the components of the *Striga* Eradication Initiative? This initiative is intended to educate stakeholders about effective *Striga* management, to provide farmers with the new technologies and tools to fight *Striga* and to assist national scientists to monitor crop improvement and reduction of the parasite. It establishes targets based upon the geographical areas and numbers of households affected by *Striga*. Over time, the initiative will reduce *Striga* in maize fields to non-significant levels and permit improved cultivation of other cereal hosts parasitised by *Striga*.

What are the new *Striga* management technologies? Herbicide-coated maize seeds and induced suicidal germination represent technological breakthroughs in *Striga* management. For example, imazapyr resistance in maize results in chemical protection against *Striga* using very small amounts of herbicide. Several companion crops can also suppress *Striga*. The root exudates of many legumes cause *Striga* seeds to germinate and die without causing injury to host cereals. Combining these two new practices, herbicide resistance and *Striga* suppressive legumes, greatly reduces the *Striga* population and its damage to cereals.

How is herbicide resistance acquired in maize? Imazapyr resistance was induced in maize and identified through an advanced screening process involving thousands of maize varieties. Imazapyr resistance is not the result of a transgenic modification and may be introduced into locally adopted maize varieties through conventional breeding approaches.

Where is imazapyr and imazapyr-resistant maize available? Imazapyr is marketed by BASF under the trade name STRIGAWAY®. IR maize is commercially available from Western Seed Company in Kenya and is in an advanced stage of pre-release field testing in several other African countries. Seed producers in Africa may obtain breeders' seed from CIMMYT and a commercial license from BASF. Breeders' seed may also be obtained from IITA for seed producers in central and west Africa.

Which legumes and field practices reduce *Striga*? Many grain and pasture legumes reduce *Striga*. Grain legumes, such as groundnut and soyabean, may be grown in rotation or intercropped with cereals. One well documented approach to *Striga* reduction, known as push-pull, intercrops desmodium, a perennial, herbaceous pasture legume, with maize. Short-term improved fallows can also reduce *Striga*.

What must we do to eradicate *Striga*?

What must farm households do to combat *Striga*? Farmers must view themselves not as victims of *Striga* but rather as front-line cadres in the war against it. Weeding *Striga* in affected fields before it flowers is essential. Also, households must be better assured that investment in new *Striga* management technologies will offer substantial returns.

What must local farmer organisations do to combat *Striga*? Farmer organisations are encouraged to voice their concerns about *Striga* and to train members on *Striga* control. These groups can also arrange for bulk purchase of *Striga* tolerant and imazapyr resistant maize varieties.

What must national research systems do to combat *Striga*? National research organisations are encouraged to improve their capacities of *Striga* characterisation and monitoring. The release and licensing of *Striga* tolerant and imazapyr resistant maize varieties should be streamlined. Agricultural extension services should develop information materials around recent developments in *Striga* management and front-line extension agents should receive up-dated training in *Striga* management.

What must the business community do to combat *Striga*? The private sector must realize the investment potential for producing and distributing *Striga* control products. Seed companies are encouraged to license and produce seeds of *Striga* tolerant and suppressive crops. Once released, imazapyr resistant cereals should be multiplied and procedures devised to package herbicide-coated seeds in a reliable manner.

What must policymakers do to combat *Striga*? Policymakers must appreciate that *Striga* greatly reduces cereal yields but it can be controlled if concerted efforts are directed toward its eradication. *Striga* eradication campaigns must be included within larger agendas for rural development.

What must donors do to combat *Striga*? Donors are encouraged to assign greater priority to the management of *Striga* in Africa and should recognise that its eradication is consistent with emerging paradigms of market-led technology adoption and agricultural value chains.

What must we all do to overcome *Striga*? Destroying *Striga* is no longer merely an area of academic study among weed scientists but an urgent objective contributing to rural development in Africa. *Striga* eradication presents an imposing test of the ability of very different partners to work together toward this common goal, each with their own special talents and complimentary purposes. Food security and rural wellbeing will only be achieved after a spectrum of stakeholders has worked together to eliminate *Striga* from the croplands of Africa's poor farmers.

Key organisations, their roles and contacts

African Agricultural Technology Foundation (AATF) escorts needed production technologies to Africa's poor farmers. Its services include streamlined regulatory approval, stewardship development and public-private partnership management. It is headquartered in Nairobi, Kenya. Contact: Dr M Bokanga, AATF, PO Box 30709-00100, Nairobi, Kenya. Telephone: 254-020-4223700. Email: aatf@aatf-africa.org. Website: www.aatf-africa.org

Africa 2000 is a Ugandan NGO specialising in rural development. It operates in eastern Uganda, an area severely affected by *Striga*. Africa 2000 has demonstrated the need for both *Striga* and soil fertility management in order to restore cereal productivity. Contact: Paul Nyende, Africa 2000 Network, Tororo Field Office, PO Box 787, Tororo, Uganda. Telephone: 256-45-45163. Email: pnyende@a2n.org. Website: www.a2n.org.ug

Ahmadu Bello University, Department of Plant Science examines *Striga* ecology and weed science. Contact: Ubale S Abdullahi, PMB 1044, Zaria, Nigeria. Telephone: 234-80-32846295. Email: drusa999@yahoo.co.uk. Website: www.abu.edu.ng

BASF is a multi-national corporation with an agricultural products division that develops, manufactures and distributes chemicals including imazapyr herbicide. It owns the right to license IR maize germplasm. Its African Regional Office is located in Addis Ababa with sales representatives in many African countries. Contact: Volker Sthamer, BASF Trade Representative, PO Box 27852 code 1000, Addis Ababa, Ethiopia. Telephone: 251-1-612539. Email: basf.tro@telecom.net.et

Bunda College of Agriculture is located near Lilongwe, Malawi in an area that is severely affected by *Striga*. Its Department of Crop Science has expertise in breeding for *Striga* tolerance and imazapyr resistance and in characterising *Striga* damage. Contact: Prof GY Kayama-Phiri, Bunda College of Agriculture, University of Malawi, PO Box 219, Lilongwe, Malawi. Email gykphiri@bunda.sdnp.org.mw

Centre Nationale de Recherche Agronomique (CNRA) selects maize, millet and sorghum for *Striga* tolerance. Contact: Louise Akanvou, Leader, Breeding Programme, 07 BP 13, Abidjan 07, Côte d'Ivoire. Telephone: 225-23-472424. Email: reneakanvou@yahoo.fr

CIMMYT is an international agricultural research, training and development organisation that focuses upon improvement of maize and wheat. Over the past several years, CIMMYT's breeders have worked closely with African national scientists to develop imazapyr-resistance in maize as a means to overcome *Striga*. The African Regional Office is located in Nairobi, Kenya. Contact: Dr Fred Kanampiu, CIMMYT, PO Box 25171-00603, Nairobi, Kenya. Telephone: 254-020-7224600. Email: F.Kanampiu@cgiar.org. Website: www.cimmyt.org

The Forum for Organic Resource Management and Agricultural Technology (FORMAT) is a Kenyan NGO that specialises in agricultural information and communication. It is working with eight other NGOs, 28 farmer organisations and over 10,000 farmers to combat *Striga* in west Kenya. FORMAT and its partners also produce and distribute several *Striga*-suppressive legume seeds that are not available commercially. Contact: Dr Paul L Woomer, FORMAT, PO Box 79, The Village Market 00621, Nairobi, Kenya. Telephone: 6752866, Email: format@wananchi.com. Website: www.formatkenya.org

The International Centre for Insect Physiology (ICIPE) has developed and promotes a low-cost and environmentally friendly push-pull technology that controls stemborer and suppresses *Striga*. Contact: Dr ZR Khan, ICIPE, PO Box 30722-00100, Nairobi, Kenya. Telephone: 254-020-3652000. Email: icipe@icipe.org. Website: www.push-pull.net

International Institute of Tropical Agriculture (IITA) is developing *Striga* tolerant and imazapyr-resistant maize lines adapted to West Africa. Contact: Dr Ababe Menkir, IITA, Oyo Road, PMB. 5320, Ibadan, Nigeria or IITA, c/o Lambourn Ltd., Carolyn House, 26 Dingwell Road, Croydon CR 9 3EE, UK. Email A.Menkir @ cigar.org. Website: www.iita.org

Kenya Agricultural Research Institute (KARI) maintains two key research facilities committed to *Striga* management in west Kenya. KARI-Kakamega developed a *Striga* tolerant OPV (KSTP 94) and KARI-Kibos hosts a *Striga* ecology laboratory. Contact: Director General, KARI, PO Box 57811, Nairobi, Kenya. Telephone: 254-20-4183301-20. Email: resourcecentre@kari.org. Website: www.kari.org

Makerere University Faculty of Agriculture works closely with agricultural extension providers in many areas of crop management, including *Striga* control. It is also investigating the stability and mobility of imazapyr resistance. Contact: Prof M Bekunda, Dean, Faculty of Agriculture, Makerere University, PO Box 7062, Kampala, Uganda. Telephone: 256-41-542277. Email mateete@agric.mak.ac.ug

Maseno University is located in west Kenya. It's Department of Botany and Horticulture has several researchers and graduate students investigating *Striga* management. Contact: Dr George Odhiambo, Department of Botany and Horticulture, PO Box 333, Maseno, Kenya. Telephone: 254-0733-768801. Email: gdodhis@yahoo.co.uk

Resource Projects Kenya is an NGO that assists farmer organisations to better access farm inputs and market crop surpluses in *Striga*-affected areas of Kenya. Contacts: Celestine Wekesa (*Striga* management) and Patrick Nekesa (marketing innovation), PO Box 1148, Maragoli. Kenya; Telephone: 254-56-51376. Email: patricknekesa@yahoo.co.uk

Savanna Agricultural Research Institute (SARI) selects cereals for *Striga* tolerance. Contact: Mashark S. Abdulai, SARI, PO Box 52, Tamale, Ghana. Telephone: 233-71-22411. Email: msabdula@yahoo.com

SCODP is an NGO committed to improving farm input supply in west Kenya, particularly blended fertilisers and improved varieties of maize and legumes. It supplies a network of 52 farm input retailers throughout an area severely affected by *Striga* in west Kenya. Contact: Dismas Okello, PO Box 5, Sega, Kenya. Telephone: 0722-389404. Email: infoscodp@yahoo.com

Sokoine University of Agriculture, Department of Crop Science characterises *Striga* distribution in Tanzania and examines legume suppression. Contact: Dr KP Sibuga, PO Box 3005, Morogoro, Tanzania. Telephone: 255-023-2603681. Email: sibuga88@yahoo.co.ke

TSBF-CIAT works with legumes that suppress *Striga*, particularly promiscuously nodulating soyabean. Contact: Dr N Sanginga, TSBF-CIAT c/o ICRAF, PO Box 30677, Gigiri, Nairobi, Kenya. Telephone: 254-020-7224765. Email: N.Sanginga@cgiar.org. Website: www.ciat.cgiar.org

Western Seed Company produces both *Striga* tolerant (WH502) and imazapyr-resistant (*Ua Kayongo*) maize varieties. It also markets a "super-stimulating" maize useful in trap cropping (WH403) and *Desmodium* spp. for intercropping in push-pull. Its headquarters is located in Kitale, Kenya and its products are sold throughout East Africa. Contact: Saleem Esmail, Western Seed Co., Ltd. Kitale, Kenya. Telephone: 254-054-30232 or 254-020-890804. Email: western@swiftkenya.com. Website: www.westernseed.net

Weizmann Institute of Science has expertise in coating seeds with herbicides including slow release formulations for prolonged activity. Contact: Prof Jonathan Gressel, Plant Sciences Department, Weizmann Institute of Science, Rehovot, Israel. Telephone: 972-8-934-3481. Email: jonathan.gressel@weizmann.ac.il