

Ua Kayongo Hybrid Maize

The Striga Killer

A New Approach to Controlling Parasitic
Striga for Kenyan Maize Producers!



Prepared by P.L. Woomer
and Musa N. Omare for the
AATF Striga Management
Project



***Ua Kayongo* Hybrid Maize: The *Striga* Killer**

A new approach to controlling parasitic *Striga* for Kenyan maize producers

Table of Contents

Mobilizing Kenyan Farmers	2
<i>Striga</i> Threatens Farmers in Kenya	3
Know Your Enemy!	4
The First Line of Defense	5
Conventional <i>Striga</i> Management	6
Introducing <i>Ua Kayongo</i> : The <i>Striga</i> Killer	7
Five Easy Steps to Establish <i>Ua Kayongo</i>	8
Other Benefits from Planting <i>Ua Kayongo</i>	10
Questions and Answers on <i>Ua Kayongo</i>	11
Translated Summary: <i>Kiswahili</i>	13
Translated Summary: <i>Luo</i>	14
Translated Summary: <i>Luhya</i>	15
Credits and Contact Details	16

Prepared by P.L. Woomer and M.N. Omare for the African Agricultural Technology Foundation's *Striga* Management Project, Nairobi, Kenya, May 2005.

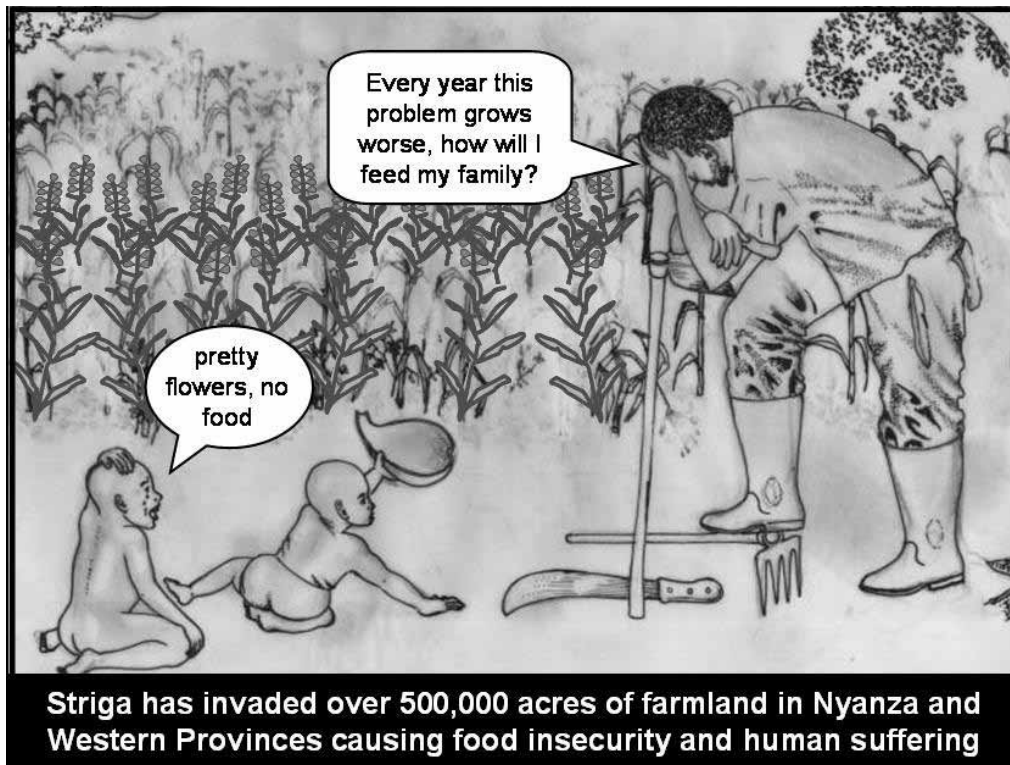
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Mobilizing Kenyan Farmers Against *Striga*!

Striga, popularly known as *Kayongo* (Luo) or *Oluyongo* (Luhya), is a parasitic weed that destroys cereal crops, particularly maize, leading to food insecurity in thousands of households. *Striga* feeds upon the sugars, mineral nutrients and moisture of its host and may result in complete crop loss under the worst of conditions. One plant produces numerous small seeds that are incorporated into the soil during tillage and remain dormant for many years. These seeds are also spread by dirty shoes and digging tools or by livestock and soil erosion. *Striga* should be hand-weeded and, together with affected crop residues, burned and buried to control its spread.

A new maize hybrid, *Ua Kayongo* that is coated with *Strigaway*_{TM} herbicide will soon be introduced in western Kenya to control *Striga* infestation in maize. The herbicide kills germinating *Striga* as it attempts to parasitize maize. *Ua Kayongo* is planted and managed much in the same way as other maize varieties by using recommended tillage, spacing, fertilizer and regular weeding. *Ua Kayongo*, however, cannot be planted in the same hole as intercropped legumes and farmers should thoroughly wash their hands after handling it, to avoid contaminating other seeds with the *Strigaway*_{TM} herbicide.

Farmers in western Kenya will soon have access to this new technology and are encouraged to combine *Ua Kayongo* with other *Striga* management technologies. The *Ua Kayongo* seeds will become commercially available to Kenyan farmers through Kenya Seed, Lagrotech Seeds and Western Seed companies prior to 2005-2006 short rains through existing retail outlets.



***Striga* Threatens Farmers in Kenya**

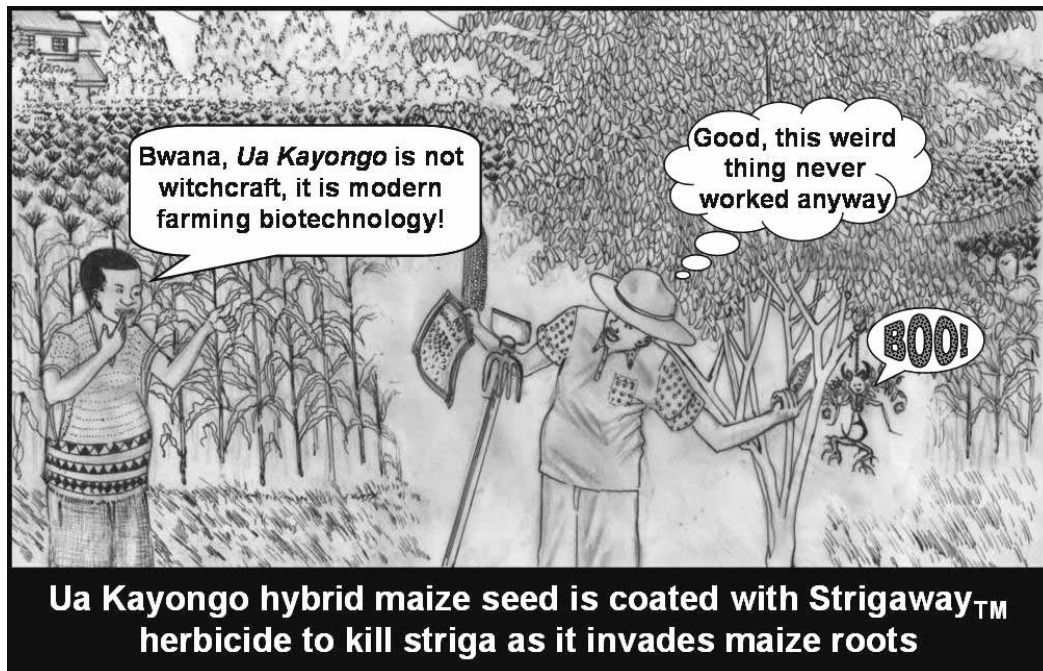
To fight the threat of *Striga*, farmers in Kenya now have a new maize hybrid *Ua Kayongo* that is coated with *Strigaway*TM herbicide that protects against and kills *Striga*. Another species of *Striga* attacks cowpea and other legumes in coastal Kenya, but this different parasitic weed is not covered in this booklet.

For many years now, Kenyan farmers in Nyanza and Western Provinces have suffered from the parasitic weed commonly known as *Striga* or *Kayongo* as it destroys their cereal crops, particularly maize. *Striga hermonthica* has invaded approximately 200,000 hectares of Kenyan cropland resulting in losses of about KSh 800 million each year and this weed is continuing to spread! *Striga* is a major contributor of food insecurity among thousands of households in west Kenya as it causes yield losses of maize, the major food crop.



Know Your Enemy!

Striga has a rather complicated lifecycle. The plant produces abundant, very small seeds that fall to the soil and are incorporated during tillage. The seeds may remain dormant in the soil for up to 20 years until they are stimulated to germinate by biochemical signals from host plant roots. The germinating seeds penetrate the host root, and remove water, minerals and photosynthates (sugars) for several weeks while living underground. *Striga* also produces toxic chemicals that stunt and discolor the host plant. Then, the *Striga* shoot emerges from the soil, producing fleshy green stems and narrow leaves, growing to a height of 50 to 100 cm. Next, it produces numerous, small purple flowers that later form capsules containing many seeds. After the host plant dies, so too does the *Striga*, causing the capsules to burst and the seeds to spread across the soil, and the cycle repeats itself.



The First Line of Defense

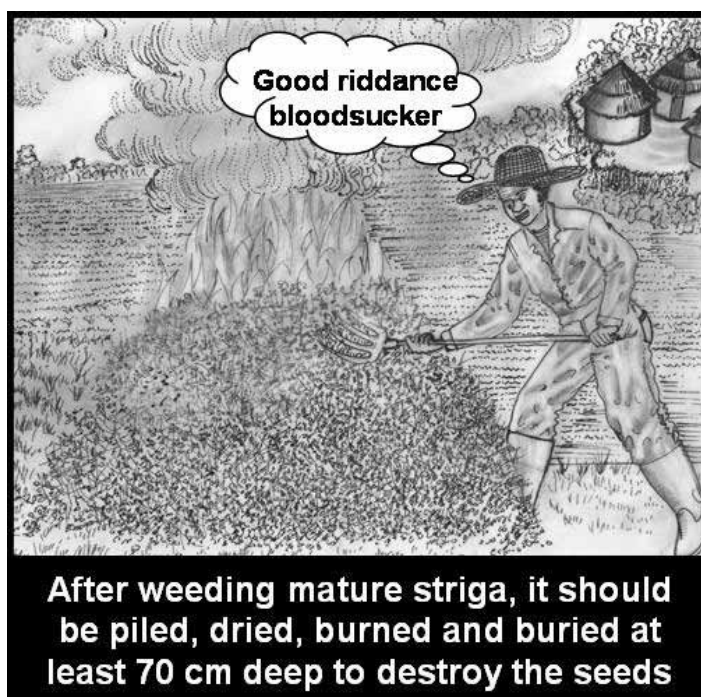
The first line of defense in the war against *Striga* is containing its invasion into new fields. Because the seeds are very small, they are easily spread to new areas by humans (for example on shoes or digging tools) and animals, as they move from one field or farm to another. If *Striga* appears in a new location, farmers should take immediate action to contain the infestation.

1. identify the field and mark the area (patch) where the *Striga* has invaded
2. repeatedly hand weed the shoots as they emerge so that new seeds do not form, and
3. in the next season, do not plant hosts of *Striga* into the field or patch but instead plant *Ua Kayongo* with soyabean, groundnut and/or lablab. The roots of these legumes will induce suicidal germination of *Striga* seeds residing in the soil.

Conventional *Striga* Management: Weed and Burn

Weeding *Striga* is difficult and seldom fully successful because its stem grows underground and is attached to the maize roots. Shortly after weeding the aboveground *Striga*, new shoots begin to emerge from the soil. Nonetheless, it is very important that *Striga* not be permitted to produce seed in your field, therefore, it is necessary to weed *Striga* once or twice later in the cropping season.

Even in the largest fields, *Striga* often appears in patches. If the *Striga* has formed flowers and matured, farmers should dig a hole about 70 cm deep in the center of the patch, gather the drying *Striga* plants and put them in the hole, burn the plants and bury them. Later, burn the crop residues that occur in the affected patch to destroy any seeds that have escaped.



A less practical option for smallholders is deep tillage (for example +70 cm), that places *Striga* seeds too deep in the soil to emerge and multiply. Remember, the simplest control practice is containment, meaning that care must be taken not to spread *Striga* into neighboring fields and farms. Immediately after weeding *Striga*, it is very important to clean your shoes and tools before the seeds can be spread to new fields, especially your own.

Introducing *Ua Kayongo*: The *Striga* Killer

A new approach to controlling *Striga* in maize developed by CIMMYT, KARI and BASF is now available to Kenyan farmers. The *Ua Kayongo Strigaway_{TM}* technology is based upon inherited resistance to a systemic herbicide (Imazapyr). When Imazapyr-resistant (I-R) maize seed is coated with the herbicide *Strigaway_{TM}*, *Striga* attempting to parasitize the resulting plants are destroyed. Indeed, for the first time, maize farmers can actively suppress and reduce *Striga* seed banks in soil by protecting their maize with a “chemical barrier” to *Striga* infestation. *Ua Kayongo* hybrid maize has been treated with *Strigaway_{TM}*



Ua Kayongo provides bumper harvests of maize where past crops have failed because of *Striga*

(Imazapyr) herbicide, Lindane insecticide and Thiram fungicide. The seeds are intended for planting in *Striga* infested fields and **MUST NOT BE EATEN!** In general, *Ua Kayongo* H1 is planted and managed in the same way you normally cultivate your maize in terms of spacing and weed management.

Five Easy Steps to Establish *Ua Kayongo*

Step 1. Identify and prepare a *Striga* infested field.

Identify a field that was affected by *Striga* the previous season and prepare it for planting using hand digging, animal ploughing or other method to a depth of 20 cm (8 inches) to 25 cm (10 inches). Unlike most conditions, slightly deeper tillage (e.g. 35 cm or 14 inches) is not an advantage because it allows *Striga* seeds to penetrate further into the soil and these seeds may infect maize roots at a later stage of development.

Step 2. Apply mineral or organic fertilizers. Apply the locally recommended combination of fertilizers. For most soils in Kenya, a pre-plant combination of Diammonium Phosphate (DAP: dark brown granules) and either Calcium Ammonium Nitrate (CAN: white granules) or Urea (white crystals) is recommended. Broadcast the DAP fertilizer and CAN or Urea at a rate of 20 to 50 kg per acre and dig into the soil about 15 cm (6 inches). In other cases a N-P-K fertilizer may be recommended and should be applied at a rate of 30 to 50 kg per acre. Manure or compost may be substituted for fertilizers at the rate of 1 ton per acre. If only 500 kg of manure or compost is available, then add 1/2 the recommended fertilizers.



***Striga* seeds are spread by shoes, hand tools, livestock, heavy rain and soil erosion**

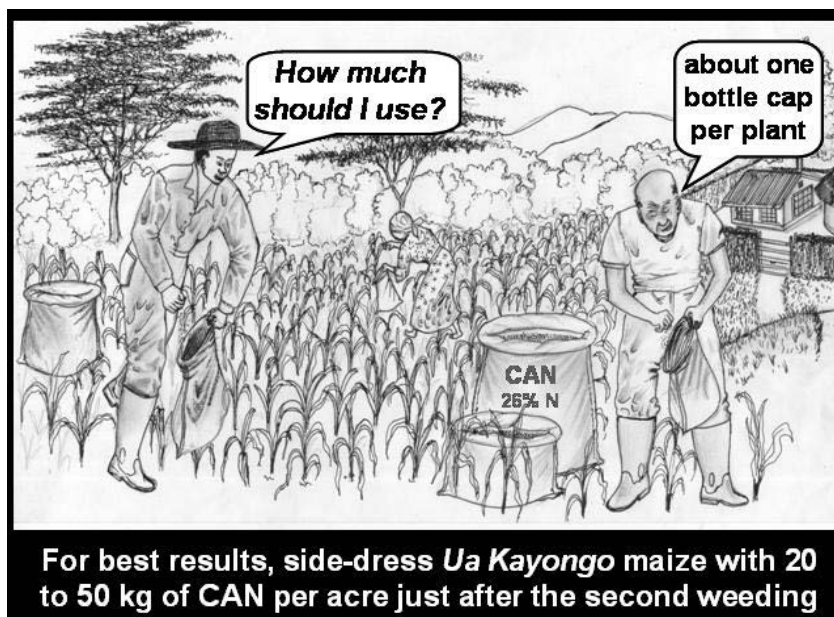
Step 3. Plant maize and its accompanying intercrop.

Plant *Ua Kayongo* at your recommended spacing, usually requiring 8 to 10 two-kg bags of seed per acre. If the *Ua Kayongo* maize is to be intercropped with a legume such as beans, then **plant the beans first** and the **treated *Ua Kayongo* maize last**. This is done to avoid *Strigaway*_{TM} herbicide damage to beans that are hand planted. *Ua Kayongo* can be intercropped with legumes, but the two must **not** be planted in the same hole, as the *Strigaway*_{TM} herbicide is likely to affect the legume seed.

Step 4. Wash you hands. After handling any commercial seed that has been treated with pesticides it is important to wash your hands thoroughly with soap and water. Washing is especially important after planting *Ua Kayongo* not because it is more dangerous to people but because the *Strigaway*_{TM} herbicide is very toxic to all other crop plants that do not have Imazapyr-resistance. For example, if you plant beans after planting *Ua Kayongo* maize without washing your hands then the beans will develop visible toxicity symptoms after emergence. So remember to always wash your hands thoroughly after planting *Ua Kayongo*.



Step 5. Apply nitrogen side-dressing. The highest yields are obtained when a nitrogen fertilizer is applied as a side-dressing to maize mid-way through its growth. Apply CAN fertilizer at a rate of 20 to 50 kg per acre as a side-dressing to the maize either following the second weeding or just before the maize tassels. If urea is applied as a side-dressing instead, lower rates may be applied (10 to 25 kg per acre) but it should be incorporated into to the surface of the soil.



Other benefits from planting *Ua Kayongo*

After planting *Ua Kayongo* with *Strigaway*TM, little or no *Striga* will emerge in the maize field! For long-term control of *Striga*, *Ua Kayongo* may be combined with other *Striga* management technologies, such as the Push-Pull system (maize intercropped with Desmodium), or MBILI planted with groundnut, golden gram, soyabean or lablab. One recently identified advantage of using *Ua Kayongo* is that the first weeding is less tedious due to the reduced number of other weeds near the young maize seedling. This effect results from the diffusion of *Strigaway*TM into the immediate soil surrounding the planted maize seed.

Questions and Answers on *Striga* and *Ua Kayongo*

What is *Striga*? It is a parasitic weed that infests farms growing cereals. It affects plant growth by attaching itself to the crop roots allowing it to feed on and damage the host plant.

What are the local names of *Striga*? The Luo call it 'Kayongo' and the Luhya 'Oluyongo'.

Which crops/fields are susceptible to *Striga* infestation? *Striga* attacks maize, millet, sorghum, upland rice, sugarcane and Napier grass throughout sub-Saharan Africa. In Kenya, *Striga* is worst on farms in the Lake Victoria basin below 1400 m elevation.

How does *Striga* spread? *Striga* seeds are very small 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. *Striga* seeds remain dormant and viable in the soil for up to 20 years leading to continuous infestation.

How does *Striga* damage the affected crop? The weed attaches itself to the roots of host plants and "sucks out" the nutrients and moisture necessary for plant growth. It also produces phytotoxic substances that cause leaves to turn yellow or bronze.

What is the impact of *Striga* on maize production in western Kenya? Yield loss due to *Striga* damage ranges from 20-80% in a given field resulting in total losses of about 300,000 tons per year.

What is *Ua Kayongo* hybrid maize? *Ua Kayongo* hybrid maize is coated with *Strigaway*TM herbicide that kills the germinating *Striga* as they attempt to infect the maize plant. This technology is also known as Imazapyr-Resistant maize or Clearfield system.

How does *Ua Kayongo* hybrid maize control the spread of *Striga*? The imazapyr herbicide acts at the time of *Striga* attachment to the maize root and so prevents the attachment of the *Striga* on the maize plant. The herbicide also kills non-germinated *Striga* seeds in the soil surrounding the maize seedling. The maize can become clear of *Striga* throughout the season.

Are fields planted with *Ua Kayongo* managed differently from the current practices? *Ua Kayongo* is planted and managed in the same way that farmers currently grow their maize. *Ua Kayongo* can be intercropped with legumes, but planted in different holes as the herbicide may affect the legume seed. For long-term control of *Striga*, *Ua Kayongo* may be combined with other *Striga* management technologies such as Push-Pull or MBILI.

Is *Ua Kayongo* only treated with *Strigaway*TM herbicide? No, *Ua Kayongo* is also treated with a fungicide (Thiram) and an insecticide (Lindane) as are all other commercial maize seed.

What returns can be expected from *Ua Kayongo*? Investment in a 2 kg bag of *Ua Kayongo* seed can result in 50 to 100 kg MORE maize in *Striga* infested fields resulting in benefit:cost ratios of about 25:1. A bag of *Ua Kayongo* treated with *Strigaway*TM herbicide costs about KSh 30 more, but is more than worth the extra price if your farm is affected by *Striga*.

Does *Ua Kayongo* hybrid maize have residual effects in the fields where it is grown? *Strigaway* is applied to *Ua Kayongo* seeds at a rate of only 1.5 grams per kilogram, becomes absorbed within the maize root and will have no effect the following season.

Where can *Ua Kayongo* hybrid maize seed be obtained? Starting in the short rains 2005-2006, *Ua Kayongo* seed will become commercially available from Kenya Seed, Lagrotech and Western Seed Companies.

Is the *Ua Kayongo* maize genetically modified? *Ua Kayongo* is not a GMO! The technology relies on herbicide resistance derived from a naturally occurring gene that was later bred into maize hybrids suitable for Kenyan conditions. More and better *Ua Kayongo* hybrids will be released in the future.

Which precautions do farmers need to take when handling *Ua Kayongo* hybrid maize? Farmers should wash their hands after handling *Ua Kayongo*. They should also not handle other seeds before they wash off the *Strigaway*TM herbicide as this may affect germination of the other crops.

Why do *Ua Kayongo* seedlings sometimes become yellow 14 to 21 days after emergence? This is the Yellow Flush that results from the initial absorption of *Strigaway*TM signaling that the maize is now defended against *Striga*. The Yellow Flush is most obvious under warmer growing conditions and seldom lasts more than one week.

Where can one obtain information on *Ua Kayongo* maize? Information can be obtained from AATF and its partners CIMMYT, KARI-Kibos, SACRED-Africa and SCODP, as well as the three seed companies marketing *Ua Kayongo* (Kenya Seed, Lagrotech, Western Seed). More information can be obtained over the internet at www.cimmyt.cgiar.org, www.africancrops.net/Striga and www.aatf-africa.org.

Kushirikisha Wakulima Nchini Kenya Kukabiliana na Gugu aina ya *Striga*

Gugu aina ya *striga* ambalo hujulikana sana kama *Kayongo* (Luo) au *Oluyongo* (Luhya), ni aina ya magugu ambayo pia ni kimelea (hutegemea mimea mingine kukua). Humea na kuharibu nafaka hasa mahindi. Hivyo basi, husababisha ukosefu wa vyakula katika maelfu ya boma. *Striga* hunawiri vema baada ya kupata chakula chake kutokana na madini ya mimea kama mahindi. Mbegu zake humea kwa urahisi katika mchanga wakati shamba linapolimwa, hivi basi zaweza kubaki kwenye mchanga bila kumea kwa miaka mingi mno. Mbegu zinazomea hujibandika kwenye mizizi ya mimea ya mahindi na hivyo hupata chakula chake kutoka kwa mimea hii. Hali hii husababisha kupooza kwa mahindi kisha kufa. *Striga* hupaswa kupaliliwa kwa mikono kisha kuchomwa pamoja na mabaki ya mimea iliyomo shambani iliyo adhiriwa na *striga*. Kuchoma hukomesha kuenea kwa *striga*.

Aina mpya ya mahindi ya hybrid, iitwayo *Ua Kayongo* ambayo imepakwa dawa aina ya *StrigawayTM* ambayo huua magugu, imeletwa sehemu za magharibi mwa Kenya ili kuthibiti kusambaa kwa *Striga* katika mimea ya mahindi. Dawa hii huua *striga* ambayo inamea na pia, hujaribu kujibandika kwenye mmea wa hindi. *Ua kayongo* hupandwa na kusimamiwa kama vile aina zingine za mahindi kwa kufuata utaratibu unaofaa wa kupanda mahindi ya hybrid. Inapaswa kupaliliwa vyema, kupatiwa nafasi bora, mbegu nzuri na hata mbolea, kisha kupalilia na kutoa magugu mara kwa mara. Hata hivyo, mahindi hii ya *Ua Kayongo* haiwezi kupandwa katika shimo moja na lile lipandwamo maharagwe, kunde na mimea mingine ya sampuli hii (legumes). Ni sharti kwa mkulima kuosha mikono yake vema baada ya kupanda mahindi hii ili kuepuka kupaka mimea mingine dawa hii ya *strigawayTM*.

Wakulima wanahimizwa kwamba, wanapotumia *Ua Kayongo*, wanafaa kushirikisha mbinu zingine zinazotumiwa ili kuthibiti kusambaa kwa *striga* kwa muda mrefu. Wakulima watatambua upungufu wa magugu mengine karibu na miche ya mahindi kwa ajili ya dawa ya *StrigawayTM*. Mbegu za *Ua Kayongo* sasa zitaanza kuuzwa katika masoko nchini Kenya. Hii ni kupitia mashirika ya Kenya Seed, Lagrotech na Western Seed. Shughuli hii itaanza mwishoni mwa mwaka huu wa 2005.

Jiwo Jopur Ma Kenya Mondo Okaw Okang Mar Tieko Kayongo

Striga, ma nyinge ong'ere ahinya kaka *Kayongo* (gi dholuo) kata *Oluyongo* (gi dholuhya), en buya marach maketho cham ahinya - molooyo to oduma, to kendo okelo kech ne ji kendo ei udi tara gi gana. Kayongo chamo chiemo moa e oduma, ma oduma onego otigo. Kodhi mar Kayongo donjo ga e low ndalo pur to kendo onyalo dong' e lowo kanyo ka ok oti kuom higni mang'eny. Koth Kayongo ma ti makore e tie oduma, aito oywayo kendo onyodho chiembe koa kuom odumano. Ma miyo oduma thirno kendo bang'e to otuo ma otho. Kayongo onego opudhi kod lwedo, chokgi kanyakla achiel kod it cham kod tiag' e puodh ma oyudore ma wang'gi mondo ogeng' keeruok mare e puothe mamoko.

Kodhi moro mar odumb hybrid ma iluongo ni *Ua Kayongo* obuki kod yadh buya ma iluongo ni *StrigawayTM*, osekkel manyien e Kenya ma yo podho chieng' mondo ogeng' kayongo monjo oduma. Yadh buya ni nego Kayongo mapod koka ti kendo temo mondo omakre e tie oduma. *Ua Kayongo* ipidho kendo irito mana kaka kothe mamoko mag oduma ka iluwo yore ma owinjore kendo madwarore mag pur, okang', kothi, mbolea kod doyo e saa mowinjore. *Ua Kayongo* kata kamano ok nyal pidh ei bur achiel kod alote kendo jopur nyaka luok lwetegi maber ahinya tok tiyo go kodhi ni mondo kik gikethi kothe mamoko kod yadh buya mar *StrigawayTM*.

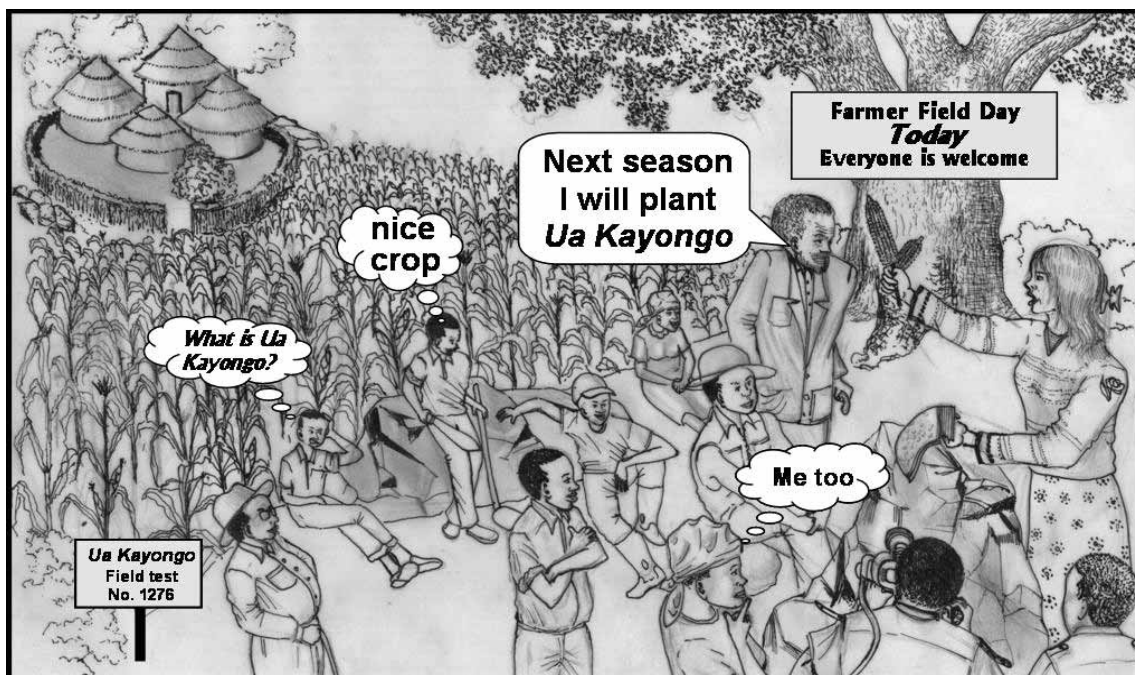
Jopur ma a Kenya ma imbo ijiwo mondo otiek Kayongo ka giriwo kodhi mar *Ua Kayongo* kod yore mamoko mag tieko Kayongo. Jopur biro fwenyo ni buya mamoko bende ok ti but odumani nikech yadh buya mar *StrigawayTM* geng'o kendo thiro gi. Kothe mag oduma mar *Ua Kayongo* biro yudore kendo ibiro loki e yor ohala e chirni ma Kenya ka ka okalo kuom kembe mag loko kodhi ma gin Kenya Seed, Lagrotech gi Western Seed e dweche adek mogik mag higa 2005.

Okhukhonya Abalimi BamuKenya Okhulonda Oluyongo - *Striga*

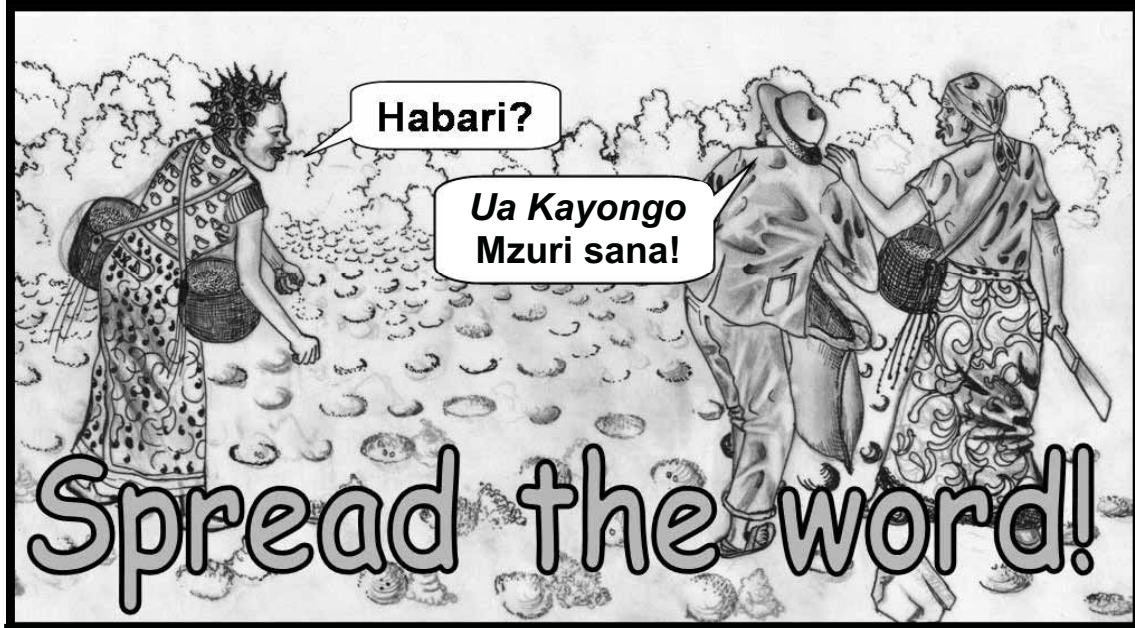
Oluyongo -*striga*, lwamanyikhana sana mbu Kayongo (Luo) nomba Oluyongo (Luhya). Ne ni aina yoluyongo olwikhonyeranga ebirakwa bindi mmukunda okhumera obulayi. Oluyongo luno lwononinja ebirakwa shingana amatuuma kachira ebiokhulia nibititiya mutsinzu tsielfu tsinyinji. Oluyongo –*striga*, lumeranga obulayi khulwa lurumishiranga eshiokhulia shiamatuuma karumishiranga mmukunda. Imwo yo oluyongo ino itsokananga mwiloba olwomukunda kulimungwa ne inyala okhumenyamwo emiaka eminji sana khonilimera olundi. Tsimwo tsiooluyongo – *striga* etsiba nitsimeranga tsikhalanga khu emisi tsia amatuuma ne tsinyoolanga eshiokhulia shiatsio okhurula khu matuuma kano, nikachira amatuuma kakhunye mana olwitsa kafwe. Oluyongo luno mbu *striga* kenyekhananga lwachirwe nemikhono nilurusibwa halala nende ebirakwa biasikala mmukunda kwalimo oluyongo luno, mana biosi bisambwe kho bilasalana mmukunda tawe.

Imwo imbya yamatuuma mbu hybrid, eilangungwa mbu *Ua Kayongo*, ni amatuuma kabakhwa omusaala mbu *Strigaway_{TM}*. Imwo ino yarererwe ebuluhya nende ebunyolo kho ilonde oluyongo lubule okhwinjira mumatuuma tawe. Omusala kuno mbu *Strigaway_{TM}*, kwiranga oluyongo luba nilumeranga mana olutemanga okhwickhala khwituumu liba niliri mmukunda. Imwo ya *Ua Kayongo* irakungwa mana ihengwa tsa shinga olwa amatuuma kandi kakawaida kahengungwa. Kenyekhanga kaachirwe obulayi, kahesibwe obwiyangu buhera mmukunda, imwo indayi, neimbolea, khandi nokhwaka omukunda khasootso norusia oluyongo. Amatuuma ka *Ua Kayongo* khandi, shikanyala okhurakwa mubwina bulala nende ebirakwa bindi shinga amakanda, tsimbini, nende ebindi ebinji shingana bino tawe. Abalimi benyekhanga bosie emikhono chiabo obulayi nibakhatiira nomba nibakharaka imwo ino, kho babule okhubakha tsimwo tsindi omusala kwa *Strigaway_{TM}*.

Abalimi betsusibwa okhutsokasia oburumishi bwe imwo ya *Ua Kayongo* nende tsinjira tsindi tsiabulano tsiokhulonda oluyongo – *striga* khumiaka eminji tsitsanga. Abalimi balalola oluyongo nilulameranga sana tawe ahambi nende amatuuma khulwa okhulekwa nende omusala kwa *Strigaway_{TM}*. Imwo ya *Ua Kayongo* ino nikusibwe khubiuro biosi muKenya okhubirira khu Kenya Seed, Lagrotech nende amaduuka kandi kakusinja tsimwo ebuluhya nende ebunyolo. Amakhuwa kano nikachake omwaka kuno (2005) nikutsitsanga okhuwa.



AATF, KARI and many local NGOs are promoting *Ua Kayongo* through extension publications, demonstrations, workshops and field days in preparation for its commercial release in July 2005!



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Ua Kayongo Hybrid Maize: The Striga Killer

A new approach to controlling the parasitic weed *Striga* (*kayongo*) is now available to Kenyan maize producers! *Strigaway*_{TM} is based upon inherited resistance to a systemic herbicide (Imazapyr). When Imazapyr-resistant (I-R) maize seed is coated with the herbicide, striga attempting to parasitize the resulting plants are destroyed! For the first time, farmers can actively suppress and reduce striga seed banks in soil by protecting maize with a “chemical barrier” to striga infection. *Ua Kayongo* hybrid maize has been treated with *Strigaway*_{TM} (Imazapyr) herbicide, Lindane insecticide and Thiram fungicide and is intended for planting in fields infested with *Striga*. *Ua Kayongo* is planted and managed in the same way you normally cultivate your maize in terms of spacing and early weed management but special care must be taken not to damage intercrops planted with maize by avoiding contact with *Strigaway*_{TM}. *Ua Kayongo* is a modern herbicide technology and NOT a GMO.



Partners in AATF Striga Management Project