

From research to farmers' fields: Accelerating the release of resistant to Striga maize varieties for food security and rural transformation in Uganda

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Key Messages

- Striga (witchweed) is a parasitic plant that attacks maize roots underground and can cause yield losses of over 50% and, in heavily infested fields, wipe out an entire harvest before a farmer even sees it flower.
- Breeding resistance into the seed is one of the cheapest and most durable solutions: once resistance is built into the seed, farmers can protect their crops without much input.
- Ugandan and international scientists have already found resistant plant material and proven it works. National Agriculture Research Organization (NARO) has released the country's first Striga-tolerant hybrid, NARO MAIZE 64 STR, which can yield 3.5-4 tonnes per hectare under Striga infestation, compared with less than 0.5 tonnes for susceptible varieties. This brief has also identified a further pipeline of resistant lines and hybrids ready for the next stage.
- The science is essentially done. What is missing is institutional follow-through for testing and evaluating the seed in more distinct areas, multiplying, and getting it into agro-dealer shops. This is where the next round of public investment should go.

1.1. Striga: The underground enemy of Uganda's maize

Farmers in eastern, northern, and parts of western Uganda have a name for it: "Kayongo." It looks like a pretty plant with small purple or pink flowers, so it is easy to mistake it for something harmless. It is not. Striga (scientifically *Striga hermonthica*) is a parasitic plant, which survives by attaching itself to the roots of a maize plant and absorbing water, nutrients, and food, maize needs to grow. Most of the damage happens underground, out of sight, weeks before the purple flowers ever appear above the soil. By the time a farmer sees the weed, the maize crop has often already lost most of its yield potential. This is what makes Striga so dangerous: farmers are fighting an enemy they cannot see until the harm is already done.

1.2. Why Striga is so hard to beat

- A single Striga plant can release hundreds of

thousands of tiny seeds, invisible to the eye, which can lie dormant in the soil for up to 25 years, waiting for a maize root to come close enough to trigger germination.

- Its dust like seeds move easily on farm tools, in animal feed, in floodwater, and mixed into uncertified grain and seed, allowing it to jump into new fields without anyone noticing.
- Striga is worst where soils are least fertile, exactly the conditions many smallholder farmers already struggle with, so the weed and poor soil fertility reinforce each other.
- Agronomic controls like hand-pulling, crop rotation, and herbicides can reduce the damage, but none of them work reliably on their own, and several cost money or labour that many households do not have to spare season after season.

1.3. What happens if Striga is left unchecked

Where infestation is heaviest, Striga can destroy an entire maize harvest, and some farmers abandon their fields altogether rather than keep planting into a losing fight. Left unmanaged, the weed keeps spreading: more land goes out of production, food available to the household shrinks, and families are pushed to clear new, often forested or marginal land to replace what has been lost, adding pressure on the environment. Across Sub-Saharan Africa, Striga already infests an estimated 40 to 50 million hectares of farmland and is estimated by the Food and Agriculture Organization (FAO) to cost the region more than USD 7 billion in lost cereal production every year, affecting the food supply of over 300 million people. Uganda's own Striga-endemic areas, concentrated in the Busoga, Acholi, Lango, Karamoja sub-regions and pockets of western and mid-western districts, sit squarely inside this regional crisis.

2.0. Crops affected by Striga: Why focus on maize?

Striga attacks the cereal crops that most Ugandan households depend on for daily food: maize, sorghum, finger millet, and upland rice are all vulnerable, and a related Striga species also damages cowpea. The table below summarizes the picture.

Maize is the priority for this brief for a simple reason: it is Uganda's most widely grown food crop, planted by more than 80% of farming households on over one million hectares, and it supplies roughly 11% of the calories Ugandans eat. National average maize yields, at about 2.4 tonnes per hectare, already sit far below the 7-9.6

tonnes per hectare achieved on research stations, and Striga is one of the single biggest reasons why. A breakthrough for maize protects the largest number of households and delivers the largest national food security gain per shilling invested, while the breeding approach described here can, in time, be extended to sorghum, millet, and rice.

3. What is already being done, and why more action is needed?

Uganda is not starting from zero. Government, NARO, universities, and international partners have been working on Striga for over a decade, through three broad lines of effort.

3.1. Helping farmers manage Striga in the field

- Hand-pulling and uprooting Striga plants before they flower and set seed, to stop the underground seed bank from growing further.
- Crop rotation and trap cropping with non-host or "trap" crops that trigger Striga seeds to germinate without a maize root present to feed on, gradually reducing seed reserves in the soil.
- Push-pull intercropping, developed with international partners, using companion plants such as Desmodium to suppress Striga while also repelling stem-borer pests.
- Improving soil fertility, since Striga is most aggressive in nutrient-poor soils; better fertiliser use and organic matter management make fields less hospitable to the weed.
- Herbicide-coated "imazapyr-resistant" (IR) maize seed, varieties such as Longe 7(IR) and NAROMAIZE 58-IR, 59-IR, and 60-IR, sold under the trade name Kayongo-Go,

Crop	How Striga affects it
Maize	The worst-affected staple; yield losses of up to 100% in heavily infested fields. Focus of this brief.
Sorghum	A major host crop, especially in drier northern and north-eastern farming systems.
Finger millet	Widely grown traditional cereal; also vulnerable to Striga infestation.
Upland rice	Increasingly affected as rice expands into former maize and sorghum land.

kill germinating Striga in the field before it can attach to the maize root. This has been an important stopgap, though it depends on farmers being able to buy the coated seed and herbicide each season.

3.2. Stopping Striga from reaching new areas

Because Striga spreads mainly through contaminated seed, soil clinging to tools and machinery, and floodwater, restricting its spread relies on straightforward but disciplined practices: using certified, weed seed free planting seed rather than uncertified grain saved from an infested field; cleaning tools, boots, and machinery before moving between fields; avoiding the movement of manure, hay, or soil from known Striga-infested farms; and early detection and rapid uprooting of new outbreaks before flowering. NARO has also produced public information materials including posters, radio messaging, and extension guides, to help farmers and district extension officers recognize Striga early and act on it, though awareness and enforcement still vary widely across districts.

3.3. Breeding Striga resistance directly into the seed

The most promising long-term fix is genetic: breeding maize varieties that resist Striga from the inside, so that protection comes free with every seed a farmer plants. NARO’s national maize breeding programme, working with international gene banks at the International Institute of Tropical

Agriculture (IITA) and the International Maize and Wheat Improvement Center (CIMMYT), has been screening maize breeding material for Striga resistance for well over a decade. This work has already delivered a tangible result. In 2024, NARO officially released NAROMAIZE 64 STR, Uganda’s first commercially released maize hybrid bred specifically for tolerance to Striga, alongside a companion vitamin-A-rich hybrid, NAROMAIZE 63 VITA. Field evaluations show that under heavy Striga pressure, NAROMAIZE 64 STR can still yield 3.5-4 tonnes per hectare, compared with well under 0.5 tonnes per hectare for susceptible varieties grown under the same conditions, a difference that can be the margin between a harvest and a lost season for a smallholder household. Complementary near-release candidate varieties have also reached advanced farmer field trials in Iganga and Namutumba districts. This research brief adds directly to that pipeline. It reports the results of Mountains of the Moon university, Makerere university and NARO research that screened a wider set of maize breeding lines for Striga resistance, identified which of them are the best genetic “parents” to breed from, and pinpointed specific resistant hybrid combinations ready to move toward release.

4. What the new research found

The research team ran three connected studies over two growing seasons at Striga-infested sites in Namutumba, Tororo, and Kasese districts.



4.1. Key findings

The research identified maize materials that can resist Striga and used them to develop promising new hybrids. Several of these hybrids are now ready for further testing in different parts of Uganda before they can be officially released to farmers. The results also show that varieties perform differently across locations. The next step is therefore to test the best materials widely, select those that perform well in specific areas, officially release them, multiply the seed, and make it available to farmers.

5. The economic justification for completing the work.

USD 7bn+ lost every year across Africa to Striga (FAO estimate)	40- 50 m ha of African farmland infested by Striga	100% possible yield loss in heavily infested maize fields
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The above national and regional figures translate into concrete, local stakes for Uganda. Uganda's Striga endemic maize area is conservatively estimated at 200,000-300,000 hectares, concentrated in the eastern, northern, and parts of the western maize belt. Applying a conservative average yield loss of around 40% across this footprint against the national average yield of 2.4 tonnes per hectare implies forgone production in the range of 150,000-220,000 tonnes of maize each season. This is worth an estimated USD 30-45 million a year in farm-gate value at prevailing prices. Even recovering half of this lost value through wider adoption of resistant varieties would return an estimated USD 15-22 million a year directly to farming households, before counting the value of land that could be brought back into productive use. Beyond these direct production gains, finishing the breeding pipeline delivers three further categories of benefit:

- Food security and household income: Restoring yields on land currently abandoned or badly depressed by Striga, without requiring farmers to buy extra herbicide, hire extra labour, or apply extra fertiliser.
- Breeding efficiency and cost savings: With resistant parent lines and their breeding value already identified, NARO and partner programmes can skip years of exploratory screening and move straight into variety development and release.
- Climate and land-use resilience: resistant, locally matched hybrids reduce the pressure on families to clear new or marginal land, including forested land, to make up for Striga-related losses.

6. Aligning with national and continental priorities

This brief slots directly into commitments Uganda has already made and into the wider continental agenda Uganda is party to.

Framework	How this research contributes
National Development Plan III & Vision 2040	Directly supports agro-industrialization and productivity growth in maize, a strategic food and cash crop, by closing the yield gap through resistant varieties.
MAAIF Strategic Plan	Advances improved seed systems, strengthens pest and disease management, and widens farmer access to quality planting material.
National Seed Policy & National Seed Strategy	Feeds proven resistant genetic material into Uganda's formal seed multiplication, certification, and marketing system, strengthening seed quality and availability.
National Variety Release System (NARO / National Variety Release Committee)	The resistant lines and hybrids identified here are positioned to enter the formal multi-locational trial and release pipeline this Committee administers.
National Agricultural Research Strategy	Reinforces the strategy's emphasis on demand-driven, farmer-relevant technology generation and on stronger links between university research and NARO's applied breeding programmes.
Comprehensive Africa Agriculture Development Programme (CAADP) / Malabo Declaration	Supports CAADP's core goals of raising agricultural productivity and strengthening resilience to biotic stresses across African farming systems.
African Union Agenda 2063	Contributes to Agenda 2063's Aspiration 1 on inclusive growth and modern, transformed agriculture, by turning home-grown research into a deployable food-security technology.

7. The remaining policy and implementation gap

The central message of this brief is simple: the science is essentially done; what remains is institutional. Resistant genetic material has been identified, its breeding value is known, and one variety (NAROMAIZE 64 STR), is already in farmers' hands. The bottleneck now sits downstream of the research station, in the steps that turn a promising breeding line into certified seed that a farmer can buy locally. The table below sets out where that gap currently lies.

Remaining gap	What is needed to close it
Validation of newest materials	The resistant lines and hybrids identified still need multi-locational trials beyond the three research sites before they can be formally recommended to farmers.
Formal variety release has not yet been sought	None of the new hybrids identified here have entered the National Variety Release Committee's testing and approval process; NAROMAIZE 64 STR is, so far, the only fully released product of this pipeline.
Seed multiplication capacity is limited.	Moving from small quantities of breeder and foundation seed to the volumes of certified seed needed for national distribution requires dedicated multiplication capacity and financing.
Last-mile delivery is patchy.	Agro-dealer networks are thinner in remote Striga-endemic areas, so even released varieties do not reliably reach the farmers who need them most.
Financing is ad hoc rather than sustained.	Breeding-to-seed work is currently funded through short, project-based grants; a predictable, multi-year budget line is needed to carry material through every remaining stage without delay.
Linkages between research, seed companies, and farmers are weak	NARO breeders, private seed companies, and farmers are not yet systematically connected, so proven resistant material can stall between the research station and the market.
Farmer awareness and trust are still building	Many farmers are not yet aware that Striga-resistant seed exists or are cautious about switching from familiar varieties; sustained demonstration plots and extension messaging are needed to build confidence and drive adoption.

None of these gaps require new research to close. They require sustained financing, clearer institutional ownership, and stronger coordination between the actors who already exist within Uganda's research and seed system.

8. Recommended policy actions and implementation roadmap

Closing the gaps identified above requires four coordinated policy actions. Indicative costs and timelines below are planning-level estimates intended to guide budget discussions and should be refined through detailed costing by NARO and MAAIF.

Action	Lead institution(s)	Timeline	Indicative budget (USD)	Success indicator
Advance identified resistant lines and hybrids into the formal release pipeline, and commission a full costed economic study of Striga's national impact.	NARO / NaCRRI; MAAIF; universities	Year 1-2	150,000 to 250,000	Priority lines and hybrids entered into national performance trials; economic study published
Validate and match varieties to specific areas, rather than a single blanket recommendation.	NARO; district agricultural extension services	Year 1-3	100,000 to 180,000	Area specific variety recommendations issued and communicated to extension staff
Fund multi-season durability testing of the strongest resistant lines, given Striga's decade-long seed-bank persistence in the soil.	NARO / NaCRRI; universities	Year 1-4 (rolling)	80,000 to 150,000	Multi-season resistance-stability data confirming mega-environment groupings
Strengthen the breeding-to-seed value chain: fund early-generation seed multiplication and formalize data-sharing between university breeders and NARO's seed unit.	MAAIF; NARO seed unit; seed companies; universities	Year 1-3 (ongoing)	300,000 to 500,000	Certified seed of released Striga-resistant hybrids available through agro-dealers

9. Reaching every farmer: Gender, youth, and equitable access

The burden of Striga is not shared equally. Hand-weeding, the most common current control method, falls disproportionately on women and children, adding hours of unpaid labour to already stretched household schedules. Because resistance is built into the seed itself, resistant varieties directly reduce this labour burden, freeing time that women in particular can redirect to other productive or household activities.

- Ensure seed pricing and small-pack sizes make resistant varieties affordable and accessible to women-headed and low-income households.
- Support youth involvement in seed multiplication, agro-dealership, and extension messaging as a source of rural employment tied to the expanding Striga-resistant seed value chain.
- Target extension messaging on Striga identification and resistant seed use to household members.

10. Conclusion and way forward

Uganda cannot weed its way out of the Striga problem. Hand-pulling, herbicide-coated seed, and crop rotation all help, but each is only a partial, recurring fix that many smallholder households cannot sustain season after season. This research confirms that a better answer already exists inside the maize seed itself: exploitable, genetically straightforward resistance to Striga, now proven in real varieties, starting with NAROMAIZE 64 STR, and backed by a further pipeline of resistant lines and hybrids ready for the next stage of development. The remaining task is not scientific but institutional: validating these materials across more areas, pushing them through formal variety release, multiplying enough seed, and getting that seed into agro-dealer shops within reach of ordinary farming households. With modest, targeted investment guided by the roadmap in Section 8, the resistant varieties described here could reach a meaningfully larger share of Uganda's Striga-affected maize farmers within a small number of additional seasons, turning a research finding into food on the table and income in the household purse.

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