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Common striga control methods in Nigeria: A review

B. A. Mahmoud[1], I. L. Hamma[2], S. Abdullahi S[3], Y. Adamu[4*]

[1]*Federal College of Horticulture Dadin-kowa, Gombe State, Nigeria*

[2]*Samaru College of Agriculture/DAC/ABU- Zaria, Nigeria*

[3]*Abubakar Tafawa Balewa University, Bauchi, Nigeria*

[4]*Federal University Kashere, Gombe State, Nigeria*

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Abstract

Striga is a parasitic weed commonly found in both cereals and legumes, reducing yield between 80-100%. Different control measures emerging from various agricultural Researchers at national and international levels are been recommended in tackling the negative effects of this weed. A review of these findings has been discussed for the benefit of our poor-resource farmers in Nigeria. Based from these findings, striga can be managed using one or more methods: use of biological control practices, use of cultural control practices, planting of resistant host crops, use of nitrogen fertilizers and use of chemicals/herbicides. The choice of any of these methods will depend on the literacy level of the farmer, available desired technology, availability of resources at his/her disposal and size of his/her farm. However, the use of resistant host crops is considered to be the most preferred because it can easily be handled, affordable, cheaper and more environmentally friendly for Nigerian farmers.

* **Corresponding Author:** Y. Adamu ✉ yauadamu@yahoo.com

Introduction

Striga is a parasitic weed which is popularly called 'witch weed' attacking a wide range of crops such as cereals, legumes etc. The attack of this weed causes a lot of economic losses. It is an obligate parasite which is chlorophyllus but usually requires a host plant to complete its life cycle (Kim, 1994). Four species out of thirty are known to be of economic importance in Nigeria, these are *Striga hermonthica, Striga gesneriodies, Striga asiatica and Allectra vogelli.* Some of the visible damages caused by this weed include blotching, scorching, wilting, loss of vigour and finally death of the plant. Other adverse effects on crops are a reduction in the ear size, plant height, stem diameter and weight of the whole plant. In addition, severe damage on roots as well as stem lodging may also be observed. Yield losses range between 10–78% especially on susceptible maize cultivars (Kim, 1994). Their life cycle is generally similar, with seeds serving as the source of inoculum and is produced abundantly with an average of 10,000 to 100, 000 seeds per plant (Kim, 1994). Kim (1994) also reported yield losses ranging from 30 – 90 % in maize, 20- 100% in sorghum and millet resulting from *Striga hermonthica* in Nigeria. It could be observed that *Striga spp* that attack cereals are distinct from those on legumes. For example, studies in Nigeria have shown that *Striga hermonthica* and *Striga gesneriodes* dorminate attack mostly cereals (Olakojo and Olaoye, 2004).While *Striga asiatica* and *Allectra vogelli* attack mostly legumes (Olakojo and Olaoye, 2004). Striga species exhibit variation in their mode of reproduction. *S. hermonthica* and *S. gesneriodes* are allogamous that is they observe cross pollination and usually rely on vectors such as bees and other agents of pollination for pollen transfer. *S. asiatica* on the other hand is autogamous that is it observes self pollination and so, no vectors are needed for pollination instead pollens are picked by the elongation of style and fertilization takes place (Kim, 1994).

Biological control method

In this method potential natural enemy of *Striga species* such as *S. hermonthica* is usually controlled in the farm using fungal pathogens like *Fusarium oxysporum*. The inoculum is introduced into the farm before planting either millet or sorghum which was observed to control striga emergence and increased host shoot and grain yield (Jost and Saverbon, 1996). Jost and Saverbon (1996) equally observed that younger plants of *Striga hermonthica* are more susceptible to *Fusarium oxysporum* than older plants. This suggested that *Fusarium oxysporum* acted as a bio herbicide against *S. hermonthica*. Studies in Burkina Faso has shown that weevils called *Smicronyx guineanus* and *Smicronyx umbrinus* can also be used to control striga in the field using their males and larvae by entering into the ovary of striga inflorescence to form galls that prevented striga seed production. Scientists in Libya have demonstrated that a bacterium isolate *(Spirillum brasilense)* from sorghum seeds was used to reduce striga from 65% to 10%. It was observed that the bacterium *(Spirillum brasilense)* produced chemicals which interfere with stimulants from the host plant preventing the survival of striga in sorghum fields. Incorporation of the isolate *(Spirillum brasilense)* in plots planted with sorghum resulted in 70% reduction of emerged striga plants, 68% reduction in striga biomass at harvest and 80% reduction in the number of flowers of striga produced compared to the control treatment.

Chemical control method

Berner *et al.* (1995) immersed cowpea seeds in aqeous solution of imazaquin as a measure of protection against striga. Results of the experiment showed that cowpea plants were protected against striga and improved yield of cowpea was realised. Imazaquin reduced seed density of striga in the soil which resulted in the mortality of striga as a result of inhibition of amino acid biosynthesis. Babiker *et al.* (1996) reported that a combination of urea and dicamba effectively controlled striga between 62-92% on sorghum, while chlorsulfuron in combination with dicamba controlled striga as much as 77 – 100% on sorghum. Babiker *et al.* (1996) reported in Burkina Faso that 2, 4- D when applied either as a single or double doses is effective in the control of *Striga hermonthica* in sorghum fields. It was observed that the herbicide reduced number of flowering striga to 53%, striga plants from 38 – 84% 10 days after sowing. Babiker *et al.* (1996) at Mali tested the herbicide 2, 4–D pre–emergence application of 2, 4–D gave better yields compared to post emergence application. However, striga populations were significantly reduced in both cases. Such control measures are recommended for Nigerian farmers.

Use of nitrogenous fertilizers

Olakojo (2004) used six nitrogen fertilizers (Urea, CAN, NPK, NH_4SO_4 and Compost) on two maize varieties; one is striga tolerant and the other is striga susceptible to study their effects in striga control at Moor plantation, Ibadan. Striga related characters were measured. Results showed that NH_4SO_4 and Urea controlled striga incidence and subsequently enhanced higher grain yield under striga infestation. Under artificial infestation in the same vein, NPK and Calcium Ammonium Nitrate (CAN) suppressed striga and enhanced higher grain yield (Olakojo and Olaoye, 2004).

Cultural control practices

This involves the use of trap crops such as soybean to stimulate the germination of striga seeds but the striga does not paratisized on soybean. The soybean causes suicidal germination of the striga seedlings which do not attack the soybean consequently; the striga is ploughed off before flowering thereby reducing the seed density of striga in the soil (Umba *et al.*, 1999). In IITA, about forty lines of soybean were screened for their ability to induce *Striga hermonthica* seeds to germinate using the cut roots of soybean plants. The results showed variability among the soybean lines in their ability to stimulate seed germination. Other cultural methods of striga include the use of hand hoe to weed off striga, pulling striga seedlings with hands before flowering. Farmers that live in areas where there is availability of land do practice shifting cultivation whereby already over used farm land is abandoned for certain number of years to regain its fertility before returning to such land, the higher the nitrogen level of the soil the less the probability of striga infestation of the land (Nworgu and Olakojo, 2006).

Use of resistant varieties

This method has to do with breeding of resistant crop varieties that can withstand the infestation of striga and still capable of producing appreciable quantity and quality of grain yield. Kim (1994) described striga tolerance as the ability of the host plant to withstand the effects of parasites that are already attached. On the other hand resistance is the ability of the host to prevent attachment of the parasite to its roots. Though latter studies were often based on count of emerged parasitic plants, this was supported by confirmation of the number of attachment of the parasite to the host plant. In an attempt to develop striga tolerant maize varieties, Kim (1994) screened some maize inbred lines under *S. hermonthica* infestation and classified them as very susceptible, susceptible and moderately tolerant using a rating scale of 1 – 9. Crosses were then made among these classes of striga tolerant inbred lines to generate F1 hybrids. The F1 hybrids were evaluated in *S. hermonthica* endemic field under artificial infestation with striga inoculums using the method described by Berner *et al.* (1995). The four – year evaluation showed that the inbred lines reduced striga infestation under maize fields. In 2004, Olakojo investigated the reaction of some maize genotypes with infestation to *S. asiatica* under artificial striga infestation using Kim, (1994) inoculation method. Results from this experiment showed that there are high tolerant levels among the inbred lines of maize to striga infestation under field condition. These results further suggested a promising future for breeding striga resistant crop varieties. The need to test different striga tolerant maize genotypes developed by Breeders thus becomes very imperative. The use of resistant crop varieties is the cheapest, most affordable and perhaps the most environmentally friendly measure of striga control.

Conclusion

Integrated measures seem to be the best option for striga control in Nigeria and Africa. Variability in farming systems, literacy level, ecological peculiarities and farmers' resources will go a long way in the choice of method to apply. The important thing is to control this devastating parasitic weed, so as to enhance higher crop yield per hectare and to better the standard of living of our poor resource farmers in Nigeria.

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