Research Application Summary pp: 321 - 327

Farmer perception on effects of the witch weed infestations in sorghum in Ishongorero sub county, Ibanda district, south western Uganda

Bua, B.[1] & Nowamani, C.[1]
[1]Department of Agriculture, Kyambogo University, P. O. Box 1, Kyambogo, Kampala, Uganda

Corresponding author: boscobua@yahoo.com

Abstract

Sorghum (*Sorghum bicolor* (L.) Moench is the fifth most important cereal in the semi arid regions of the world in terms of production and area planted. However, sorghum production is constrained by a number of factors including pests and diseases. Witch weed (*Striga* spp.) is one of the pests constraining sorghum production in most parts of Uganda including Isonghorero sub-county in Ibanda district. Therefore, the objective of the study was to assess farmer perceptions on effects of the witch weed infestations on sorghum in Ishongorero sub-county. The study was a cross sectional survey. Multi-stage random sampling technique was used to identify and interview 70 respondents comprising of farmers, opinion leaders, political and technical leadership of the sub-county. *Striga* infestation was widespread and devastating in most of the fields surveyed. The effects of *Striga* included stunted growth and reduced yield among others. Different control measures were reportedly employed to contain the spread of *Striga* including uprooting and crop rotation/fallowing. *Striga* weed was mostly devastating at the pre-flowering stage and exhibited a number of effects including stunted growth and reduced yields among others. Different control measures were employed to contain the spread of *Striga* including uprooting and crop rotation/fallowing.

Key words: Control, effects, prevalence, yield

Résumé

Le sorgho (*Sorghum bicolor* (L.) Moench est la cinquième céréale la plus importante dans les régions semi-arides du monde en termes de production et de la superficie ensemencée. Cependant, la production de sorgho est limitée par un certain nombre de facteurs, y compris les parasites et les maladies. La mauvaise herbe sauvage (*Strigaspp.)* est l'un des ravageurs qui limitent la production de sorgho dans la plupart des régions de l'Ouganda, y compris le sous comté d'Isonghorero, dans le district d'Ibanda. Par conséquent, l'objectif de l'étude était d'évaluer les perceptions des agriculteurs sur les effets des infestations de mauvaises herbes sauvages sur le sorgho dans le sous comté d'Ishongorero. L'étude était une enquête transversale. Les techniques d'échantillonnage multi-étape aléatoire ont été utilisées pour identifier et entretenir 70 répondants comprenant des agriculteurs, les leaders d'opinion, le leadership politique et technique du sous comté. L'infestation de *Striga* a été généralisée et dévastatrice dans la plupart des domaines étudiés. Les effets de la S*triga* ont inclus, entre autre, un retard de croissance et un rendement réduit. Les mesures différentes de contrôle auraient été utilisées pour contenir la propagation de *Striga* y compris le déracinement et la

rotation des cultures / jachère. Les herbes de *Striga* étaient surtout dévastatrices au stade de préfloraison et présentaient un certain nombre d'effets, y compris un retard de croissance et des rendements réduits, entre autres. Des différentes mesures de contrôle ont été utilisées pour contenir la propagation de *Striga* y compris le déracinement et la rotation des cultures en/ jachère.

Mots clés: contrôle, les effets, la prévalence, le rendement

Background

Sorghum (*Sorghum bicolor* (L) Moench is the fifth most important cereal in the semi arid regions of the world in terms of production and area planted (Mushonga *et al.,* 1992). Besides, the bicolor races, the other races of sorghum widely adapted and grown include *guinea, caudatum, durra* and *fakir.* According to Harlan and de Wet (1972), sorghum is able to produce good yields under dry conditions unfavorable to most other cereal crops. In fact, the crop has been grown for almost 5000 years or more. Accordingly, about 90% of the global area planted to sorghum is in developing countries especially Africa and Asia (FAO, 2002).

In Uganda, sorghum is the third most important cereal crop after maize and finger millet. Sorghum is widely grown in the drier short grass areas of northern, eastern and western parts of the country by the resource poor farmers (Oryokot *et al.,* 1999).Consequently, there are many cultivars of sorghum grown in Uganda for a variety of purposes including food, porridge, beer and fodder as well as cash income. However, production statistics showed that sorghum production in Uganda has decreased from 467000 metric tones to 43,000 tones in 1975 and 2002, respectively (FAO, 2002). According to Ebiyau *et al.* (2005), about 265,000 hectares of sorghum was grown in the south western highlands districts of Kabale, Ibanda and Kamwenge as well as in the lowland areas of east and northern regions of Uganda. The low acreage and production of sorghum is attributed to a number of factors including pest and disease infestations as well as declining soil fertility amongst others. *Striga* weed also commonly known as witch weed is among one of the most devastating pests of sorghum worldover. In fact, *Striga* weed greatly reduced the quantity and quality of sorghum produced per unit area. However, in Ishongorero sub-county, information on farmer perception of the effects of *striga* weed infestations on sorghum is not known. Therefore, this study was undertaken to assess farmer perception of the effects of *Striga* weed infestations on sorghum production in Ishongorero sub-county.

Literature summary

Striga parasitism is one of the serious constraints in cereal crop growing in many regions of tropical Africa. *Striga* infests crops like sorghum, maize, millet, rice and sugarcane. However, available evidence indicates that *Striga* is more damaging in sorghum. *Striga* belongs to the family of *Scrophilariales.* Although, it is chlorophyllous, *Striga* requires a host plant like sorghum to complete its life cycle (Musselman, 1987).

Accordingly, the *Striga* weed seriously constrains the productivity of sorghum because it survives by siphoning water, photosynthates, minerals and nutrients from the crop for its growth. *Striga* causes damage to the host crop upon attachment to host roots thus, resulting it into wilting, withering, yellowing of leaves, leaf desiccation, curling, stuntedness in growth and result into less sorghum yields (Kim., 1991). According to Sauerborn *et al.* (1990), *Striga* weed infests as much as 45 million hectares of small holders farm lands in the sub-Saharan Africa causing yield losses ranging from 20-80% or even total crop failures under severe infestation (Oiokeh *et al*., 2006). In fact, Ejeta (2007) estimated that the annual loss due to *Striga* weed parasitism is approximately US$7 billion which is very detrimental to the lives of over 100 million African people. Moreover, *Striga* weed is not only a biological constraint to food production in sub-Saharan Africa but also a social economic constraint to resource poor farmers (Vallance, 1995).

The problem of *Striga* has been recognised in Uganda for over 60 years with little progress in addressing it. Consequently, with the increasing demographic pressure, *Striga* infestation has gradually increased and become a threat to food production in Uganda. According to Pieterse and Verklief (1991); Parker and Riches (1993), the distribution of *Striga* is mainly determined by biophysical factors. In fact, studies done elsewhere indicate that the degree of infestation is related to the characteristics of the farming systems (Parker, 1992; Elisaba *et al.*, 1997). In addition, the low and erratic rainfall conditions predominant in the cereal growing areas of Uganda have exacerbated the *Striga* problem. For example, recent survey in Uganda indicated that *Striga* was found in 83% and 80% of the fields in Pallisa and Tororo districts, respectively. The estimated sorghum grain yield losses ranged from 60-100% (Anonymous, 1997).

The most damaging species in sub-Saharan Africa is *Striga hermonethica* which affects maize, sorghum, rice, finger millet and sugarcane. *Striga* is difficult to control as it produces numerous tinny seeds which can remain viable in the soil for up to 20 years (Worshan and Egley, 1990). In fact, *Striga* produces a lot of toxins that interfere with other crop species. Seeds are stimulated by crop exudates to germinate and infest the host crop while reproducing and increasing the *Striga* seed bank in the soil, thus; escalating the reduction of yields (Okonkwo, 2006).

Therefore, the best way to minimise the problem of *striga* is to avoid contamination during harvest and threshing of the crop or not to lay a harvested product on the ground where *Striga* weeds are transferred to the clean seeds especially those of sorghum (Esilaba *et al.,* 1997). The seeds should be cleaned before planting, prevent ruminant animals wandering from infested areas, ensure that planting materials come from a *Striga* free area, weed control should be done before six weeks. Hand puling is preferred because it poses little risk to the *Striga* plants developing just under the soil surface. Also, mechanical tillage should not be used after or when *Striga* weed has emerged out of the soil (Sand *et al*., 1990), herbicides for example Triazine or Gramaxone can be used to interfere with amino acid biosynthesis resulting in successful *Striga* control. However, the most effective control against *Striga* infestation is to avoid growing susceptible crops, abandoning of infested *Striga* areas by practicing land fallowing, use of non-host crops which stimulate *Striga* to germinate

but do not support its growth (Wild, 1998). In fact, the non-hosts can significantly deplete the soil seed bank by inducing suicidal germination of *Striga*. Non- hosts may be grown intermixed or inter sown into standing cereal crop (Parkinson *et al*., 1988).

Study description

The study was conducted in Ishongorero sub-county, Ibanda district, western Uganda during the period February and June 2013. The study was a cross sectional survey to assess farmer perception of the effects of *Striga* weed infestation on sorghum in the sub-county. The sub-county was chosen because it is one of the major sorghum growing areas in the district. All the five parishes of Rwenkobwa, Kakinga; Muziza, Rushaka and Kalangala were surveyed because of the intensity of sorghum production and *Striga* weed infestations. The target respondents were the farmers, opinion leaders, political and technical leadership in the sub county. In total, 70 respondents comprising 50 farmers, 15 political leadership and 5 agriculture officials were interviewed on farmer perception of the effects of *Striga* weed infestations on sorghum, the prevalence of striga weed infestation on sorghum, factors favouring *Striga* weed distribution, effects of *Striga* and control methods. Focused group discussions were conducted to validate the information collected from the farmers. All the data collected were summarised and entered into Excel spreadsheets and analysed using the descriptive statistics of the SPSS computer programme.

Research application

Slightly over 50% of the respondents involved in sorghum growing were married female aged 35 years or above an indication that sorghum is mainly grown by women (Esilaba *et al.,* 1997). Overall, close to 70% of the respondents had some form of education ranging from primary to tertiary level of education. *Striga* weed was encountered in all the parishes surveyed but with varying prevalence. The highest and lowest prevalence was recorded from Rwenkoba and Rushaka, respectively. However, no significant differences were observed in prevalence among the parishes of Kakinga, Rushaka and Kangara (Table 1). This finding is in agreement with Olupot *et al.* (2005), who observed that *Striga* was found in 88% of the field surveyed. This, therefore, means that *Striga* is a serious threat to small holders' agriculture. The *Striga* weed infestation and distribution was associated with a

Table 1. Prevalence of *Striga* weed in Isonghorero sub county, Ibanda district, 2013.

Parishes	Frequency (%)
Muziza	22
Kakinga	18
Rwenkobwa	30
Rushaka	14
Karangara	16
Total	100

number of factors. According to earlier studies, *Striga* is ubiquitous in most farming systems associated with intense demographic pressure and soil infertility (Parker, 1992; Esilaba *et al.*, 1997). The effects associated with *Striga* infestations on sorghum are presented in Table 3. The most commonly reported effects of *Striga* weeds were stunted growth and yield reduction as opposed to the complete death of the plants. Overall, *Striga* was reportedly devastating during the pre-flowering stage. Different control measures were employed for

Table 2. Factors favouring *Striga* weed survival and distribution in Ishongorero sub county, Ibanda district, 2013.

Factors	Frequency (%)
Production of toxins	32
Diverse mechanisms of dispersal	22
Poor methods of farming	18
Resistant underground structures	14
Inadequate farming inputs like herbicides	8
High dormancy	16
Total	100

Table 3. Effects of *Striga* weed infestation on sorghum in in Isonghorero sub county, Ibanda district, 2013.

Effects of striga weed	Frequency (%)
Stunted growth and reduced yields	44
Increased cost of production and poor quality of produce	18
Abandoning of land infested with weed	14
Death of the plant	12
Others	10
Total	100

Table 4. Control measures for striga weed in sorghum in Ishongorero sub-county, Ibanda district, 2013.

Control measures	Frequency (%)
Uprooting and crop rotation/fallowing	52
Use of herbicides	24
Early planting and mixed cropping	12
Burning	2
Nothing done	10
Total	100%

the control of *Striga* weed (Table 4). The most commonly reported practice was uprooting and crop rotation as opposed to burning. The sources of information for the *Striga* infestations were varied including school children, extension workers and fellow farmers among others. According to many authors, control of *Striga* cannot be achieved using a single method but by an integrated approach (Esilaba *et al*., 1997; Odhiambo and Ransom, 1997; Olupot *et al*., 2005).

Recommendation

Due to the devastating effects of *Striga* weed on cereal crops production, there is need for the government and other stakeholders to provide resources to develop varieties which are resistant to the *Striga* weeds. Also, since the majority of the respondents were not very conversant with the devastating effects of the weed, there is need for sensistisation and awareness creation on *Striga*, means of spread and control. Above all, there is need for an integrated control approach.

Acknowledgement

This was done by the second author in partial fulfillment of the requirements for the award of Bachelor of Vocational Studies in Agriculture with Education of Kyambogo University. The cooperation of the respondents during data collection is greatly appreciated.

References

Ebiyau, J., Arach, T. and Serunjogi, L.K. 2005. Commercialisation of sorghum in Uganda, *African Crop Science Conference Proceedings* 7:695-696.

Ejeta, G. 2007. The *Striga* scourge in Africa: A growing problem. pp. 3-16. In: Integrating new technologies for Striga control: Toward ending the witch-hunt. Ejeta, G. and Gressel, J. (Eds.). World Scientific Publishing Co., Hackensack, NJ.

Esilaba, A.O., Mulatu, T., Reda, F., Ransom, J.K., Woldewahid, G., Tesfaye, A., Fitwy, I. and Abate, G. 1997. Factors affecting the incidence of *Striga* and its control in northern Ethiopia. *East African Biennial Weed Science Conference Proceedings* 16:221-229.

Food Agriculture Organization (FAO). 2002**.** Statistics series No.176, Rome, Italy, Volume 56.

Harlan, J.R. and de Wet J.M. 1972. A simplified classification of cultivated sorghum. *Crop Science* 12:172-176

Kim, S.K. (Ed.). 1991. Combating *Striga* in Africa. Proceedings of the International Workshop organised by IITA, ICRISAT, and IDRC, 22-24 August 1988. IITA, Ibadan, Nigeria. 151 pp.

Musselman, L.J. 1987. Taxonomy of witchweeds. pp. 3-12. In: Parasitic weeds in agriculture volume I: *Striga*. CRC Press, Inc., Boca Raton, Florida, U.S.A. 317pp.

Mushonga, J.N., Gono, L.T. and Sithole, S.Z. 1992. Sorghum. In: Whingwiri, E.E., Mashingaidze, K. and Rukuni, M. (Eds.). Small-scale Agriculture in Zimbabwe. Book 2. Field crop production. Rockwood Publishers Harare, Zimbabwe. p. 193.

Odhiambo, G.D. and Ransom, J.K. 1997. On-farm evaluation of an integrated approach to striga control in western Kenya. *African Crop Science Conference Proceedings* 3: 887-893.

Oikeh, S.O., Chude, V.O., Kling, G.J. and Horst, W.J. 2007. Comparative productivity of nitrogen-use efficient and nitrogen-inefficient maize cultivars and traditional grain sorghum in the moist savanna of West Africa, *African Journal of Agricultural Research* 2: 112–118.

Okonkwo, S.N. 2006. In vitro post-germination growth and development of embryos of Alectra (Scrophulariaceae). *Physiologia Plantarum* 34:378-383.

Olupot, J.R., Abaijuka, I., Dradiku, F., Edema, P. and Mukalazi, J. 2005. Striga infestation in the west Nile Agro-ecological Zone of Uganda: The Socio-economic perspective and the way forward. *African Crop Science Conference Proceedings* 7:1507-1511.

Oryokot, J., Ebanyat, K. and Edema, R.1999. Impact of striga weed on cereal crops, Makerere University Printing Press, Kampala-Uganda. pp. 112-116.

Parker, C. 1992. Review of *Striga* studies in Ethiopia up to 1986. pp. 22-34. In: Rezene Fessehaie and Parker, C. (Eds.). Problems and control of parasitic weeds in Ethiopia. Proceedings, 2nd Ethiopian Weed science Workshop, Addis Ababa, 1988. EWSC, Addis Ababa, Ethiopia.

Parker, C. and Riches, C.R. 1993. Parasitic weeds of the world. Biology and control. CAB International.

Parkinson,V.O., William, R.D., Lambart, D.A. and Cook, J.1987. Potential use of trap crop as a cultural measure of *Striga* weed control in Africa, FAO Annual bulletins report.

Pieterse, A.H. and Verkleij, J.A.C. 1991. Effect of soil conditions on *Striga* development. A review. 329-339. In: Ranson, J.K., Musselman, L.J., Worsham, A.D. and Parker, C, (Eds.). *Proceedings of the fifth international symposium on parasitic weeds, Nairobi, Kenya*.

Ramaiah, K.V., Collins, R. and Raynal, R.A. 1993. Methodology for establishing witch weed *Striga hoermotheca* in research plots. Witch Weed Technology Proceedings. Addis Ababa, Ethiopia. pp. 548.

Sand, P.F., Eplee, R. and Westbrooks, R.G. 1990. Witch weed research and control in the United States America, monograph series of weed science, America Weed Science Society Number 5.

Sauerborn, J. 1991. The economic importance of the phytoparasites *Orobanche* and *Striga.* pp. 137-143. In: Robsom, J.K. and Musselmen, L.J., Worsham, A.D. and Parker, C. (Eds). Proceedings of 5th International Symposium on parasitic weeds, Nairobi, Kenya

Vallance, K. 1995. Studies on germination of seeds of *Striga hoermotheca* and its botany Vol.2 River line Printers Nairobi, Kenya.

Wild, H. 1948. A suggestion for the control of tobacco witchweed (*Striga gesnerioides* (Willd.) Vatke) by leguminous trap crops, *Rhodesia Agriculture Journal* 45:208.

Worsham A.D. and Egley G.Y. 1990. Physiology of witchweed seed dormancy and germination. In: Witchweed Research and Control in the United States. Manograph 5; Weed Society of America, Champaign, IL, eds S and, P.F. Eplee, R.E. West Brooks, R.G.