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Research Application Summary

Status of weeds and weed management practices in finger millet growing areas in eastern Uganda

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Abstract

Finger millet (*Eleusine coracana* (L.) is a staple food crop and income earner in most drought stressed areas in Uganda. Unfortunately, rural communities are increasingly abandoning production of the crop due to complications with weeding arising from intensive labour associated with broadcast as a method of finger millet sowing and weeds infestation. However, limited research has been undertaken with respect to weeds affecting this crop and this has formed the rationale of this study. The objective of this study was to inventory the current weed profile, management practices and challenges faced in finger millet production within Lake Kyoga basin in Uganda. A semi-structured questionnaire was used to collect data from households in the millet producing area in Pallisa and Buyende Districts. In Pallisa District almost all (95%) households grew finger millet mostly in the first season; while in Buyende District 67% indicated that the crop is grown in both rainy seasons. *Striga hermonthica* (Delile) Benth was a menace in Pallisa District while *Acanthosperm hispidium* and *Oxygonium sinuatum* were dominant weeds in Buyende District. Weed diversity was greater in Buyende District (32 weed species) compared to Pallisa District (18 weed species). Weeding activities which constituted the burdensome component of finger millet production were done by women and children in Pallisa District. Buyende District had a fairly balanced distribution of roles among gender groups. Inaddition, it was established that in Pallisa district there inadequate extension services and they are almost non-existence in Buyende district, limited availability of labour particularly for weeding, frequent drought, low soil fertility, use of landrace seeds and termites limited production potential of the crop.

Key words: *Acanthosperm hispidium*, finger millet production, *Striga hormonthica,* weeds management

Résumé

L'éleusine (*Eleusine coracana* (L.) est une culture vivrière de base et une source de revenu dans la plupart des zones en Ouganda où la sécheresse est accentuée.

Malheureusement, les communautés rurales abandonnent de plus la production de la culture en raison de complications avec le désherbage découlant d'un travail intensif qui est associée à la diffusion en tant que méthode de semis d'éleusine et d'infestation des mauvaises herbes. Cependant, peu de recherches ont été entreprises en ce qui concerne les mauvaises herbes affectant cette culture, ce qui a constitué la raison d'élaboration de cette étude. L'objectif de cette étude était d'inventorier le profil des mauvaises herbes en cours, les pratiques et les défis de gestion face à la production d'elusine au sein du bassin du lac Kyoga en Ouganda. Un questionnaire semi-structuré a été utilisé pour recueillir des données auprès des ménages dans les zones productrices de culture du millet dans les districts de Pallisa et Buyende. Dans le district de Pallisa, la quasi-totalité (95%) des ménages ont planté l'éleusine principalement dans la première saison, tandis que dans le district de Buyende 67% ont indiqué que la plante est cultivée dans les deux saisons des pluies. Le *Striga hermonthica (Delile)* Benth était une menace dans Pallisa tandis *Acanthosperm hispidium* et *Oxygonium sinuatum* étaient des mauvaises herbes dominantes dans Buyende. La diversité des mauvaises herbes était plus grande dans Buyende (32 espèces de mauvaises herbes) par rapport à Pallisa (18 espèces de mauvaises herbes). Les activités de désherbage qui constituaient la composante la plus difficile de la production du millet étaient réalisées par des femmes et des enfants dans Pallisa. Buyende avait une répartition assez équilibrée des rôles entre les groupes de genre. En outre, il a été établi que dans le district de Pallisa, qu'il y avait des services de vulgarisation inadéquates et que dans le district de Buyende ce services étaient presque non-existence, la disponibilité limitée du travail en particulier pour le désherbage, des sécheresses fréquentes, la faible fertilité des sols, l'utilisation de semences de variétés locales et les termites ont limité le potentiel de production de la culture.

Mots clés: *hispidium Acanthosperm*, production d'elusine, *Striga hormonthica*, la gestion des mauvaises herbes

Introduction

Finger millet (*Eleusine coracana* (L.) Gaertn) is a staple and food security cereal crop for millions of people in semi-arid regions of the world, particularly in Africa and India (Shukla *et al*., 2015). Its long storability and high nutritive value in addition to its drought tolerance makes it a suitable staple food crop in drought prone areas of sub-Saharan Africa (Thilakarathna and Raizada, 2015). By and large, weeding remains the most constraining factor to viability of finger millet production in most rural areas in sub-Saharan Africa. A range of factors are blamed for this anomaly, including weeds, high labour costs, low soil fertility and use of less productive landrace seeds, among others (Owere *et al*., 2014).

Finger millet yields in countries like Uganda, are reportedly low (400-800 kg ha^{-1}) compared to on-station statistics (2500 kg ha^{-1}) (Tenywa *et al*., 1999). This low yield is exacerbated by the practice of broadcast sowing, which seems more convenient but quite burdensome and costly at weeding stage. Sowing and weeding of the crop are yet to be facilitated by mechanization, despite the several attempts to intervene through research and development efforts (Tenywa *et al*., 1999). Further research and development initiatives will require proper documentation of the present status and developments (both indigenous and improved),

as well as the changing landscape of weed dynamics among communities in the region in order to provide a logical platform for designing viable interventions. The objective of this study was to inventory current weed profiles, management practices and challenges faced in finger millet production within Lake Kyoga basin in Uganda.

Literature review

Finger millet production is labour intensive relative to other crops, and this has limited yields in production areas (Kidoido *et al*., 2002). The small seed size of the crop necessitates sowing at high planting densities, thus broadcasting is widely practiced, but makes weeding of *Digitaria scalarum* (Schweinf.) Chiov difficult (Nyende *et al*., 2001). The difficulty in weeding is further complicated by other weeds that resemble the crop (*Eleucine indica* (L.) Gaertn, *Digitaria* spp, *Cynodon dactylon* (L.) Pers., *Cyperus* spp) (Tenywa *et al*.,1999). The most important weeds associated with the crop are *Striga hormonthica* and *Eleucine indica* (Owere *et al*., 2014). *Striga hermonthica* is a serious hemi- parasitic weed that often emerges above ground after the first weeding (Atera *et al*., 2013). Consequently, the crop becomes stunted giving poor yields (Olupot *et al*., 2013). Nitrogen at different rates reduced *Striga* infestation by as much as 46-86% (Olupot, 2002). Intercropping the cereal crop with traps stimulates suicidal germination of *Striga*, and this is one of the methods used to check the weed population (Atera *et al*., 2008). Olupot *et al*. (2013) also reported that intercropping of *Celosia argentea* (L.) and cowpea (*Vigna unguiculata* (L.) Walp) caused suicidal germination of *Striga*. In terms of research, finger millet has received little attention compared to other cereal crops. This formed the rationale for this study whose objective was to take inventory of the current weed profiles, management practices and challenges faced in finger millet production within Lake Kyoga basin in Uganda.

Materials and methods

A field survey was carried in Buyende and Pallisa districts that are some of the major finger millet growing areas in eastern Uganda. A semi-structured questionnaire was administered targeting 60 households per District during November – December 2015. Households were randomly selected from lists provided by agricultural officers. Household heads were targeted for this purpose. For each household a field visit was made to assess the weed profile. In addition, focus group discussions were carried out.

Data generated were analyzed using descriptive statistics to characterize and summarize farmer responses using SPSS statistical package Version 2015.

Results

The major constraint reported across the two Lake Kyoga basin districts was the high labour requirements. In both Pallisa and Buyende Districts, weeds were mentioned to increase the labour costs and were considered a major limiting factor to fingermillet production in the two districts. The most constraining weed species in Pallisa District was *Striga hormonthica*, which drastically curtailed the crop yields. In Buyende District the most dominant weed

species were *Acanthosperm hispidium* and *Oxygonium sinuatum*. Although *Striga* was absent in Buyende District, farming communities were fairly aware of it and its menace elsewhere but were unprepared for its control. There is need for active extension campaigns in Buyende District targeting Striga awareness in order to prepare communities for Striga control. Drought was reportely common in Buyende District and was ranked 2 in importtance. In Buyende District, low finger millet production was also attributed to other factors such as lack of improved finger millet varieties and the inability to utilize moisture enhancing inputs such as cattle manure regardless of its availability. However, farmers in Pallisa District reportedly applied manure; practiced crop rotation and intercropping to counteract the Striga infestation and improve soil fertility. In both Districts, farmers only used broadcasting method to sow.

Other constraints that were reported across the districts were use of landraces, resulting in low yields as a result of total crop failure during grain filling. This situation prevails, despite presence of more recently released improved varieties such as Pese1, Seremi 1 and Seremi 2 (Owere *et al*., 2014). Unlike Buyende District, Pallisa District farmers had access to and were knowledgeable about the improved varieties, especially Seremi 2. Improved variety Seremi 2 has high grain yield, large grain size, large head size, higher grain weight, tolerance to lodging, disease tolerance, drought tolerance, medium plant height, early maturity, tolerance to shattering and ease of threshing, good aroma and taste and gives quality brew (Owere *et al*., 2014).

Farmers in Pallisa district also experienced instances of theft. About 67% farmers reported to have lost their millet either in the garden and/or after harvest. This was however not a pronounced issue in Buyende district. Both districts noted that low soil fertility further

Table 1. Major finger millet production constraints in eastern Uganda

Constraint	District			
	Pallisa		Buyende	
	Score	Rank	Score	Rank
Weeds	7	2	4	1
High labour cost	5	1	6	1
Striga hermonthica	6	1	-	-
Lack of market	3	4	2	5
Low soil fertility	5	2	2	1
Low yielding varieties	3	2	3	4
Drought	1	5	2	2
Pests such as termites	-	-	5	3
Thefts	1	6	-	-

Ranking used is 1 - 7; with 1 being the highest rank (most severe constraint) and 7 the lowest rank. Whereas – denotes constraint not reported

Table 2. Management practices used to address the finger millet production constraints in eastern Uganda

Constraint	Practices	District	
		Pallisa	Buyende
		Percentage of responses	
Inadequate extension	Training - Community/neighbours	43.3	-
	- NAADS/ extension services	46.7	-
	- Makerere University	-	-
	- NARO	-	-
Weeds	Planting rows	-	-
	Use of organic manure	26	-
	Use of inorganic fertilisers	-	-
	Family labour (women and children)	100	50
High labour cost	Hire of casual labour	91	35
	Use of previously under cultivation field	100	65
Striga	Crop rotation	46	-
	Growing sweet potatoes and legumes	34	-
	Use of intercropping	45	-
Low soil fertility	Use of organic manures	45	-
	Crop rotation	65	-
	Use of intercropping with legumes	30	-
Low yielding varieties	Use of improved varieties	35	
Drought	Planting short duration varieties	35	-
	Early planting	50	50
Thefts	Storage in the house	100	-

Percentage of farmers reporting from each farmer each District. NAADS; National Agricultural Advisory Services, NARO; National Agricultural Research Organization

exacerbated poor millet yields in the districts. While farmers in Pallisa district had access to extension services farmers in Buyende District did not (Table 2).

Discussion

The yields of the crop are reported low in the two districts due to the production constraints stated by the households (Table 1). The perceived low yield could be attributed to landrace seeds susceptible to *Striga* infestation which develops on minerals and photosynthate from

host crop. Atera *et al*.,(2013) reported piecemeal approach in *Striga* management as a setback to transfer technologies to farmers as a cause of 100% cereal yield loss several stress factors are involved. Farmers have given little attention to the crop due to non-adaptation of improved weed management practices, improved finger millet varieties, poor attitude to the crop, and changing climatic conditions. The farmers reported production constraints that seriously lowered yields especially weeds and low soil fertility (Table 1). Weeds cause most of the crop losses and farmers spend more of their time weeding the crop. Legumes are used in rotation or intercropped with finger millet to cause suicidal germination of *Striga hormonthica* as well suppressing the co-existing weeds. Crop sequencing intercepts weed composition, weed emergence, growth and fecundity. The farmers identified *Eleusine indica* as the major constraint affecting finger millet production in Buyende District. Grassy weeds such as *E. indica* predominates the finger millet fields in Uganda and this weed has intensive root system which causes difficulties in uprooting as finger millet is also uprooted in the process (Nyende *et al*., 2001). In addition, *Eleusine indica* resembles finger millet at vegetative stage which makes weeding difficult. Weeds such as *Acanthosperm hispidium* and *Oxygonium sinuatum* are thorny which prick the farmers while weeding. Farmers in Buyende district had limited extension service on the improved finger millet varieties possibly because they were distant from the fingermillet Research Institute (NaSSARI) (Table 2). Other key constraints contributing to the decline in finger millet production apart from weed management, tools and equipment, high labour costs and limited application of manure as previously reported by Kidoido *et al*. (2002). It is envisioned that the use of cattle manure would increase the organic matter content and water holding capacity of the soils in Buyende District which were predominantly light textured. Additionally, provision of pro-active extension services is necessary to encourage farming communities to exploit the locally available resources for improvement of productivity of finger millet.

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