

Research Application Summary

Influence of soil fertility management on *Striga* seed bank dynamics and grain yield of sorghum in semi arid areas

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Abstract

The parasitic weed *Striga* poses a serious threat to cereal production in sub-Saharan Africa. Infestation usually results in significant yield losses, quite often over 70%. Many control options have been reported but, the effect of soil fertility management on *Striga* seed production is not well known. Understanding *Striga* seed production is one of the key elements to management of this weed in Africa. Field experiments in two growing season will be conducted to determine the growth, *Striga* seed production and sorghum grain yield treated with different rate and source of organic and inorganic materials. The treatments will include farmyard, chicken manures, urea and triple superphosphate.

Key words: *Sorghum bicolor*, sub-Saharan Africa, witchweed

Résumé

La mauvaise herbe parasite *Striga* constitue une menace grave pour la production des céréales en Afrique sub-saharienne. L'invasion se traduit généralement par des pertes de rendement importantes, bien souvent au-dessus de 70%. De nombreuses options de contrôle ont été signalées mais l'effet de la gestion de la fertilité des sols sur la production des graines de *Striga* n'est pas bien connue. Comprendre la production des graines de *Striga* est l'un des éléments clé de la gestion de cette mauvaise herbe en Afrique. Des expériences sur terrain durant deux saisons de croissance seront effectuées afin de déterminer la croissance, la production des graines de *Striga* et le rendement en grains de sorgho traités avec différents taux et source des matières organiques et inorganiques. Les traitements comprendront la basse-cour, les fumiers de poulailler, de l'urée et du superphosphate triple.

Mots clés: *Sorghum bicolor*, Afrique sub-saharienne, mauvaise herbe parasite

Background

Striga, commonly known as witchweed, is a root parasite that attacks cereals and legumes (Westerman *et al.*, 2007). The weed is responsible for keeping crop productivity in many regions of Africa below subsistence level. *Striga* remains uncontrolled despite many years of research, therefore affecting livelihood of millions of people in Africa (Pageau *et al.*, 2003). This is because cereals apart from being staple food are also source of income for producers and traders in Africa. *Striga asiatica*, *S. hermonthica* and *S. gesneroidence* cause most damage in cereals. *Striga* is found in Sub-tropical areas with an annual rainfall ranging from 300–1200 mm.

Striga has become not only a biological constraint to food production in Sub-Saharan Africa but also a socio-economic problem to resource poor farmers. Controlling *Striga* has therefore become an huge task considering the seed production rate of 10,000 – 100,000 seed/plant which remain viable in the soil for up to 20 years (Ikie *et al.*, 2006).

The factors that intensify uneconomical crop production through severe *Striga* build ups among others are poor soil fertility and moisture stress (Ikie *et al.*, 2006). The poor performance of the host crop is much more severe when *Striga* infestation and drought are combined together. It is known that application of fertilizer increases the host yield but is not known how fertilizer application affects the *Striga* populations. The system that would improve soil condition to increase crop yield as well as reduce *Striga* seed production will be of double advantage.

Literature Summary

Application of high dosage of nitrogen fertilizer is generally beneficial in delaying *Striga* emergence and obtaining stronger crop growth (Dugje *et al.*, 2008). Despite the evident benefit of nitrogen fertilization in protecting crop against *Striga*, it is still not clear if and how improved soil fertility which stimulate crop growth and yield influence *Striga* population (Van Mourik, 2007). Also other advantageous effects of fertilizers include increasing soil nitrogen and other nutrients, replenishing the organic matter of the soil and increasing soil moisture holding capacity (Ikie *et al.*, 2006).

Study Description

In this study an experiment was conducted to evaluate the effect of different sources of fertilizers on sorghum yield and the interaction between soil chemical characteristics on *Striga* seed. The phosphorous treatments consisted of 40 kg P₂O₅ ha⁻¹ applied as triple superphosphate (TSP), Urea at 50 kg N/ha, while the

sources of organic manure were chicken and Farmyard manure (FYM) each applied at a rate equivalent to 50 kg N ha⁻¹. All treatments were laid out in a randomized complete block design with four replications.

Another factorial experiment laid out in randomized complete block design with four replications was used to determine the effects of FYM and Urea on sorghum grain yield and *Striga* seed production. Four levels of fertilizers were used as treatments, Urea at 0, 60, 90, 120 kg N ha⁻¹, FYM at 0, 60, 90, 120 kg N ha⁻¹. Prior to fertilizer application, the sample of organic input was taken to laboratory for N determination, and the amount of organic input to be applied equivalent to 60, 90, 120 kg N ha⁻¹ was determined.

Prior to planting, surface soil samples (0-15cm depth) of the experimental area were collected from five points along a diagonal using a 5cm diameter auger. The soil samples were composited to form a composite sample. The soil sample was analyzed for nutrients status. Data collected such as plant height, above ground biomass and *Striga* counts, *Striga* seed production will be analysed using Genstat computer package.

Research Application

Results on seed bank replenishment will show an indication on control measure that can reduce seed production at different stages in the weed life cycle. Some fertilizer rate and source may reduce recruitment levels or affect survival of the weed to maturity hence, reduce seed bank development. Therefore at the end, the integrated *Striga* management will combine measures that improve soil fertility with appropriate use of organic and inorganic fertilizers.

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