Research Application Summary

Influence of legume biomass on soil fertility status and maize performance in *Striga* infested soils of Iringa, Tanzania

Hepelwa, R.[1], Msaky, J.J.[1] & Sibuga, K.P.[2]
[1]Department of Soil Science, Sokoine University of Agriculture, Morogoro, Tanzania
[2] Department of Crop Science, Sokoine University of Agriculture, Morogoro, Tanzania
Corresponding author: sibuga88@yahoo.co.uk

Abstract

Striga asiatica is one of the most severe biological constraints to cereal production in low soil fertility areas, reducing maize and sorghum yield by 10-100%. The use of inorganic nitrogen fertilisers counteracts the effect of this parasite. These fertilisers are not easily access majority of the farmers in Tanzania. The use of legumes biomass residues has shown potential for improving soil fertility status and thus mitigate the effects of Striga. In this study, the effects of the legumes cowpea, green gram, mucuna, canavalia, sun hemp and chick pea on maize yield in Striga infested, low fertility fields on maize yields in rural Iringa district, Tanzania was studied. Sun hemp, canavalia and mucuna released significantly more N compared with other legumes. These three should be incorporated in a package for mitigating the effect of Striga in Tanzania.

Key words: Legumes, maize, soil fertility status, *Striga*

Résumé

Striga asiatica est l'une des contraintes les plus sévères pour la production céréalière dans les zones à faible fertilité des sols, réduisant le rendement du maïs et du sorgho de 10-100%. L'utilisation d'engrais azotés inorganiques contrecarre l'effet de ce parasite. Ces engrais ne sont pas facilement accessibles à la majorité des agriculteurs en Tanzanie. L'utilisation des résidus de la biomasse des légumineuses a démontré une possibilité pour améliorer l'état de fertilité des sols et donc une possibilité d'atténuer les effets de la *Striga*. Dans cette étude, les effets du niébé légumineux, du gramme vert, du mucuna, du canavalia, du chanvre du soleil et des pois chiches sur le rendement du maïs dans les champs infestés de Striga et la faible fertilité sur les rendements du maïs dans les régions rurales du district d'Iringa, en Tanzanie ont été étudié. Le chanvre du soleil, le canavalia et le mucuna ont libéré significativement beaucoup plus d'N par rapport à d'autres légumineuses. Ces trois éléments devraient être intégrés à l'ensemble pour atténuer l'effet de la Striga en Tanzanie.

Mots clés: Légumineuses, maïs, fertilité des sols, *Striga*

Background

Maize (*Zea mays* L) is the main staple crop in Tanzania. It is the major cereal consumed with an estimated average consumption of 113 kg per person per year**.** Maize yield per unit area is unfortunately still low with an average of 1.2 t ha^{-1}. This is opposed to the national potential yield range of 4 – 8 t ha^{-1}. Its production is limited by factors such as low soil fertility, pests and diseases and low yielding varieties.

Literature Summary

Striga is a major biotic problem for production of cereals such as maize and sorghum. It is a parasitic weed especially important in areas with low soil fertility. The two most important species of this weed are *Striga hermonthica* and *Striga asiatica*. Tanzania, the weed is especially important in the Southern plateau areas such as the Iringa rural district.

Legumes biomass can play an important role in soil fertility improvement when incorporated into the soil by improving soil organic matter, moisture retention and soil workability. Thus incorporation of legumes in Striga infested fields may reduce the impact of this weed by enhancing soil fertility, thus counteracting the effects of the parasite.

Study Description

The experiment was conducted in Iringa district at Mangalali and Kiwere villages, Tanzania. The site is characterised by a unimodal rainfall pattern with the growing season starting running from November to June. Soil samples were taken from highly Striga infested farms in the two villages before planting the legume. The legumes planted included cowpea, green gram, mucuna, canavalia, sun hemp and chick pea. The soil physical and chemical properties were determined. Legumes biomass samples were also sent to the laboratory for N mineralisation determination.

Research Application

Results of soil properties in the two study areas are shown in Table 1. The soils are low in organic matter, total N, CEC, available P, total S and CEC. This together with low pH is a clear indication of low soil fertility status. Such soils are susceptible to *Striga* infestation.

Results for N mineralisation for the various biomass sources are shown in Figure 1. Sun hemp released more N than the rest of the legumes followed by canavalia and mucuna. Chick pea released the lowest amount of N. Its performance in the field was also very poor. For all legumes, most of the N was released between 4 and 8 weeks.

Table 1. Some physical and chemical properties of the experimental soils.

Parameter	Unit	Soils	
		Kiwere	Mangalali
Textural class		Loamy sand	Loamy sand
pH (1:2.5 H_2O)		4.88	6.33
OC	%	0.25	0.77
TN	%	0.023	0.13
Extractable P (Bray-1-P)	mg kg^{-1}	9.59	6.29
Ext. S	Cmol(+)kg^{-1}	1.42	1.04
CEC	Cmol(+)kg^{-1}	12.76	9.91

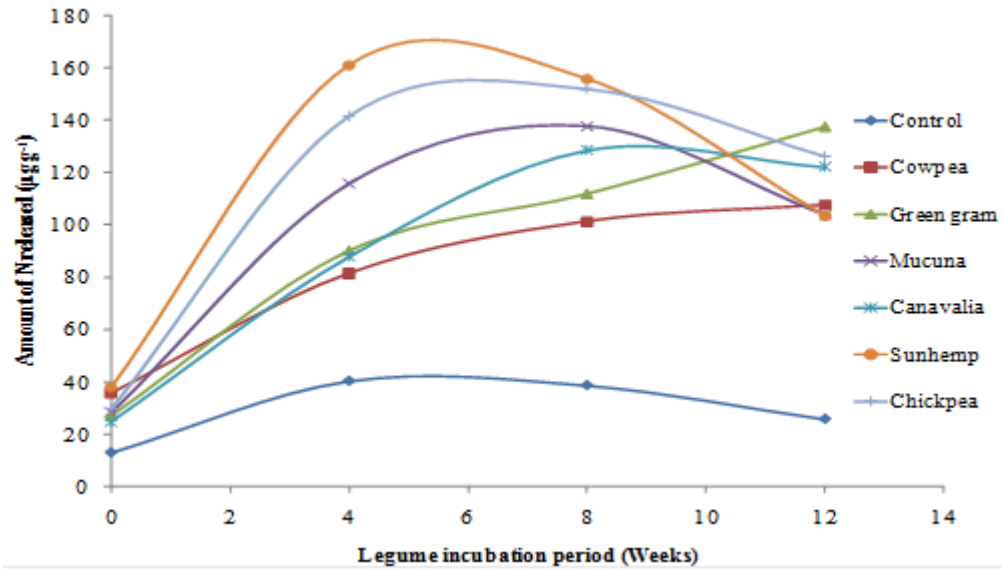

Figure 1. Trends of N release by different legumes at different incubation periods.

Recommendation

The use of legume biomass has shown the potential to increase maize yield within low fertility, striga infested fields. The use of these legumes is recommended.