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Research Application Summary

Effect of varying Desmodium and maize harvesting regimes on their yields and growth attributes within the "Push- Pull" intercropping systems in Western Kenya

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Abstract

This study tested the hypothesis that inclusion of *Desmodium* spp. into maize cropping system under the push-pull technology enhanced crop growth and yield. Field trials were conducted in Siaya and Busia districts of western Kenya with the following treatments: two *Desmodium* spp (*Desmodium uncinatum* Jacq and *Desmodium intortum* Urb.) intercropped with maize, sole maize with urea (90 kg N /ha) and sole maize without urea and three Desmodium harvesting regimes (9, 12 and 17 weeks after planting maize- WAPM). Maize shoots/grain harvesting and sampling for mineral N (up to 120 cm) was conducted at 9, 10, 12, 13, 15 and 17 WAMP. Soils from both sites were acidic (pH < 5.3), had low N (<0.091%), very low available P (<3.78 mg P/kg) and moderate organic carbon (<2.42%). Establishment of Desmodium was slow during the first season and maize yield was affected drastically with the monocropped maize performing better during the first season. It was concluded that the intercropping system could benefit farmers only during later cropping seasons.

Key words: Maize-legume intercrop, nitrogen, maize

Résumé

Cette étude a testé l'hypothèse que l'inclusion de l'espèce *Desmodium* dans le système de culture du maïs en vertu de la technologie push-pull a amélioré la croissance des cultures et le rendement. Des essais sur terrain ont été menées dans les districts de Busia et Siaya de l'ouest du Kenya avec les traitements suivants: deux espèces de *Desmodium* (*Desmodium uncinatum* Jacq et *Desmodium intortum* Urb.) intercalées avec le maïs, le maïs en monoculture avec de l'urée (90 kg N / ha) et le maïs en monoculture sans urée et trois régimes de récolte de

Desmodium (9, 12 et 17 semaines après la plantation de maïs(WAPM). Les pousses de maïs / la récolte et l'échantillonnage des grains pour l'azote minéral (jusqu'à 120 cm) ont été menés à 9, 10, 12, 13, 15 et 17 semaines après la plantation de maïs (WAMP). Les sols des sites étaient acides (pH <5,3), avaient une faible teneur en N (<0,091%), très faible teneur en P (<3,78 mg P / kg) et une teneur modérée en carbone organique (<2,42%). L'établissement du Desmodium a été lent au cours de la première saison et le rendement du maïs a été touché de façon drastique avec le maïs en monoculture de meilleurs résultats au cours de la première saison. Il a été conclu que le système de culture intercalaire ne pourrait être bénéfique aux agriculteurs que pendant les dernières saisons culturales.

Mots clés: Culture intercalaire de maïs et de légumineuses, azote, maïs

Background

Decline in maize production (<1 t ha^{-1}) in western Kenya has mainly been attributed to low soil fertility particularly of nitrogen (N) and phosphorus (P), African witchweed (*Striga* spp.) and stem borers infestation (Shephered *et al*., 1996; Khan *et al*., 2006). In Western and Nyanza provinces of Kenya, *Striga hermonthica* occurs in about 200,000 hectares of land causing crop yield losses of 5-15% with sparse infestation and 80-100% with heavy infestation. Ensuring sustainable agriculture therefore requires the implementation of methods to balance nutrients and reduce pest and disease infestation. "Push-Pull" (PP) technology which was developed by the International Centre of Insect Physiology and Ecology (ICIPE) and partners, is an integrated method capable of adding soil nutrients and reducing striga and stemborer infestation. The technology involves intercropping maize with *Desmodium* spp. (leguminous crop) which repels stemborers and planting nappier grass around the intercrop which attracts and traps stemborer moths. Another important property of PP technology is that *Desmodium* spp. produces chemicals that stimulate germination of *Striga* but does not support its full growth resulting in significant increase in maize yields.

Literature Summary

Despite relatively well documented role of *Desmodium* spp in controlling Striga and stemborer (Khan *et al*., 2001, 2002), its contribution to overall improvement of soil nitrogen is not well understood. This study tested the hypothesis that inclusion of *Desmodium* spp. into maize cropping system may provide a substitute for inorganic N fertilizers to enhance crop growth and yield.

Study Description

Field trials were established in Siaya and Busia districts of western Kenya in April and August, 2009. Treatments consisted of four maize-legume cropping systems namely; 2 *Desmodium* spp. [*Desmodium uncinatum* Jacq and *Desmodium intortum* Urb.) intercropped with maize, sole maize with urea (90 kg N / ha) and sole maize without urea and three Desmodium harvesting regimes (9, 12 and 17 weeks after planting maize-WAPM) in Siaya and Busia districts of western Kenya. Plant sampling was conducted at harvest during Long rains 2009 but during Short rains 2009 at harvesting of maize shoots/grain. Sampling for mineral N (up to 120cm) was conducted at 9, 10, 12, 13, 15 and 17 WAMP. Fresh plant samples were oven dried and expressed into kg/ha. Laboratory analysis was conducted using procedures described by Okalebo *et al*. (2002) and analysis of variance computed using Genstat program.

Research Application

In both Busia and Siaya the soils were acidic (5.32 and 4.89 respectively), had low N (0.071 and 0.091% N), very low available P (3.78 and 2.35 mg P/kg) and moderate organic carbon (1.73 and 2.42%C). Results obtained during long rains (LR) 2009 showed that in terms of vigor and grain yield, mono maize performed better than maize intercropped with Desmodium while the establishment of Desmodium was slow (Plate 1, Fig 1). Highest maize grain yields during LR 2009 in Busia and Siaya was 2.30 and 1.27 t/ha in monomaize treatment. Desmodium shoots yields were 2.69, 2.68 t/ha in Busia and 1.35, 1.20 t/ha in Siaya for *Desmodium uncinatum and Desmodium intortum* respectively. Results from maize shoots sampled at different sampling times (9,10,12 and 13, 15 and 17 weeks after planting maize) in short rains 2009 showed that benefit to the intercropped maize in terms of improved vigor (Plate 1), increased nitrogen and crop yield is not likely to occur early but later in the season.

Plate 1. Poor Desmodium establishment/cover during long rains 2009 (left plate) and good Desmodium establishment/cover and improved maize vigor during short rains 2009 (right plate).

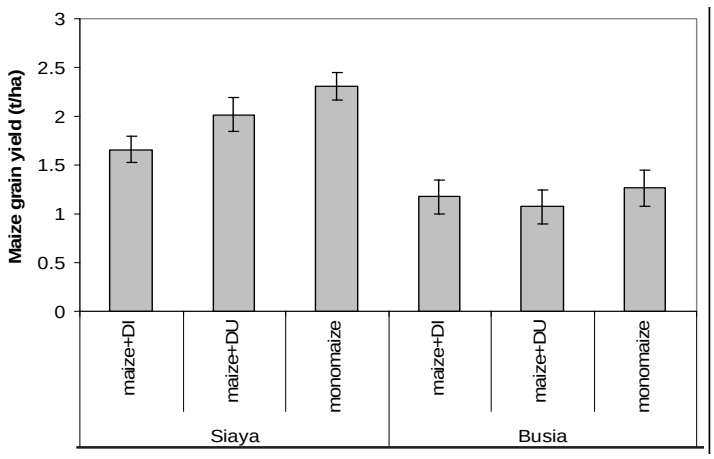

Figure 1. Effect of intercropping maize with two Desmodium spp (DI- *Desmodium intortum*, DI- *Desmodium uncinatum*) on maize grain yields (t/ha) in Busia and Siaya Districts of western Kenya during long rains 2009.

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