Optimizing Yield of Maize and Pigeonpea in Kongwa and Kiteto Districts, Tanzania

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Background

Yield advantages in intercropping is determined by the net effects of positive (facilitative and complementarity) interactions and mitigating negative (competitive) interactions (Kimaro et al., 2009). Pigeonpea plants have both physiological and morphological attributes that may reduce interspecific competition in mixed culture. The initial slow growth of pigeonpea relative to cereals minimizes competition in intercropping systems, making pigeonpea compatible with most cereal-based systems (Snapp et al., 2002). In semi-arid areas, however, growing seasons are increasingly becoming shorter because of low and sporadic rainfall. Consequently, yield of intercropped pigeonpea may be adversely affected by competition, if farmers do not use appropriate agronomic practices. Pigeonpea is a fairly new legume crop in Kongwa and Kiteto district, requiring both adaptability studies and agronomy studies particularly for sustainable intensification purposes. Thus, this study is being carried out to assess component interactions and their impacts on farm productivity in order to provide guidelines for optimizing yields of maize and pigeonpea in semi-arid climates of Central Tanzania.

Objectives

1. To evaluate the effects of maize-pigeonpea intercropping under different spatial cropping arrangements on crop yields and wood supply.
2. To identify the spatial cropping arrangement for optimizing farm (crop and wood yields) productivity in Kongwa and Kiteto districts.

Material and Methods

The study was conducted at Mlali and Chitego villages in Kongwa District. We adopted a randomized complete block design with three replications. Treatments were various intercropping arrangements of maize and pigeonpea (Fig. 1): Pure stand, alternate rows of maize and pigeonpea (1:1), 1-maize row and 2 piegonpea rows (1:2), two maize rows and one pigeonpea row (2:1). Spacing of pigeonpea was 30cm x 120cm (pure stand) and for maize was 60cm x 90cm. Pigeonpea variety ICEAP0057 was selected by farmers based on superior growth and grain yield during the PVS trials in 2013.

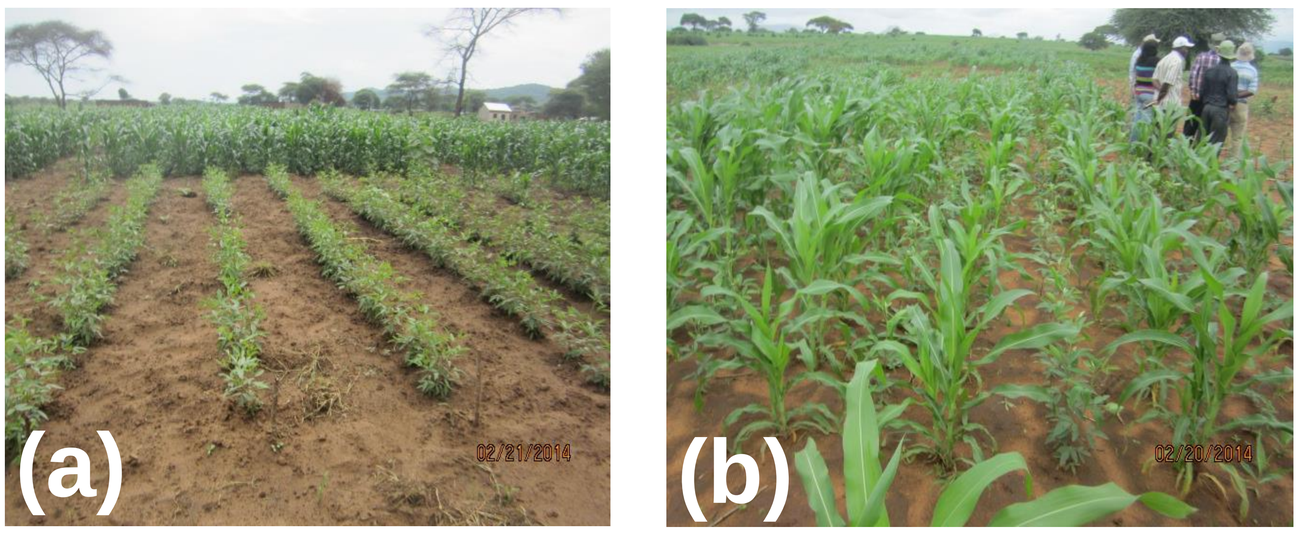

Figure 1. Pure stands (a) and alternative - 1:1 (b), 2:1 (c) and 1:2 (d) spatial arrangements of rows of maize and pigeonpea.

Results and Discussion

Maize grain yield

Maize grain yield ranged from 1.20-2.04t/ha in Mlali and from 1.24-3.25t/ha in Chitego, reflecting higher potential in the latter site (Fig. 2a). Relative to monoculture, yield of intercropped maize was reduced by 28-40% in Mlali and by 2-62% in Chitego with the highest reduction noted in treatments with large proportions of pigeonpea. The reduction at 1:1 ratio, the ratio commonly used by farmers, was modest and ranged from 30-40% in both sites. Similar trend was noted for pigieonpea grain yield (Fig. 2b). Declined crops yield with increasing ratio of pigeopea in mixture reflects interspecific competition. However, the competition did not reduce the overall farm production because Land Equivalent Ration (LER) was above one in all cropping combinations (ratios). These results suggest that intercropping was more efficient in utilizing land resources and inputs for sustained productivity (Table 1).

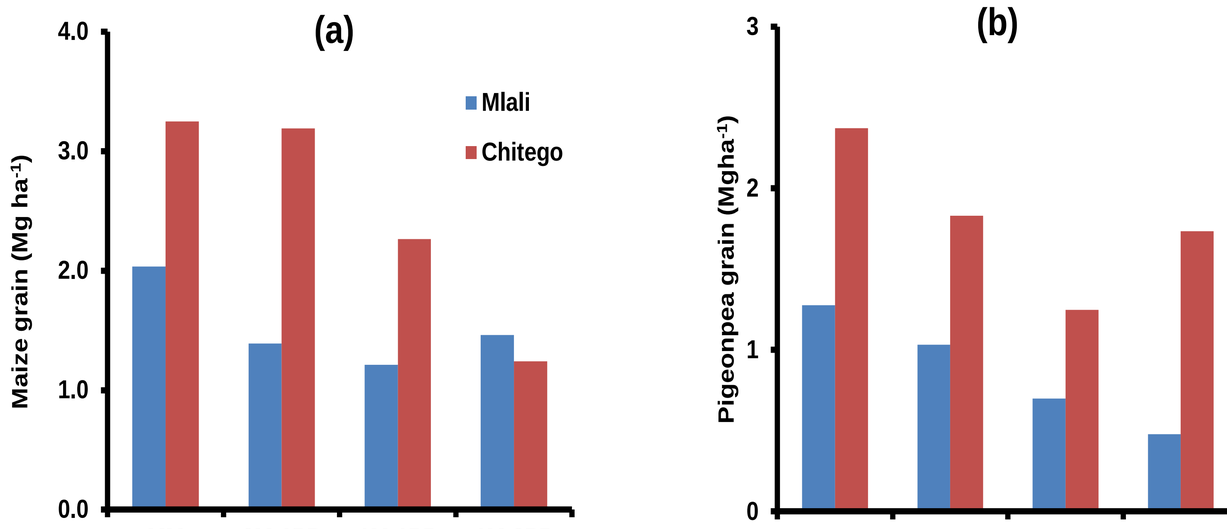

Figure 2: Maize and Pigeopea grain yields at Mlali and Chitego Villages, Tanzania

LER also revealed that increasing the proportions of pigeonpea in maize based systems was more beneficial to farmers in less potential sites (LER = 1.53) than in high potential sites (1.15) at 1: 2 ratio of Maize and pigeonpea intercropping. At higher potential sites, farmer can benefit more by having larger proportion of maize (2:1 ratio) than pigeonpea (1.06 versus 1.71). The 1:1 ratio seems to be less sensitive to variations in site conditions and could be adopted for wider use by farmers in the study sites, but with only 14-22% more yield benefits compared to 53-71 for 1:2 and 2:1 ratios. Thus, pigeonpea intercropping at the appropriate proportions based on local site conditions is necessary and a promising strategy to optimize yields in mixture (Table 1).

Table 1: LER for Maize-Pigeonpea Intercropping in Mlali and Chitego Villages

Maize-PP ratio	Mlali	Chitego
2M:1PP	1.06	1.71
1M:1PP	1.14	1.22
1M:2PP	1.53	1.15

Conclusions

The LER analysis revealed that farmers diversifying crop production by intercropping maize and pigeaonpea may benefit more even in low potential sites and/or seasons of uncertain crop production if appropriate plant combinations which optimize crops yield is adopted. Additional benefits are also expected from other non-food products like fuelwood and soil fertility improvement from pigeonpea. Cost-Benefit Analysis to assess economic benefits of the maize-pigeonpea system in terms of grain and wood yields is being conducted to provide a comprehensive picture of benefit of this system.

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