

Research Application Summary

Evaluation of Mungbean plant spacing for optimising yield in smallholder cropping systems

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Abstract

Mungbean production in Uganda is done largely by smallholder farmers and characterized by low yields. In order to increase the production and adaptability of mungbeans, it is vital to determine the optimum spacing within smallholder cropping systems. Mungbean spacings T₁ (10cm), T₂ (20cm), T₃ (30cm) T₄ (40cm) at a constant inter-plant spacing of 10cm were studied in a Completely Randomized Block Design. The experiment was undertaken in two mungbean growing districts of Eastern Uganda (Mayuge and Serere) and at the Makerere University Agricultural Research Institute, Kabanyolo in central Uganda during the second rains (August-December) of 2015. Yield and yield components were significantly influenced by plant spacing. At harvest, the highest plant height (53.62cm) was recorded under the spacing of 30 x 10cm T₃. The highest number of pods per plant was recorded under spacing of 40 x 10cm T₄ and highest grain yield under spacing of 10 x 10cm T₁. These preliminary results indicate that various spacings were optimum for vegetative as opposed to grain yield. The more dense 10 x 10 cm spacing resulted in the highest mungbean grain yield and could significantly enhance yield in Uganda.

Keywords: Adaptability, agricultural productivity, Mungbeans, optimum plant spacing

Résumé

En Ouganda, la production du haricot Mungo est majoritairement faite par les petits exploitants et caractérisée par de faibles rendements. Il est essentiel de déterminer l'écartement optimal dans les systèmes de culture des petits exploitants afin d'augmenter la production et l'adaptabilité du haricot Mungo. Des écartements T₁ (10cm), T₂ (20cm), T₃ (30cm) T₄ (40cm) avec une distance constante de 10cm entre plants du haricot Mungo ont été étudiés en utilisant un dispositif de Bloc Complètement Aléatoire. L'expérimentation a été conduite pendant la deuxième saison pluvieuse de 2015 (Août-Décembre) dans deux districts producteurs de haricot Mungo situés à l'Est de l'Ouganda (Mayuge et Serere) et à l'Institut de Recherche Agricole de Makerere University, Kabanyolo, au centre de l'Ouganda. Le rendement et ses différentes composantes ont été fortement influencés par l'écartement des plantes. A la récolte, la hauteur la plus élevée (53,62 cm) a été enregistrée avec l'écartement de 30 x 10 cm (T₃). Le plus grand nombre de gousses par plant a été enregistré avec l'écartement de 40 x 10 cm (T₄) et le rendement le plus élevé a été obtenu avec l'écartement de 10 x 10 cm (T₁). Ces résultats préliminaires indiquent que divers écartements sont optimaux pour le développement végétatif à l'opposé du rendement en

grains. L'écartement la plus dense de 10 x 10 cm a permis d'obtenir le rendement en grains le plus élevé du haricot Mungo et pourrait significativement améliorer le rendement en Ouganda.

Mots-clés: adaptabilité, productivité agricole, haricot Mungo, écartement optimal des plants

Background

Mungbean (*Vigna radiata* (L.) Wilczek) is among the most important pulse crops of the world (Khattak *et al.*, 2004). It contains substantial amounts of protein, iron (AVRDC, 2013) and certain essential amino acids such as lysine and tryptophan that are absent in cereals (Ahmed *et al.*, 2003). In addition, mungbean fixes atmospheric nitrogen through its symbiotic association with Rhizobium bacteria.

The production of mungbeans in Uganda is mainly done by smallholder farmers and yields are low estimated to be 500 Kg/ha (Akibode, 2011). The low yields in Uganda are mainly attributed to among others, pests and diseases and inappropriate plant spacing and cropping systems (Talwana *et al.*, 2010). Smallholder farmers in Uganda generally plant mungbean either in pure-stand or as an intercrop with maize, sorghum, cassava or millet (Apio *et al.*, 2014). However, mungbean seed yield decreases when it is intercropped, but the total productivity of the system and land use efficiency markedly increases by intercropping (Ali, 1992). Owing to the fact that many smallholder farmers grow mungbeans in sole and intercropping systems, determining optimum plant spacing under these cropping systems is a vital step towards increasing its yield and adaptability. This study therefore seeks to evaluate mungbean spacings for increased yield and adaptability.

Study description

The experiment was conducted in two mungbean growing districts of eastern Uganda; Serere, Mayuge and in Makerere University Agricultural Research Institute, Kabanyolo in Central Uganda during the second rains of 2015. A Completely Randomized Block Design with three replications and four treatments T₁ (10 x 10cm), T₂ (20 x 10cm), T₃ (30 x 10cm) and T₄ (40cm x 10cm) was used. Data on plant height, number of seeds/pod, number of pods per plant and yield was collected and analyzed using Genstat. The analysis of variance (ANOVA) was used to elicit differences in attributes. Differences between treatments were separated using LSD test at 5% level of significance.

Results and discussions

Results showed that plant height varied from 50.74 to 53.62 cm. The highest plant height (53.62cm) was achieved at 30 x 10cm spacing in Serere (Table 1). The number of pods per plant ranged from 10.59 (T₁) to 11.0 (T₄) directly affects grain yield of legumes (Table 1). Plants sown at a spacing of 40 x 10cm had the highest average number of pods

per plant (16.18). However this was statistically identical with the number of pods per plant under the spacings of 30 x 10cm (14.86). Wider spacing allows plants to produce a large number of pods per plant as plants have access to enough nutrients, sunlight, water and other growth requirements. This finding is similar with Ihsanullah *et al.* (2002); Ahamed *et al.* (2011), who reported that increasing plant spacing increases the number of pods/plant.

Seed yield is as a result of interaction of several phenological, morphological, biochemical and physiological events occurring in the plant. Spacing significantly affected yield (Figure 1). Highest yield (2085 Kg/ha⁻¹) was achieved under spacing of 10 x 10cm. The high yield under spacing of 10 x10 cm can be explained by the high number of pods per plant and number of seeds/pod. The lowest yield was in spacing of 30 x 10cm in Serere. Mean yield under spacing of 40 x 10cm and 20 x 10cm was not significantly different. Mayuge had the highest mean yield for mungbeans in Season 2.

Table 1: Evaluation of mungbean spacing in Uganda

Treatment	Plant height	No of seeds/pod	Yield/ha	No of pods/plant
10 x 10cm	50.86 ^a	10.59 ^a	2085 ^c	14.48 ^{ab}
20 x 10cm	50.74 ^a	10.77 ^a	1323 ^b	12.71 ^a
30 x 10cm	53.62 ^b	10.68 ^a	1171 ^a	14.86 ^b
40 x 10cm	51.20 ^a	11.09 ^a	1391 ^b	16.18 ^b
LSD	1.998	NS	155	1.859
Muarik	48.07 ^a	8.02 ^a	1029 ^a	5.69 ^a
Serere	53.25 ^b	11.954 ^c	919 ^a	17.12 ^c
Mayuge	48.84 ^a	10.472 ^b	3586 ^b	13.03 ^b
LSD	1.332	0.5546	163.7	1.861

Means followed by the same letters within a column do not differ significantly ($P < 0.05$)

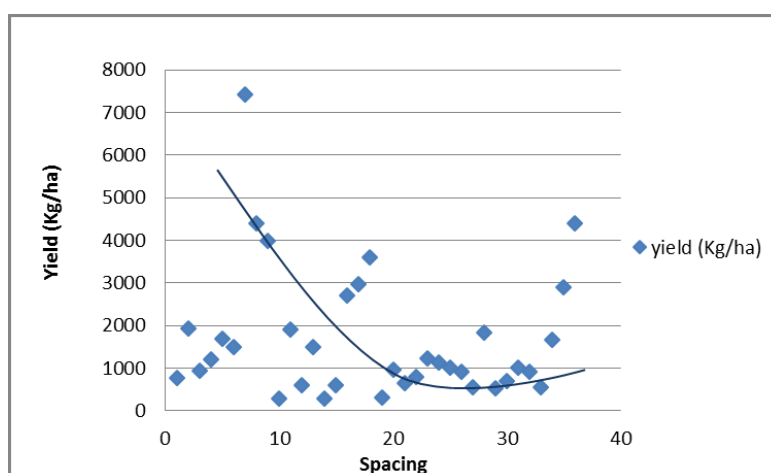


Figure 1: Mungbean yield in kg/ha at 4 spacings in Uganda.

Conclusion

These preliminary results show that a spacing of 10x 10cm revealed the highest yields at all sites and can be recommended for yield enhancement in Uganda. Spacing of 40 x 10cm can also be recommended as the yield under this spacing was high and agronomic management of the crop under this spacing is efficient. There is need for repeated and expanded studies to confirm these study findings.

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