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Research Application Summary

Effect of seed source on crop establishment, bacterial blight intensity, grain and dry matter yield in cowpeas

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Abstract

Most cowpea (*Vigna unguiculata* L.Walp*)* farmers use informal seed. The quality of this seed is unknown and thus crop establishment and performance is often uncertain. A study was conducted during the 2016 short rains in Makueni County in Kenya at two sites namely Kambi Ya Mawe and Kiboko at Lower Midland sub zone IV (LM 4) and Lower Midland sub zone V (LM 5), respectively. Effect of three different seed sources, i.e., certified, market sourced and farm saved of three different cowpea varieties (KVU, M66 and K80) were evaluated. Certified seed recorded the highest seedling emergence and plant stand. Crop raised from farm saved seed had the highest disease intensity of bacterial blight. Dry grain and dry matter were higher in LM5 than in LM4. The results also showed that dry grain yield and dry matter yield were highest in certified seeds. Therefore, for the farmers whose basic interest in the cowpea crop is dry grain for food and dry matter for fodder, use of certified seeds is recommended.

Key words: Cowpea, crop stand, Kenya, seed source, *Vigna unguiculata*

Résumé

La plupart des agriculteurs du niébé (Vigna unguiculata L.Walp) utilisent des semences informelles. La qualité de ces semences est inconnue et donc l'établissement et la performance des cultures sont souvent incertains. Une étude a été menée pendant les courtes pluies de 2016 dans le Comté de Makueni au Kenya sur deux sites, à savoir Kambi Ya Mawe et Kiboko dans la sous-zone IV de basses terres moyennes (LM 4) et la sous-zone V de basses terres moyennes (LM 5), respectivement. L'effet de trois sources de semences différentes, c'est-à-dire certifiées, achetées sur le marché et conservées à la ferme de trois variétés de niébé différentes (KVU, M66 et K80) a été évalué. Les semences certifiées ont enregistré l'émergence des plantules et le peuplement les plus élevés. Les cultures issues de semences conservées à la ferme présentaient l'intensité de la maladie de brûlure bactérienne la plus élevée. Le grain sec et la matière sèche étaient plus élevés en LM5 qu'en LM4. Les résultats ont également montré que le rendement en grains secs et en matière sèche était le plus élevé chez les semences certifiées. Par conséquent, pour les agriculteurs dont l'intérêt fondamental pour la culture du niébé est le grain sec pour l'alimentation et la matière sèche pour le fourrage, l'utilisation de semences certifiées est recommandée.

Mots clés: Niébé, peuplement des plantes, Kenya, source de graines, *Vigna unguiculata*

Introduction

Cowpea (*Vigna unguiculata*) is one of the most ancient crops known to man and it is grown across varying agro-climatic conditions. However, it is commonly grown in the dry areas of sub-Saharan Africa as a sole crop or intercropped with cereals like sorghum or millet (Agbogidi, 2010). Recent studies suggest that the centre of origin of cowpea might have been in the Central African Region (Ogunkamni *et al.,* 2006). It is a multipurpose and drought tolerant legume hence very attractive to farmers in marginal and drought prone areas (Hallensleben *et al.*, 2009). It is popular for its nutritious protein-rich grain commonly consumed together with cereals in addition to being drought tolerant (Dugje *et al.,* 2009).

It is commonly referred to as the poor man's meat in West Africa. It is composed of 22% protein, 1.4% fat, 59.1% carbohydrates and 3.7% ash. This rich composition makes it recommendable for consumption by pregnant mothers when cooked alone as mature seeds or together with other vegetables as accompaniments to cereal meals (Vanderborght and Baudoin, 2001). The world's population is increasing and so is demand for more food. However achieving this has been a challenge due to ever decreasing arable land safe for the arid and semi arids areas that are used for production of drought tolerant crops such as cowpea. This crop is capable of surviving under adverse agricultural conditions anywhere in the world (Muoneke *et al.,* 2012).

Cowpea is grown by resource-constrained farmers who buy certified seed once and recycle it for subsequent seasons. This is because cowpea certified seeds are not readily accessible at planting time since private seed producers consider production of these seeds less lucrative due to low demand compared to the open pollinated crops especially cereals like maize (Kimani *et al.,* 2014). Furthermore farmers are unwilling to buy cowpea seed at a cost more than twice that of the grain cowpea (Rubyogo *et al.,* 2007) yet informal seed are always available in the market when required (Salifou *et al.,* 2017).

High quality seed is one of the key factors for successful crop production as it results in high field establishment (Louwaars, 2007). To a farmer, seed is the only way to benefit from investments in crop improvement and therefore high quality seed is essential in establishing a sufficient crop stand that will directly influence crop performance in terms of yields (McGuire, 2005). Therefore, there was a need to evaluate the effect of the cowpea seed sources used by farmers on seed emergence, plant stand, bacterial blight intensity and dry grain and dry matter yield.

Materials and methods

The experiments were carried out in the field at two sites namely Makindu and Wote in Makueni County during the 2016 short rain. Wote is in LM 4 at an altitude of 1280m. It receives bimodal rainfall with average annual rainfall of 800-1200mm. Temperature range is 20.2-24.6 ^{o}C. Makindu lies at LM 5 at an altitude of 750m. It receives bimodal rainfall with average annual rainfall of 157-1200 mm. Temperature range is 18-25^{o}C.

Seed samples (1 kg) of cowpea varieties KVU, K80 and M66 available in the area of study were collected from market places, farmers and certified seed sources. Seeds of the different cowpea varieties were planted in a randomized complete block design (RCBD) in a split plot layout. The main plot was seed source and varieties were subplots. Main plots measured 9 m by 3 m while subplots measured 3 m by 3 m. The crop spacing was 60 cm x 20 cm with four seeds planted per hill. There were thus 150 plants per plot. Data were collected on seedling emergence, crop stand, bacterial blight intensity, dry grain yield and dry matter. Data were analysed by analysis of variance and means separated using Fisher's multiple range test at LSD ($P \leq 0.05$).

Results and discussions

Effect of seed source on emergence, plant stand count and cowpea bacterial blight intensity. There was a significant variation in mean seedling emergence between the two sites with the agro-ecological zone LM5 site recording a generally higher mean seedling emergence than the other site by over 7% (Table 1). This concurs with Dube *et al.* (2014) that difference in soil moisture content and the fluctuation of rain during emergence stage as well as soil borne pathogen inoculum influence seed emergence especially on the early stages of growth. Koger *et al.* (2004) also reported that environmental factors such as temperature, soil moisture, pH and light significantly affect seed germination and this could explain the difference in seedling emergence between the two sites. There was a significant effect of seed source on seedling emergence that was consistent across the sites with certified and market sourced seeds having a higher emergence than farm saved seed.

Certified and market sourced seeds recorded a significantly higher plant stand than the farm saved seeds (Table 1). Farmer saved seed is of unknown quality and hence its use risk low emergence, plant vigour and quality (Matthews *et al.,* 2012). The difference in performance of the crop across the two sites could be attributed to difference in the level of infection by seed borne pathogens which results in reduced seedling germination and subsequent post emergence damping off hence a reduction in plant stand count (Botelho *et al.,* 2013).

There was a significant variation in intensity of bacterial blight of cowpea between the sites with farm saved seed having the highest intensity though this was not statistically significant (Table 1). Ajeigbe *et al.* (2008) also reported a difference in incidence of bacterial blight among sites accompanied with a high and negative correlation with grain yield. Similarily, Nandini (2012) reported a variation in cowpea bacterial blight incidence among different districts in India as this was dependent on various factors like relative humidity, rainfall, and temperature. The higher disease incidence in agro-ecological zone LM4 may be attributed to the generally heavy rain and higher temperature as reported by Jaetzold *et al.* (2006) that create conducive environment for bacterial blight. Cowpea bacterial blight incidence was low and not significantly different between sites and among seed sources.

Effect of cowpea seed source on dry grain and dry matter yield. In agro-ecological zone LM 5, certified seed source recorded the highest dry grain yield which was significantly different from the other two sources (Figure 1). These findings were similar to those reported by Asiedu *et al.* (2007) working on certified and farm saved seeds. They reported that certified seeds were

superior to farm saved seeds especially for grain yield. Additionally, Sofijanova *et al.* (2012) reported that average yield in wheat (a self-pollinated crop) from certified seed source was 22.5% higher than those of uncertified seed sources. Use of good quality seed has been reported to increase yield by 20-30% (Mula, 2012).

According to Akoth *et al.* (2010), certified seeds are treated with fungicides and pesticides and hence the significant difference in grain yield compared to the performance of seeds of untreated source since the treatments exert control over pests and pathogens. Lilian *et al.* (2012) also reported positive effect of treated seed on grain yield which was attributed to the better emergence and plant stand count which resulted in increased yields. Furthermore, Maphosa *et al.* (2016) working on legume seeds from different seed sources reported that certified seeds had the least disease infection level and therefore could be forecasted to achieve highest grain yield. Dry matter yield from certified seed source was the highest and significantly different from the ones from the other two seed sources (Figure 1). Sofijanova *et al.* (2012) reported that certified seed use did not only lead to use of less seed per unit area but also ensured more income and higher straw yield compared to use of uncertified seed.

Table 1. Percentage emergence, final plant stand and intensity of cowpea bacterial blight in cowpea seed from different sources at two sites in Kenya

Seed source	Emergence (%)	Final plant stand	Disease Intensity
Kambi Mawe (LM 4)			
Market sourced	80.1[a]	96.6[a]	2.0[a]
Certified	72.4[a]	98.8[a]	2.0[a]
Farm saved	48.9[b]	61.1[b]	2.2[b]
Mean	67.1	85.0	2.0
LSD ($p< 0.05$)	16.9	23.1	0.2
CV (%)	25.4	27.2	7.9
Kiboko (LM 5)			
Certified	79.0[a]	105.8[a]	0.9[a]
Market sourced	75.7[ab]	106.4[a]	1.0[ab]
Farm saved	62.3[b]	87.6[a]	1.1[b]
Mean	72.3	99.9	1.0
LSD ($p< 0.05$)	13.7	23.3	0.2
CV (%)	19.1	23.5	18.9

Means with different letters are significantly different ($p< 0.05$) with the Fisher's multiple range tests, LSD= Least significant difference, CV= Coefficient Variation

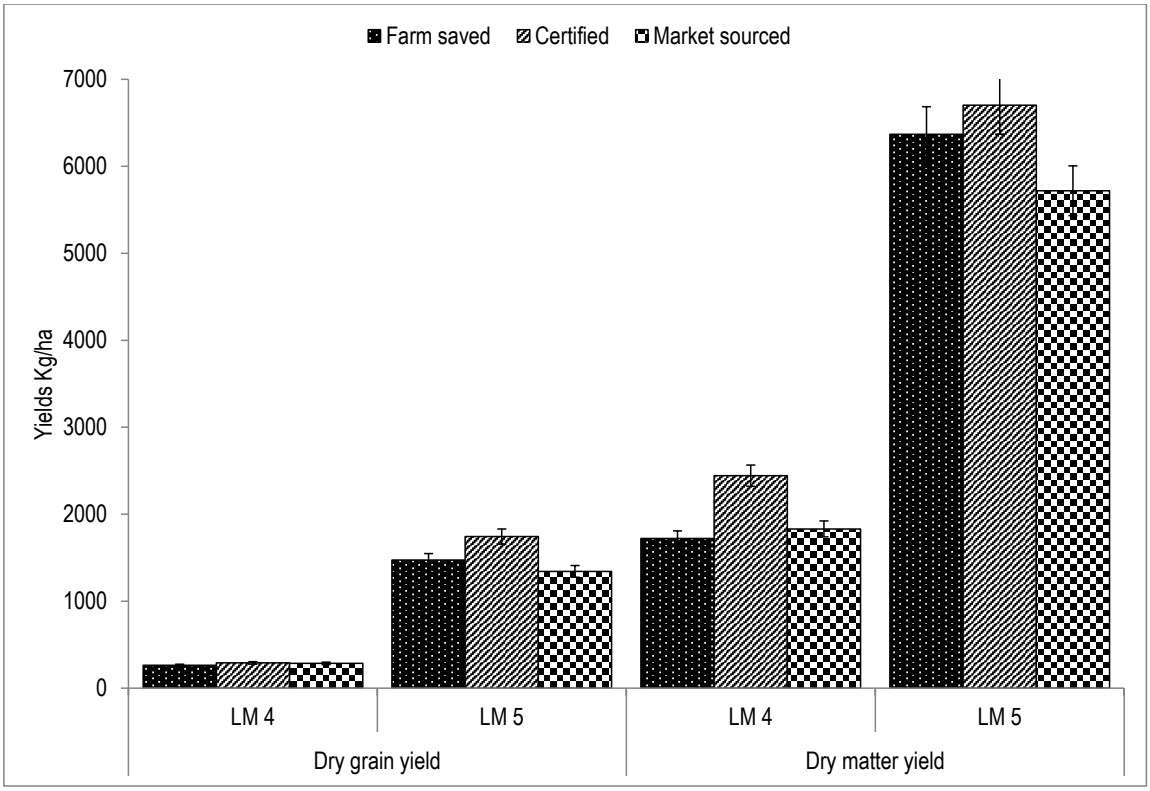

Figure 1. Dry grain and dry matter yield of cowpea seed from different sources at two sites in Kenya

Conclusions

Low seedling emergence, reduced plant stand over the season and low cowpea grain yield is characteristic of a crop raised from seed of uncertified source. This results from degeneration the seed due to recycling and build-up of seed borne pathogens resulting into pre and post emergence damping off diseases and subsequently low crop stand and yield. Farmers should be made aware of the high yield margins they are capable of achieving if they use certified seeds.

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References

Agbogidi, O.M. 2010. Screening of six varieties of cowpea (*Vigna unguiculata* (L) Walp) for adaptation to soil contaminated with spent engine oil. *Journal of Environment Chemistry and Ecotoxicology* 7:103-109

Ajeigbe, H.A., Singh, B.B. and Emechebe, A.M. 2008. Field evaluation of cowpea improved lines for resistance to bacteria blight, virus and Striga under natural infestation in the West African Savannah. *African Journal of Biotechnology* 7 (20): 3563-3568.

Akoth, S.A., Otadoh, J.A. and Ochanda, J.O. 2011. Improved seedling emergence and growth of maize and beans by *Trichoderma* spp. *Tropical and Subtropical Agro-Ecosystem* 13: 65-71.

Asiedu, E. A., Asante, R., Sallah, P. Y., Baduon, A. and Avah, E. 2007. Effects of farmers'seed source on maize seed quality and crop productivity. *Ghana Journal of Agricultural Science* 40 (1):105-111.

Botelho, L. D.S., Zancan, W.L.A., Machado, J.D.C. and Barracos, E.N. 2013. Performance of common bean seeds infected by the fungus *Sclerotinia sclerotiorum*. *Journal of Seed Science* 35 (2):153-160.

Dube, E., Sibiya, J. and Fanadzo, M. 2014. Early planting and hand sorting effectively controls seed-borne fungi in farm retained bean seed. *Africa Journal of Science* 110: 36-42.

Dugje, I. Y., Omoigui, L. O., Ekeleme, F., Kamara, A. Y. and Ajeigbe, H. 2009. Farmers' guide to cowpea production in West Africa. IITA, Ibadan, Nigeria. 20:12-14.

Hallensleben, M., Polreich, S., Heller, J. and Maass, B.L. 2009. Assessment of the importance and utilization of cowpea (*Vigna unguiculata* L. Walp.) as leafy vegetable in small-scale farm households in Tanzania, East Africa. Conference on International Research on Food Security, Natural Resource Management and Rural Development, held 6-8 October 2009 at University of Hamburg, Tropentag.

Jaetzold, R., Schmidt, H., Hornetz, B. and Shisanya, C. 2006. Farm management handbook of Kenya. Natural conditions and farm information. Vol. II, Part C1 – East Kenya. 2nd edition. Ministry of Agriculture, Kenya.

Kimani, P., Kamundia, D. K., Narla, R. D. and Mwang'ombe, A. W. 2014. An integrated seed delivery system and seed research in Kenya: Case studies of pigeon pea, onion and dry bean. pp. 73-88. In: Seed systems, science and policy in East and Central Africa. CTA.

Koger, C.H., Reddy, K.N. and Poston, D.H. 2004. Factors affecting seed germination, seedling emergence and survival of Texas weed (*Caperonia palustris*). *Weed Science* 52 (6): b989-995.

Lilian, G.D., Hugo, D., Allessandro, L.B., Alberto, L., Thiago, T.R., Gleberson, G.P. and Carlos, A.S. 2012. Insecticide treatment and physiological quality of seeds, insecticides. In: Farzana, P. (Ed.). Advances in integrated pest management. Intech, Shangai, China.

Louwaars, N. 2007. Seeds of confusion: the impact of policies on seed systems. PhD Thesis, Wageningen University.

Maphosa, M., Ncube, O. and Ndlovu, E. 2016. Physiology of legume grain in informal markets used as seed source: Implications for food and nutritional security. *Journal of Food Security* 4 (6):126-130.

Matthews, S., Noli, E., Demir, I., Khajeh-Hosseini, M. and Wagner, M.H. 2012. Evaluation of seed quality: from physiology to international standardization. *Seed Science Research* 22: 69-73.

McGuire, S. 2005. Getting genes: rethinking seed system analysis and reform for sorghum in Ethiopia. PhD Thesis, Wageningen University.

Mula, M. G. 2012. Seed delivery system: The key for sustainable pulse agriculture for smallholder farmers. *Green Farming Journal* 3 (6):1-1.

Muoneke, C.O., Ndukwe, O.O., Umana, P.E., Okpara, D.A. and Asawalam, D.O. 2012.

Productivity of vegetable cowpea (*Vigna unguiculata* (L.) Walp) and maize (*Zea mays* L.) intercropping system as influenced by component density in a humid tropical zone of South-eastern Nigeria. *International Journal of Agriculture and Rural Development* 15 (1):835-847.

Nandini, R. 2012. Studies on bacterial blight of cowpea caused by *Xanthomonas axonopodis* pv *vignicola* (Burkh.). MSc. Thesis, University of Agricultural Sciences, Dharwad, India.

Ogunkamni, L.A. 2006. Genetic diversity of cowpea in its wild relatives. PhD Thesis, University of Lagos, Nigeria.

Sofijanova, E., Kletnikoski, P., Dimovska, V. and Dimitrovski, Z. 2012. Comparative economic analysis of wheat production using certified and uncertified seed: The case of Ovcepole region in Republic of Macedonia. pp. 922-926. In: Scientific Works of UFT Volume LIX-2012: Food Science, Engineering and Technologies.

Salifou, M., Tignegre, J.B.L.S., Tongoona, P., Offei, S., Ofori, K. and Danquah, E. 2017. Farmers' preferred traits and perceptions of cowpea production constraints in Niger. *Journal of Agriculture and Food Technology* 7 (6):1-11.

Vanderborght, T. and Baudoin, J. P. 2001. *Vigna unguiculata* (L) Walp) in crop production in tropical Africa. pp. 334–348. In: Romain, H. R. (Ed.), DGIC Belgium.