

EVALUATION OF POTATO (*Solanum tuberosum* L.) NITROGEN USE EFFICIENCY UNDER LEGUME INTERCROPPING SYSTEMS

Seed Potato for Africa

Introduction

- In Kenya, the annual per capita potato consumption is 30 kg and is expected to rise further due to the increasing growth rate of the fast-food industry.
- Both locally and globally, demand for potatoes is rising at a greater rate than other food crops.
- Small-scale farmers are the main potato producers in the country and they intercrop it with other crops like maize and beans to cushion against production risks like crop failure.
- However, these farmers are not aware of the best crop to integrate into potato production systems that could not affect potato production.
- Potato is a shallow rooted crop with about 85 % of its roots found in the upper 0.4 m of the soil, hence, calling for an intercrop that competes less for nutrients especially nitrogen leading to higher tuber yield.
- Studies on potato intercropping have focused on evaluating the effect of the intercrop on potato yield only while ignoring nutrients use efficiency aspects.
- Therefore, this study evaluated the effect of incorporating legume crops, into potato-based systems on nitrogen use efficiency and yield.

Materials and Methods

- The experiment was laid in a randomized complete block design with four replicates at field station based in University of Nairobi 0.25° S, 36.73° E at an elevation of 1859 m a.s.l during the 2014 short and 2015 long rainy seasons.
- The treatments were: Sole Potato and Potato intercropped with either dolichos (*Dolichos lablab*), garden pea (*Pisum sativum*) or climbing bean (*Phaseolus vulgaris*).
- Pre-sprouted seed tubers were manually sown spaced at 0.3 m within rows and 0.9 m between rows at a depth of 0.1 m.
- The intercrop legumes were planted in a row between potato rows.
- 200 kg ha⁻¹ of 17N: 17P: 17K fertilizer was applied at planting and an equivalent quantity of CAN (27% N) as a top dress to potato crop only.
- Ten plants were randomly sampled per plot at physiological maturity stage, fresh tuber weight taken then haulms (stem and leaves) and tubers were oven dried at 70 °C for 72 hours to determine dry weight, ground to pass through a 1.0 mm sieve for nitrogen content analyses by Kjeldahl method.

Equation 1 was used for estimation of nitrogen use efficiency

$$NUE = \frac{\text{Tuber dry matter (kg/ha)}}{\text{Nutrient Supply (kg/ha)}} \quad [1]$$

- Data Analysed with Genstat 14th Edition and means separated using LSD at 5% level of probability

Results

Sole potato plots recorded significantly ($p < 0.05$) the highest potato N uptake followed closely by dolichos plots (Fig. 1) that in turn were the most efficient in nutrient use (Fig. 2) leading to higher tuber yield (Fig. 3).

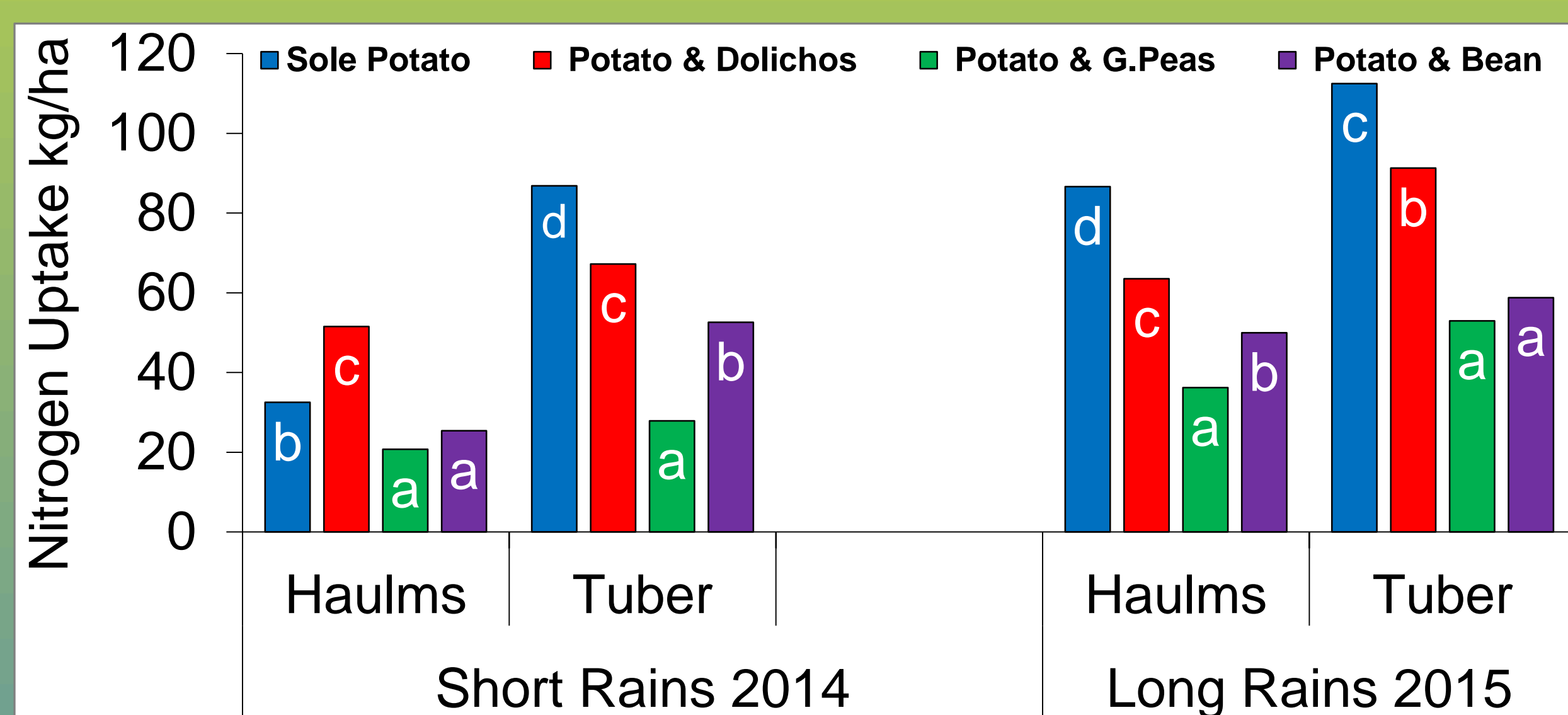


Figure 1: Nitrogen uptake in tubers and haulms

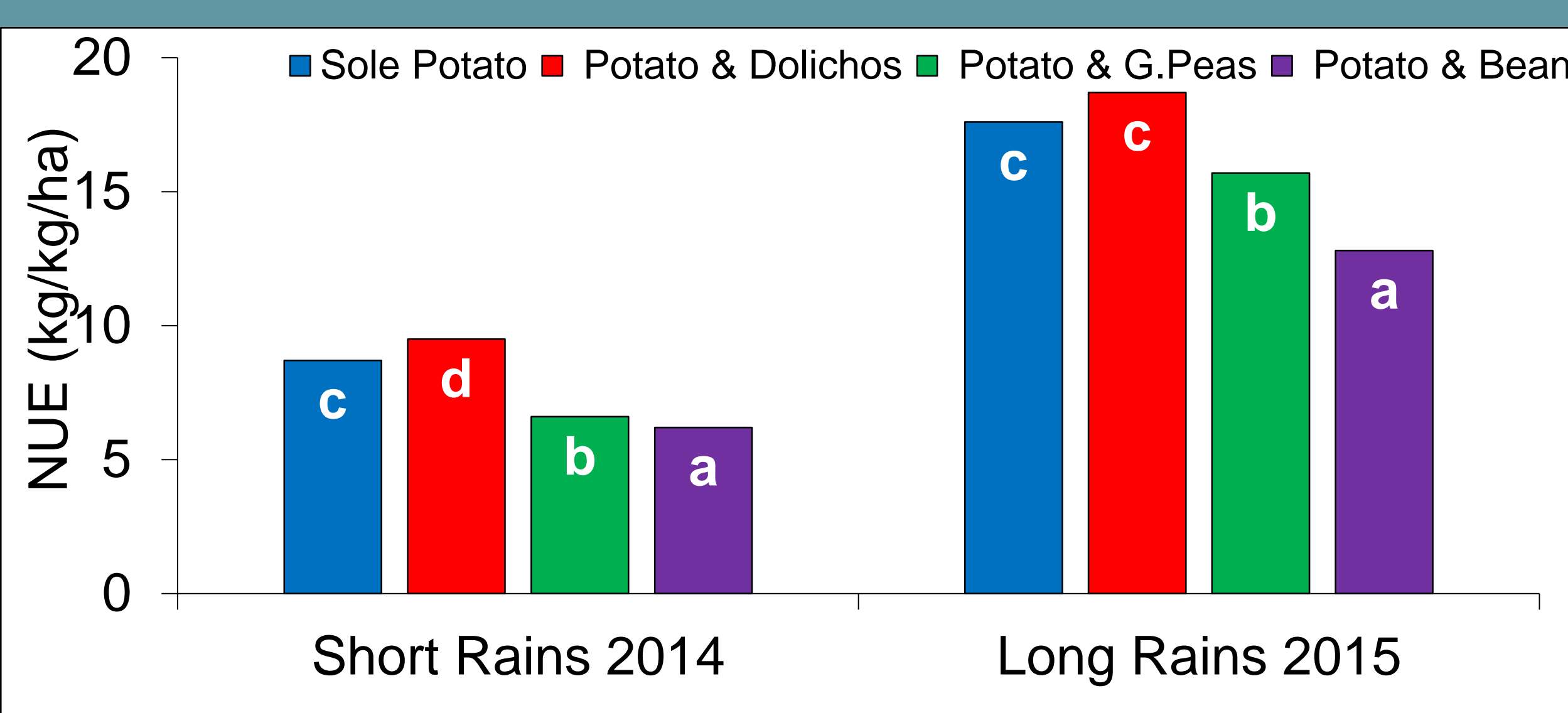


Figure 2: Nitrogen uptake efficiency

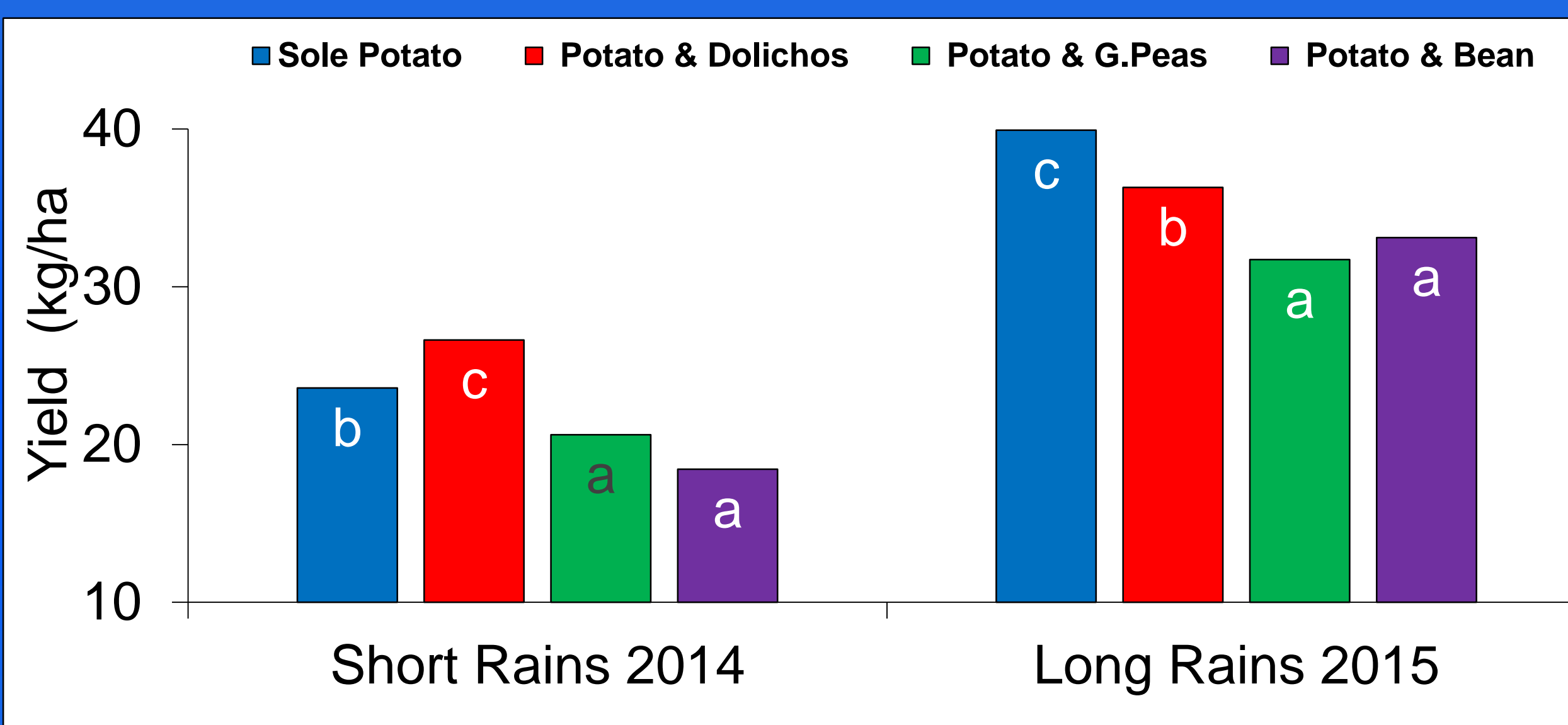


Figure 3: Fresh tuber yield under intercropping systems

Conclusions

- This study has demonstrated that legume crops could be integrated into potato cropping systems.
- *D. lablab* was identified as the best legume in promoting potato nutrient uptake and use efficiency hence its productivity.
- Further research is recommended to assess performance of crops under different spatial and temporal arrangement in potato-based cropping systems

Bibliography

- Desalegn, T., & Fekadu, W. (2012). Performance of highland maize and potato varieties for intercropping in the western highlands of Ethiopia. *Journal of Agricultural Research*, 1 (7): 275 – 280.
- Dua, V.K., Govindkrishnan, P.M., Lal, S.S. & Khurana, S.M. (2007). Partial Factor Productivity of Nitrogen in Potato. *Better Crops*. 91 (4): 26-27.
- Jamshidi K., Mazaheri D., & Saba, J. (2008). An evaluation of yield in intercropping of maize and potato. *Desert*. 12: 105-111.
- Janssens, S.R.M., Wiersma, S.G., Goos, H. & Wiersma, W. (2013). The value chain of seed and ware potatoes in Kenya. Opportunities for development. LEI Memorandum 13-080. 57.
- Sharaiha, R.K., & Battikhi, A. (2002). A study on potato/corn intercropping-microclimate modification and yield advantages. *Agricultural Science*, 16: 97–109.
- Singh, S.N. Trehan, S.P & Kumar. M. (2008). Response of Potato Cultivars to Nitrogen in the Plains of Bihar. *Potato Journal*. 35 (3 - 4): 158-160.
- Singh, S.P., & Kushwah V.S. (2012). Effect of Planting Method on Production Potential of Potato- Pea Intercropping System. *Potato Journal*, 39 (1): 95-97.

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