N2Africa - Putting nitrogen fixation to work for smallholder farmers in Africa

Benefits of inoculation, P fertilizer and manure on yields of bean and soybean are also seen in increased yield of subsequent maize

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Introduction

- Legumes are considered as a key component of integrated soil fertility management (ISFM) strategies for smallholders in sub-Saharan Africa (Vanlauwe et al., 2010). They have a significant role in effective management of fertilizers and improving soil health in sustainable agriculture
- However, growing legumes does not necessarily lead to improved soil fertility (Vanlauwe and Giller 2006)
- Legumes require phosphorus (P) for symbiotic N2fixation, P deficiency may be an important constraint for legume crop production
- Several authors have suggested that it may be beneficial to target P to the legume phase of a legume-cereal rotation (Zingore et al., 2008)
- Manure is important for maintenance of soil fertility through nutrient cycling and improvement of soil physical properties, but also has a liming effect. This could in turn provide favourable conditions for rhizobial survival in soil
- Smallholder farmers grow bean and soybean without fertilizer addition and expect improved grain yield even in the subsequent cereals in rotation.

Objective

Evaluate the benefits of inoculation, P fertilizer and manure on yields of bean and soybean, and how these benefits are translated in increased yields of a subsequent maize crop

Materials and Methods

- Experimental sites: Bugesera (South-East of Rwanda) and Kamonyi (Central plateau)
- Bean-maize and soybean- maize rotations were established in the short rains 2013 through the long rains 2014
- Treatments: Inoculum, three rates of manure and two rates of P fertilizer. Bean variety RWR 2245 , Soybean variety SB 24 and Maize variety ZM 607 were the test crops
- Experimental layout: Split-split plot, with three replications

Results

Plate 1: Well nodulated soybean trial with inoculation, P and manure addition at Kamonyi site

Plate 2: Maize after soybean, responded well to previous inputs at Kamonyi site

- The two legumes responded well to inoculation when manure and P fertilizer were added
- For both legumes, grain yield increased (P<.001) with increasing manure doses (Fig. 1)
- Grain yields varied from 1.7 t ha^{-1} and 1.6 t ha^{-1} in unamended control plots to 3.7 t ha^{-1} and 3.8 t ha^{-1} in inoculated with P and manure addition plots for bean and soybean respectively

- Yields of maize grown after soybean varied from 1.7 t ha^{-1} in control plots to 4.6 t ha^{-1} in previously amended plots. Maize yields after bean varied from 2.2 t ha^{-1} in control plots to 5.6 t ha^{-1} in treatments previously inoculated with P and manure addition

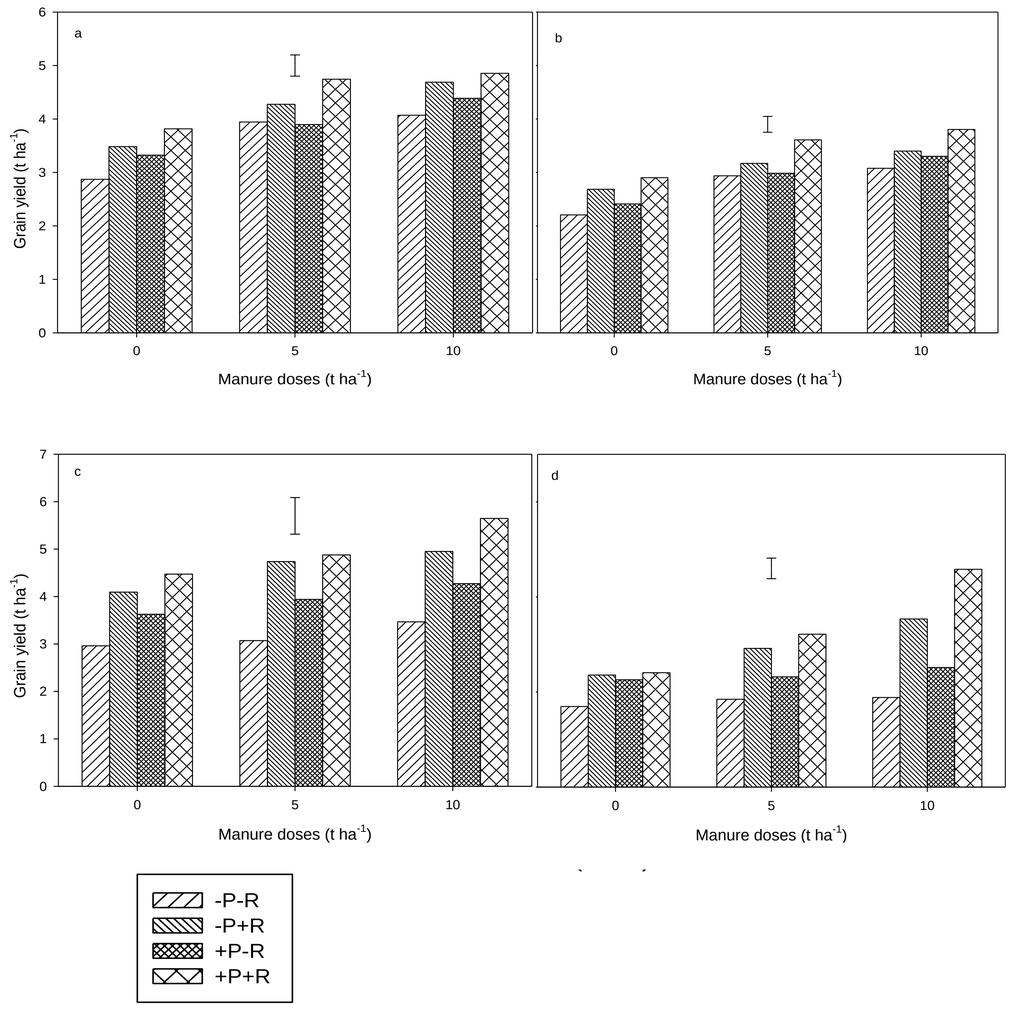

Fig. 1. Grain yield (t ha^{-1}) response of bean (a), soybean (b), maize after bean (c) and maize after soybean (d) to inoculation, P fertilizer and three rates of manure at Kamonyi site. The error bars represent the standard errors of differences between means of the treatments.

Conclusion

- Yield of bean and soybean can be improved by use of inoculum with modest amount of inorganic and organic fertilizer.
- Yield of maize grown after bean and soybean can be improved if inoculum, P fertilizer and manure are well used in the two legumes

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