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

RESPONSE OF COMMON LEGUMES IN ZIMBABWE TO APPLICATION OF DIFFERENT FERTILIZER AMENDMENTS

Talkmore Mombeyarara[1], Freddy P Baijukya[2] and Angelinus C. Franke[3]

Introduction and justification

Legume production has the potential to increase soil fertility, household food security, nutrition, and income for smallholder farmers in Zimbabwe. Multiple nutrient deficiencies which usually occur in sandy soils impede optimum growth and yields especially in the granite derived sandy soils. Farmers in Zimbabwe traditionally allocate fertilizers and manure to the staple maize crop on fertile soil while legumes grow unfertilized on less productive soils (Zingore et al, 2007)

But BNF requires proper targetting , input use and management: i.e

Successful BNF = (L X *R)* X *E* X *M*

(*L*egume genotype X *R*hizobium strain) X *E*nvironment X *M*anagement

In this study improved legume varieties and matching rhizobium strains were used for soyabean in diffèrent environments.

Materials and Methods

A number of fertilization options were tested for soybean, cowpea and groundnut production under smallholder conditions in Zimbabwe. Compound L (N, P, K, S), Single super phosphate (P, S) and dolomitic lime (Ca, Mg) were used solely and in combinations to determine the best nutrient requirements for the different legumes.

Location : Mhondoro (30.64253E 18.28134S)
Murewa (31.6986E, 17.72303S)

Crops grown: soyabean, cowpea, groundnuts

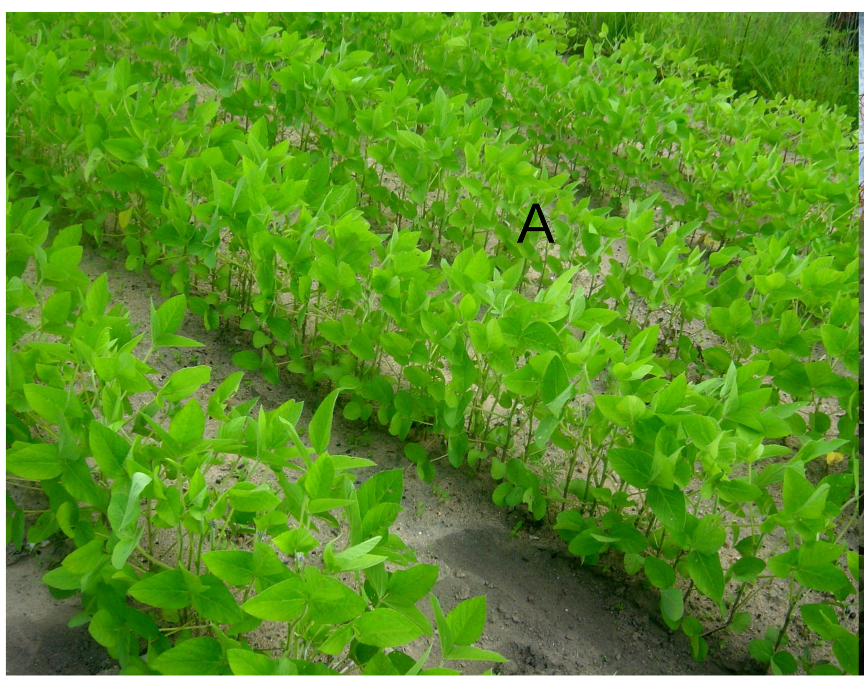
SSP - P at a rate of 20 kg /ha.

Dolomite - Ca and Mg at 27 kg/ha and 15 kg/ha respectively.

Compound L - N , P and K at 13kg/ha , 20 kg/ha and 21 kg/ha respectively.

Table 1. Soil characteristics of some fields in Mhondoro and Murewa

	pH (H2O)	Total C	Total N	P (Olsen)	K	Ca	Mg	Sand	Silt	Clay
		%	%	ppm	cmol/kg	cmol/kg	cmol/kg	%	%	%
Murewa	4.23	0.40	0.05	16.70	0.08	0.50	0.11	92	4	2
Mhondoro 1	4.97	0.50	0.04	10.60	0.16	2.20	0.40	90	6	4
Mhondoro 2	4.59	0.80	0.10	10.38	0.61	7.45	3.75	64	18	18



Picture 1. Uninoculated soyabean crop in a farmer's field in Guruve

Picture 2. Inoculated soyabean crop with compound L fertilizer in Guruve

Results and discussion

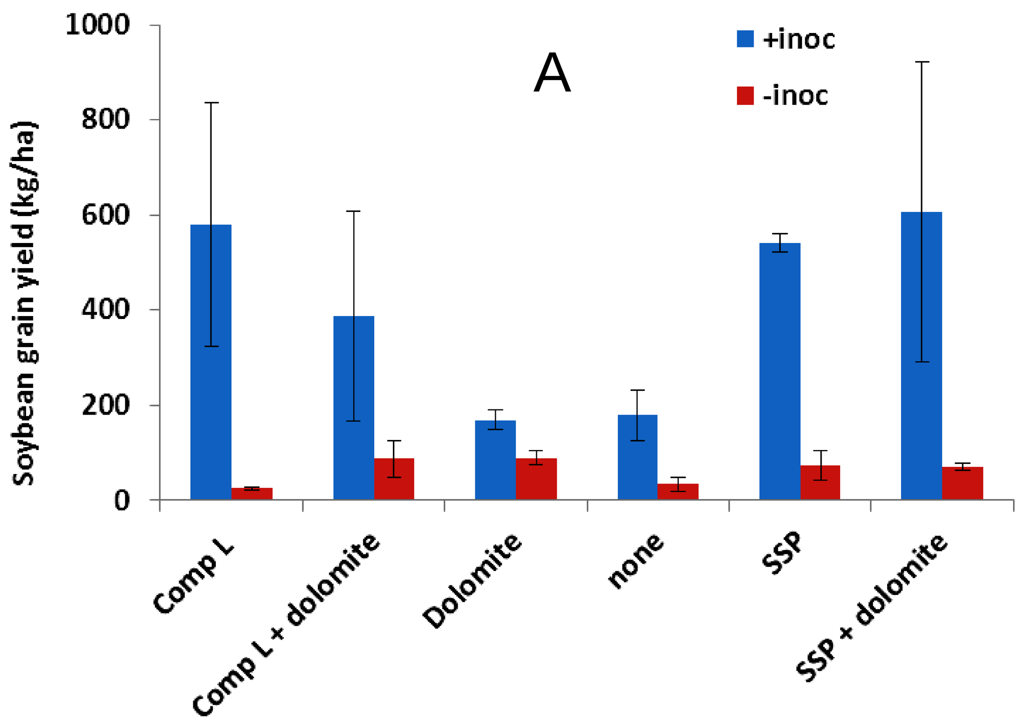


Figure 1. Soyabean grain yield response to different fertilizer amendments in a poor outfield in Murewa

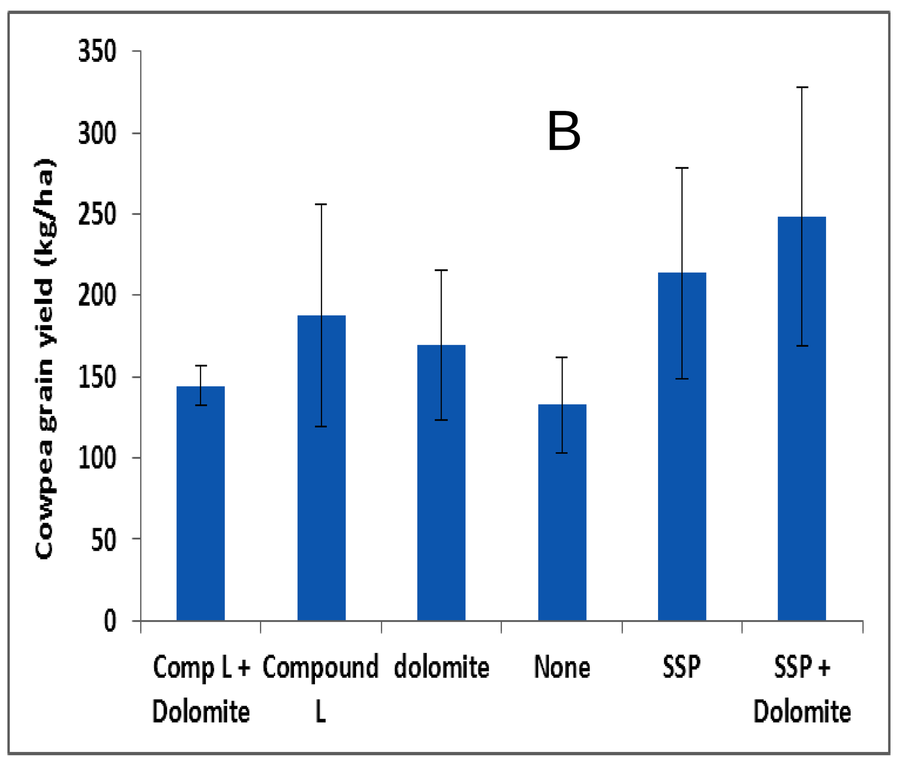


Figure 2. Cowpea grain yield response to different fertilizer amendments in a poor outfield in Mhondoro1

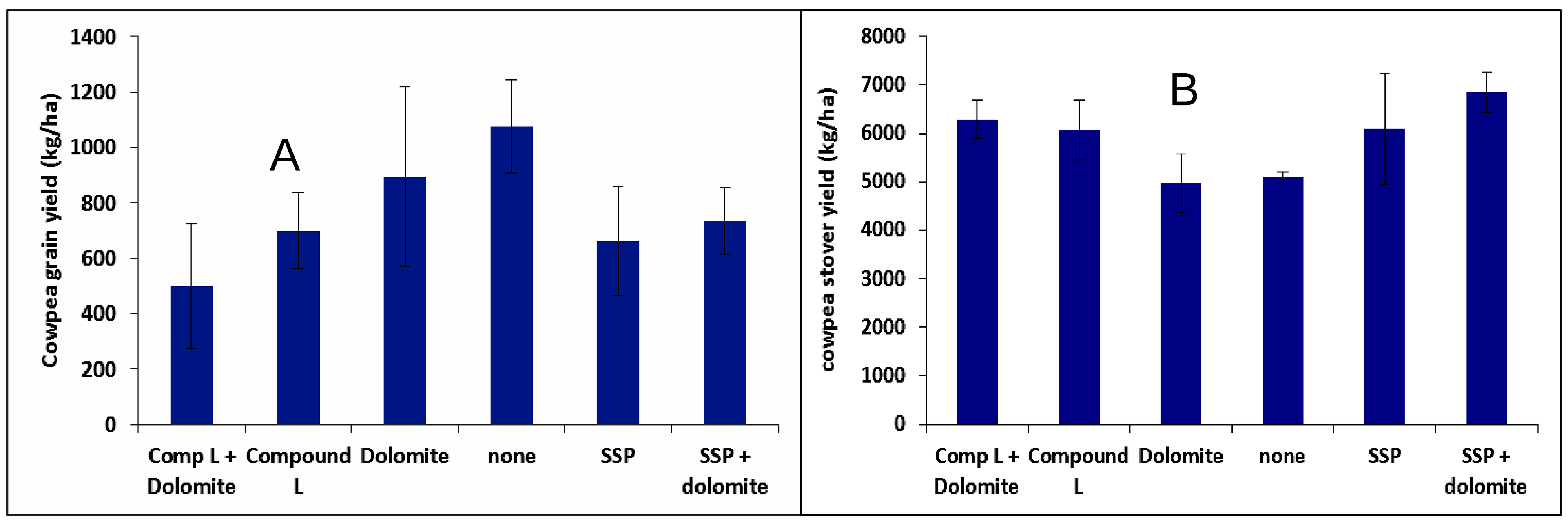


Figure 3. Graph to show cowpea grain (A) and biomass (B) yield response to different fertilizer amendments from a previously manured soil in Mhondoro 2

Soyabean grain yield was very low in Murewa (Fig1) because of the poor soils with low organic carbon and micronutrient deficiencies especially Zn (Zingore et al, 2007). They also have low rhizobial populations hence the huge response to inoculation. A double pot greenhouse experiment by Van der starre, 2012, also showed that there are K deficiencies in the acid sandy soils of Zimbabwe which limit soyabean growth.

Cowpeas responded positively to fertilizers in a poor soil (Fig 2) but negatively in a fairly well managed soil.The higher fertility lead to vegetative growth (Fig 3B) at the expense of reproductive growth (Fig 3A). Cowpeas is also promiscuous in its rhizobial association hence yields fairly in poor soils.

Groundnuts yield was affected by moisture stress at pod formation but stover yield indicated a positive response to P application.

Conclusion

Proper nutrient management is central to optimum yield gains in the highly leached granitic sandy soils in Zimbabwe.

References

Van der Starre, W.J. (2012). Nutrient limitations for soybean on low-responsive sandy soils in Zimbabwe tested by a double pot experiment. MSc thesis Plant Production Systems, Wageningen University.

Zingore, S and Giller, K.E. (2007). Optimizing Phosphorus and Manure Application in Maize-Soyabean Rotations in Zimbabwe, Better Crops/ Vol.96 Pgs 23-25

Acknowledgements

The authors acknowledge the BMG foundation for providing funding through CIAT

Name Organisation[1]:CIAT
Address: Box MP 228 , Harare
E-mail:t.mombeyarara@cgiar.org
Phone: +263772752727

Name Organisation[2] :CIAT
Address: Mbsa/MARI, Tanzania
E-mail: f.baijukya@cgiar.org

Name Organisation[3]:Wageningen University
Address: Wageningen University ,Wageningen, The Netherlands
E-mail: Linus.franke@wur.nl