# Narrowing Common Bean Yield Gap and Improving Productivity Using Organic Soil Amendments within Smallholder Farming Systems of Sub-Saharan Africa

**Powell Mponela[1].** *, Gift Ndengu[1], Barthlomew Chataika[1], Rowland Chirwa[1] and Lulseged Tamene[1].

*[1]International Centre for tropical Agriculture, Africa RISING The project was funded by USAID through Africa RISING and supported by CGIAR Research program on Dryland Systems.*

## Introduction

Common bean is mainly grown as intercrop in maize without soil fertility amendment leading to low yield in Malawi. As beans enter international markets, sustainable intensification will be eminent.

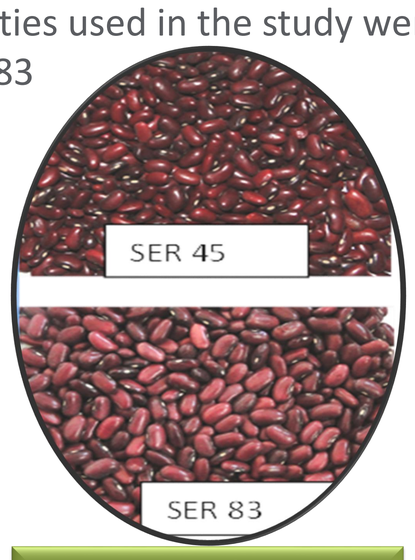
The recent publication by Woittiez *et al*., (2015) proposes that for farmers to move out of the current the first step is to close the current yield gap, followed by introduction of new technologies and ultimately, re-design the farming systems for commercial orientation.

Using Integrated Soil Fertility Management (ISFM) framework, advances in bean cropping have been made with regard to use of improved varieties and efforts are being made to find feasible options for improving productivity of smallholder systems.

## Methods

This study was conducted during 2014-15 season to assess bean yield and varietal response to soil fertility amendment and cropping systems.

Chicken manure is found to be rich in nutrients (e.g 236 mg $kg^{-1}$ phosphorus) has potential to be used in small amounts and on small farms to increase productivity. Two varities used in the study were SER45 and SER83




SER45 and SER83

The manure was applied at rate of 17 ton $ha^{-1}$ . Study plots were laid out in split-plot design with following treatments: Bean unfertilised, Bean+manure, bean+manure+fertliser, Bean +maize unfertilised, bean+maize+manure, and bean+maize+manure+fertliser

## Results

Yield in pure stands treated with chicken manure were higher (0.76 - 1.85 ton $ha^{-1}$) while control plots without manure and the business as usual fertilizer application in maize intercrop gave low yields (0.4 - 1.0 ton $ha^{-1}$).

Manure application significantly increased overall grain yield by 60% in sole bean stands and 53% in bean-maize intercrops over the control.

Bean yield in the common practice of maize intercrop was higher by 15% in manure compared to NPK treatments. Combining manure and NPK resulted in 9% yield gain over manure treated stands in sole crops while in intercrop, the yield gain was 27 and 11% over the merely fertilizer and manure treatments, respectively.

In sole cropping, manure plus fertilizer treatment gave higher yield for SER 83 while SER 45 performed better under mere manure. When intercropped with maize, SER 45 responded to fertilizer plus manure treatment while SER 83 showed no response.

**Table 1: Summary of yield averages and confidence intervals across soil fertility management and cropping systems for dwarf beans in Linthipe and Kandeu**

| | dwarf | | | SER 45 | | | SER 83 | | |
|---|---|---|---|---|---|---|---|---|---|
| | mean | CI 95% | | mean | CI 95% | | mean | CI 95% | |
| B | .90 | .76 | 1.03 | .94 | .82 | 1.06 | .85 | .59 | 1.11 |
| Bc | 1.44 | 1.13 | 1.75 | 1.73 | 1.19 | 2.27 | 1.20 | .83 | 1.56 |
| Bcf | 1.57 | 1.29 | 1.85 | 1.53 | 1.10 | 1.96 | 1.61 | 1.20 | 2.01 |
| BM | .61 | .47 | .76 | .54 | .38 | .71 | .72 | .44 | .99 |
| BMc | .94 | .76 | 1.11 | .89 | .56 | 1.22 | .99 | .87 | 1.11 |
| BMcf | 1.04 | .84 | 1.23 | 1.04 | .72 | 1.36 | 1.03 | .77 | 1.29 |
| BMf | .82 | .70 | .93 | .82 | .63 | 1.00 | .82 | .65 | .98 |

B=bean, M=maize, c=chicken manure, f=inorganic fertiliser

## Conclusions

The study shows that use of chicken manure on small farms would significantly increase bean yield and improve fertilizer use efficiency of some varieties under maize mixed farming systems.

It also reveals that the impacts of soil management options are specific to bean varieties.

Women applying manure in Ungwe Village

Village Head Ungwe interpreting graphical results

## Reference

Woittiez L., Descheemaeker K. and Giller E K. (2015). Adoptability of sustainable intensification technologies in dryland smallholder farming systems of West Africa. Research Report no. 64. Patancheru 502 324. Telangana, India: International Crops Research Institute for the SemiArid Tropics. 84 pp

**Contact:**

p.mponela@cgiar.org

RESEARCH PROGRAM ON Dryland Systems

CGIAR

CIAT International Center for Tropical Agriculture Since 1967 / Science to cultivate change

Africa RISING

roduced for the Pan-African Grain Legume & World Cowpea Conference

27 February – 4 March 2016

2016 INTERNATIONAL YEAR OF PULSES