Reducing yield gaps under small holder farmers conditions in Babati Tanzania: potentials and opportunities

Lyimo S.D.[1*], Kihara J.[2], Kizito F.[2], Yangole L.[1]

[1]Selian Agricultural Research Institute (SARI), Arusha – Tanzania
[2]International Center for Tropical Agriculture (CIAT), Nairobi – Kenya

*Corresponding author: Lyimo S.D., sdnlyimo@yahoo.com

Abstract

Maize and pigeonpeas yields in Babati are poor due to low rains availability (average precipitation for the district is 790 mm/year). and distribution, use of unimproved seeds and low or non-use of fertilizers. This study assessed the potential of sustainable intensification options through maize-pigeon peas intercropping using improved seed, phosphorus fertilizers, and farm yard manure for reducing the yield gap as well as increase income of the farmers. The trials initiated in 2013 included 3 villages namely Sabilo, Selotho and Long, which are located at 1635 to 2200 m.a.s.l.; and evaluated 3 sources of P fertilizer (Minjingu Phosphate Rock [N 0%, P 13%, K 0%]), Minjingu Mazao [N 10%, P 9%, K 0%] and DAP [N 18%, P 20%, K 0%]) applied at a rate of P= 20 kg/ha at planting, compared with farmers' practice of improved maize/pigeonpeas intercropping without fertilizer. Different improved maize varieties were used based upon the villages' altitude/elevation, amount of rainfall received and the rainfall duration. An early maturing maize variety called PAN 4M-19, and a medium maturing variety called SC 627 and a long maturing one called PAN 691 were planted at Sabilo, Selotho and Long villages respectively. An improved long maturing pigeonpea variety called Mali (ICEAP 00040) was intercropped with the maize in all villages. In 2014, different P sources (as in 2013) and farm yard manure were applied to 4 improved maize varieties, that had been selected by farmers based upon their priorities and performance in their respective areas, and tested in 6 villages. Farmers in Long village selected PAN 691, Longe 6H, Pioneer 2859 and SC 627 maize varieties; whereas farmers in Selotho, Sabilo, Hallu, Matufa and Shaurimoyo villages selected DK 8031, PAN 4M-19, Pioneer 3253 and SC 627 varieties. Each maize variety was intercropped with the Mali pigeonpea variety, or Lyamungu 90 common beans variety in the case of Long village. The fertilizer treatments for 2015 were similar to 2014 but, the number of maize varieties were reduced to two based again on farmers' preferences, and the number of villages to 4. Long village farmers selected SC 627 and PAN 691, whereas those in Selotho, Hallu and Sabilo villages chose SC 627 and Pioneer 3253 maize varieties. Trial plot size was 10 x 10 m for each of the treatments. Both maize and pigeonpeas were planted at 100 cm between rows and 50 cm between hills with 2 plants per hill, while beans were planted at 80cm x 40cm with 20 cm in between beans holes. The data collected included characteristics of soil samples at 20 cm depth during planting, plant stand, biomass, grain yield and socio-economic data for calculating economic benefits of the treatments. Soils in the villages were highly deficient of N, and the P levels in Seloto and Sabilo villages were average/medium, with high variability between individual fields. DAP and Minjingu Mazao fertilizers were the best sources of P nutrient in all the 3 years. The high yielding maize varieties were PAN 691, SC 627, Pioneer 2859 and Pioneer 3253. On average, maize yields obtained from the two fertilizer sources in 2014 and 2015 seasons across the different sites increased from about 1.5 t/ha to 6 t/ha for the high yielding varieties with adequate rainfall like in Long village . Pigeonpea increased by more than 5 times from 0.2 t/ha to 1.3 t/ha in the same period when the two fertilizers were applied; whereas common beans increased from 0.35 t/ha to 0.5t/ha in 2014, and from 0.1 t/ha to 1.9t/ha in 2015. Applying farm yard manure alone in both intercrops did not increase yield as compared to the combination of Farm Yard Manure with Minjingu Mazao. The benefit cost ratios for the maize pigeonpeas using DAP or Minjingu Mazao fertilizers in 2013 were 2 times more compared to the non-fertilized treatment, whereas the DAP/Minjingu Mazao fertilized maize-common beans intercropping gave a benefit:cost ratio of about 3 times more in 2015 compared to the unfertilized treatment. In moisture stressed conditions, DAP performs better than Minjingu-based sources. However, in seasons with adequate moisture, the performances of both DAP and Minjingu fertilizers is more or less the same. The pigeon pea or common beans -maize intercrop with phosphorus fertilization did not only increase yield and income but, could change Babati to a food secure and richer district.