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# Effect of Rhizobium strains on Yield and Yield Components of different released Common bean varieties in Metekel Zone/ North West Ethiopia

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## Abstract

Pulse crops are the most important source of food in the national diet of Ethiopia next to cereals. Common bean is an important component of the production systems and a major source of protein for the poor in Eastern and southern Africa. It is also an important cash crop. An experiment was conducted to evaluate the interaction of common bean varieties with the selected rhizobial strains in 3 districts of metekel zone for two years. Three common bean varieties and 3 rhizobial strains including positive and negative controls combined in a factorial RCBD design. The over-all analysis result shows that Hawassa Dume variety was the best performed variety. There was no significant difference between levels of rhizobial strains.

**Keywords:** Pulse crops, rhizobial strains, RCBD design,

## Introduction

Pulse crops are the most important source of food in the national diet of Ethiopia next to cereals. Nationally, pulses occupied 14% of the cultivated land yielding 2.86 million metric tons (11.4% of the total grain crop production) in 2013/14 *meher* season (CSA, 2014).

Common bean is an important component of the production systems and a major source of protein for the poor in Eastern and southern Africa. Common bean (Phaseolus vulgaris L), also referred to as dry bean, is an annual leguminous plant that belongs to the genus, Phaseolus, with pinnately compound trifoliate large leaves. It is largely a self-pollinated plant though cross-pollination is possible if the stigma contacts with pollen coated bee when extended. Seeds are non-endospermic and vary greatly in size and colour from the small black wild type to the large white, brown, red, black or mottled seeds of cultivars, which are 7-16 mm long (Cobley and Steele, 1976). Common bean shows variation in growth habits from determinate bush to indeterminate, extreme climbing types. The bushy type bean is the most predominant type grown in Africa (Buruchara, 2007).

In Ethiopia, the common bean is usually grown by subsistence farmers as a sole crop and/or intercropped with either cereals (maize and sorghum) or tree crops (enset, coffee, etc.). The national area of common bean production is estimated at 366,876.94 ha of land and from which about 463,008.49 tons are produced in2015 cropping season.

The current national average yield of common bean is 1262 kg ha-1. However, this yield is far less than the attainable yield (2500-3000 kg ha-1) under good

management conditions for most improved cultivars. Low soil fertility has been repeatedly reported as one of the major factors affecting bean production in the central rift valley of Ethiopia (CSA, 2014). A range of environmental factors, such as low soil nitrogen and phosphorus levels, and acidic soil conditions are important constraints for bean production in most areas where the crop is grown.(Assefa et al 2017)

In Ethiopia, bio fertilizer is new technology and not widely used by the farmer but inoculants were selected and distribute to the farmers.

### Objectives

- To select the most efficient rhizobia strain on field that can be used for inoculant production in Metekel Zone.
- To observe the possibilities of common bean varietal and strains interactions.

## Materials and Methods

### Sites

The study was conducted in Mandura, Dibatie, Pawe and Bullen districts of Metekel Zone in Benishangul Gumuze Region. The Benishangul-Gumuz region is one of the nine administrative regions of Ethiopia located in the western part of the country, sharing an international border with Sudan in the west. In a national setting, the region shares borders with the Amhara, Oromiya, and Gambella regional states (Figure 1). It occupies an estimated total area of 50,380 km2 (BGRS, 2004), and has a total population of 670,847 (CSA, 2008). The population consists of indigenous ethnic minority groups of Berta, Gumuz, Shinasha, Mao and Komo. It is also inhabited by settlers with a diverse ethnic background from other regions.

Metekel is one of the three administrative zones in the BenishangulGumuz Regional State, covering seven districts namely Dangur, Guba, Womera, Mandura, Dibate, Bullen, and Pawe. It is lowland with a high rainfall and hot temperatures. Its diverse agro-ecology provides potential for cultivation of different crops. Farmers practice a mixed crop livestock production system. Cereals (maize, sorghum and finger millet) and oilseeds (soybean, sesame, and groundnut) are the most important food grains mainly cultivated in the zone.

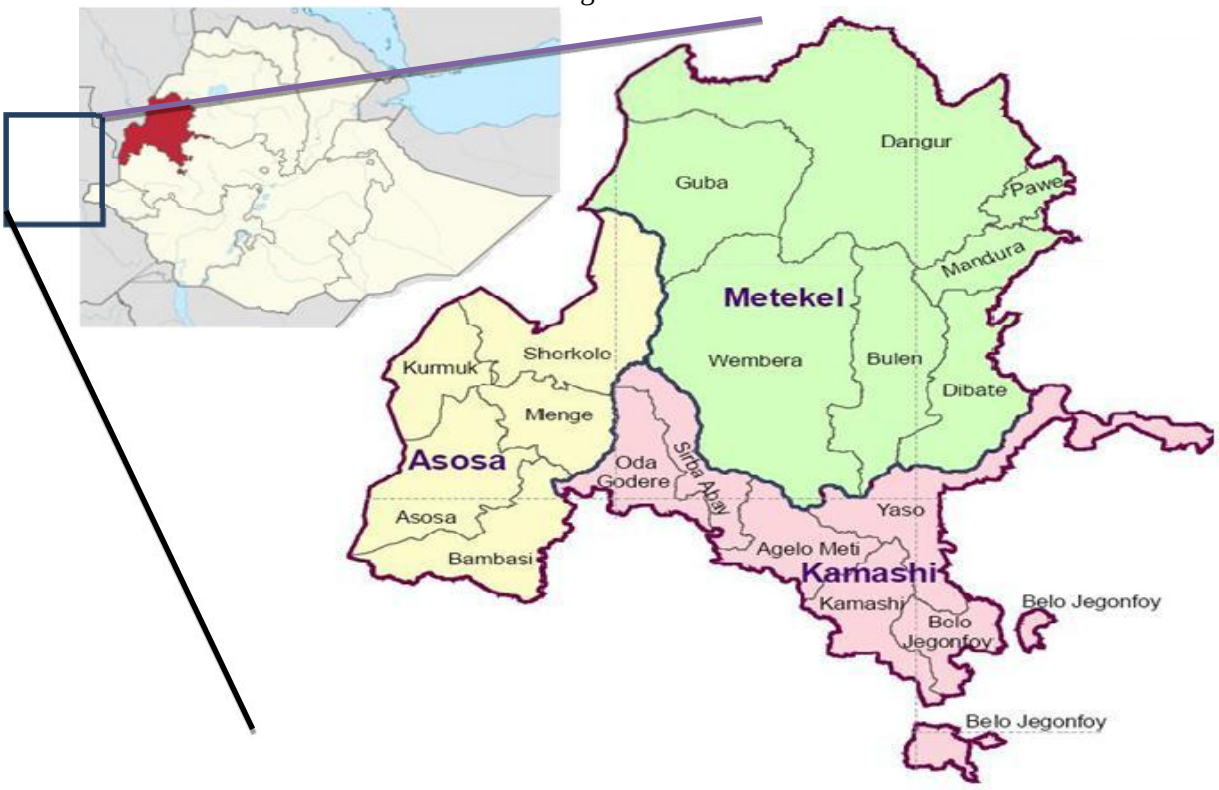


**Figure1.** Map showing Benishangul Gumuz Region and the three administrative zones with corresponding districts

Target Common bean varieties Nassir, Awasa Dume and Acos Red with three strains HB A-15, CB-NAK 91, and HB EAL 429 with positive and negate control of N fertilizer were designed with factorial RCB design. The factors were common bean variety and inoculants. 50 kg NPS fertilizer was added for each treatment (supplies 9.5 kg N, 19kg P and 3.5kg S per hectare). The N+ treatment will receive additional 28.3kg/ha as urea (to supply 13.5kg N per ha i.e. together with the N available from NPS, supplies 23kg of N per hectare for the N+ treatment). But in the N- treatment there was no inoculant or additional Urea, only 50kg/ha of NPS was add.

## Results and Discussion

**Table 1:- Effect of different varieties and inoculants on the yield component of common bean, Mandura 2016.**

| Variety | BY | GY | Strain | BMY | GY |
|---|---|---|---|---|---|
| Acos | 1232.7a | 1122.7b | RN | 1232.7a | 1503a |
| Awasa dome | 939.46b | 1938.1a | HB-429 | 1068.5a | 1443.9a |
| Nasir | 757.39c | 919.7b | Ctl | 1024.2ab | 1298.9a |
| CV (%) | 24.3 | 27.7 | HB-A-15 | 816.2bc | 1213.3a |
| LSd (0.05) | 177.83 | 275.54 | CB-NAK-91 | 741.1c | 1175.1a |
| | | | CV (%) | 24.3 | 27.7 |
| | | | LSd (0.05) | 229.58 | ns |

**Table 2:- Effect of different varieties and inoculants on the yield component of common bean, Mandura 2017.**

| Variety | BY | GY | Strain | BMY | GY |
|---|---|---|---|---|---|
| Acos | 1432.9a | 535.35a | RN | 1558.3a | 528.7a |
| Awasa dome | 1595.5a | 520a | HB-429 | 1202.6a | 434.92a |
| Nasir | 1107.7b | 325.48b | Ctl | 1388.9a | 482.46a |
| CV (%) | 31.4 | 26.8 | HB-A-15 | 1439.7a | 414.55a |
| LSd (0.05) | 324.38 | 92.256 | CB-NAK-91 | 1304.2a | 440.76a |
| | | | CV | 31.4 | 26.8 |
| | | | LSd | 418.77 | ns |

**Table 3:- Effect of different varieties and inoculants on the yield component of common bean, Dibate 2016.**

| Variety | BY | GY | Strain | GY | BMY |
|---|---|---|---|---|---|
| Acos | 1493.2a | 1368.13b | RN | 1278.21a | 1525a |
| Awasa dome | 1215.61b | 1726.19a | HB-429 | 1160.79a | 1203b |
| Nasir | 839.61c | 933.05c | Ctl | 1120.37a | 1356.5ab |
| CV (%) | 17.7 | 15.9 | HB-A-15 | 1227.2a | 1438.1a |
| LSd (0.05) | 156.9 | 160.11 | CB-NAK- 91 | 1127.46a | 1189.7b |
| | | | CV (%) | 17.7 | 15.9 |
| | | | LSd (0.05) | ns | 206.7 |

**Table 4:- Effect of different varieties and inoculants on the yield component of common bean, Dibate 2017.**

| Variety | BY | GY | Strain | BMY | GY |
|---|---|---|---|---|---|
| Acos | 1788.6a | 786.83b | RN | 2151.1a | 972.34a |
| Awasa dome | 2022.4a | 970.53a | HB-429 | 1710.7b | 701.59c |
| Nasir | 1951.2a | 715.88b | Ctl | 1930.9ab | 863.45ab |
| CV (%) | 19.8 | 18.5 | HB-A-15 | 2032.5ab | 826.91abc |
| LSd (0.05) | ns | 114.33 | CB-NAK-91 | 1778.5b | 757.77bc |
| | | | CV (%) | 19.8 | 18.5 |
| | | | LSd (0.05) | 367.93 | 147.6 |

In the two years performance common bean variety Hwassadume gave superior in its agronomic yield up to 30% advantage over the other varieties. This variety is newly released variety which is being replacing the oldest local varieties in southern part of the country (Ganewo et. al. 2017).The nasir variety which was released earlier as best variety in the area was not competent as Hawassadume. Therefore this result indicates that having potential variety for the particular site is guaranteed. Therefore this experiment meet one of its target objective as well as point out the presence of competitive native rhizobia in the study area. In biomass yield Acos red variety was also competent in some areas. But in grain yield hawassadume is significantly higher (P=0.05 level of significance) than other two varieties.

Application of NP fertilizer gave better yield than other treatments. Non-responsiveness of rhizobial strains may be due to the presence of native competent rhizobial strains in the soil. Since all strains are imported strains they may not equally compute as local strains.

## Conclusion

From the evaluated common bean varieties Awassadume showed better grain yield potential in both locations over the two seasons and AcosKeyo also showed promising fresh biomass. Regarding the strain and varieties interface no interaction were observed in this two season experiment. In the case of inoculants effect none of the tasted strains showed the super dominant performance of biomass and grain yield instead the negative control showed similar performance as the inoculants and recommended N plots which might be an indicator for the presence of competitive native strains in theareas. So the author recommends that using the best common bean variety and screening native strains in the study area will improve productivity in Metekel zone.

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