

Performance Evaluation of Common Bean (*Phaseolus Vulgaris* (L.)) Varieties at Benatsemayworeda of South Omo Zone, SNNPR, Ethiopia

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ABSTRACT

Common bean (*Phaseolus vulgaris* L.) is the second most important source of human dietary proteins and the third most important source of calories and also it has a high nutritional value with important protein contents (~22%), minerals (calcium, copper, iron, magnesium, manganese, zinc), and vitamins necessary to warrant the food security of people in the developing countries. A field experiment was conducted on farmer's field of Kakokebele of Benatsemayworeda of South Omo Zone of Southern Ethiopia using six improved common bean (*Phaseolus vulgaris* (L.)) varieties under rain fed condition in 2015. The objective of the study was to select the best performing common bean varieties that will increase productivity and production of common in the target areas. The treatments involved were six improved varieties of common bean Tatu, Remeda, Sari-1, Wajo, Ibado and Deme. The experiment was carried out using a randomized complete block design (RCBD) with three replications at Kako in 2015. The result of analysis of variance showed that both of the phenological and yield and yield component parameters studied were significantly affected by varieties. In this study, there were significant variations observed among the common bean varieties for days to flowering, plant height, 1000 seed weight and grain yield. The effect of varieties on grain yield was significant and the best performing varieties of common bean namely Tatu (1.033kg/plot), Remeda (0.959kg/plot), Sari-1 (0.849kg/plot) or Wajo (0.908kg/plot) would be recommended for the specific community and its vicinity even though further study should be carried out including a number of recently released varieties for improved common bean production in the target area and also to put the recommendation on strong basis.

Keywords: Common Bean, Phenological Parameters, Yield Components, Varieties, Yield

INTRODUCTION

Common bean (*Phaseolus vulgaris* L.) is the second most important source of human dietary proteins and the third most important source of calories (Bennink, 2005; Widars, 2006; Sarikamiset al., 2009). According to Miklas et al. (2006), this crop has a high nutritional value with important protein contents (~22%), minerals (calcium, copper, iron, magnesium, manganese, zinc), and vitamins necessary to warrant the food security of people in the developing countries. *P. vulgaris* is the most widely distributed *Phaseolus* species as it is grown across all the continents with a broad range of adaptation to various environmental conditions. Total national production was estimated at 5137.21 ton in 2014 (CSA, 2014).

It is the most important food legume in Latin America and East and Southern Africa. Common bean is a traditional crop of the neotropics, where it was domesticated several thousand years ago (Freytag et al., 2002). Though the total world production of the common bean could not be calculated with certainty due to confusion with other legumes in some of the data, but estimated between 11 and 12 million tons (FAOSTAT, 2006). The total common bean production in sub-Saharan Africa is around 3.5 metric tons with 62% of production in East African countries of Burundi, DR Congo, Ethiopia, Kenya, Rwanda, Tanzania and Uganda, making this the most important region for the crop within the African continent (Broughton et al., 2003). The East African highlands are a region of important common

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bean production and high varietal diversity for the crop (Fivawo et al., 2011).

In Ethiopia, generally legumes are the major sources of protein where common bean accounts for the largest proportion next to faba bean and field pea (CSA, 2010; 2011). It is one of the major grain legumes widely cultivated and grown as source of protein and cash by smallholder farmers by the smallholder farmers in the Southern Ethiopia (Fekadu, 2013). Even if its production is concentrated at low land areas; but the extent of production of common bean in the target area especially in South Omo Zone is with the use of farmers' variety rather than the improved varieties so far. The lack of the improved varieties of common bean is the major problem that plays a great role for the lower yield of the common bean in the study area. The lack of improved varieties is one of the top problems for low yield of common bean (Fekadu, 2007).

Therefore, there is need to introduce the improved common bean varieties to the target area is paramount important to come up with improved productivity and production of common bean in the study area. So, this research was initiated with the objective of selecting the best performing common bean varieties in the study area.



Fig1. Field performance of Common Bean Varieties

Data Collection

Phenological Parameters

Phenological parameters such as days to flowering and days to maturity were recorded. Days to flowering was recorded by counting the number of days after emergence when 50% of the plants per plot had the first open flower. Days to maturity was recorded when 95% of pods matured per plot.

Grain Yield and Yield Components

Three central rows were harvested for determination of grain yield. Grain yield was adjusted to 14% moisture content. Five plants

MATERIALS AND METHODS

Description of the Study Area

The experiment was conducted at Kako farmer's field located at 036° 40.259' E longitude and 05°38.332' N latitude and at an altitude of 1305 meters above sea level (masl). Geographically, Kako is situated in South Ethiopia at about 711 kms from the Addis Ababa. The long term weather data of the area revealed that the mean annual rainfall of the area is 68.14 mm with a range of 32.59 to 115.96 mm. The experiment was conducted during the main cropping season (April to July, 2015) under rain fed conditions.

Treatments and Experimental Design

The treatments involved were six improved varieties of common bean namely; Tatu, Remeda, Sari-1, Wajo, Ibado and Demi. The experiment consisted of 6 treatments with a total of 18 plots. The field experiment was laid out in a randomized complete block design (RCBD) with three replications. Common bean was sown on April 28, 2015 in five rows per plot with spacing of 3 meters length with row-to-row distance of 40 cm and plant-to-plant distance of 10 cm. 100 kg/ha of DAP were applied during planting.

were randomly selected from the four central rows to determine yield and yield components, which consisted of number of pods per plant and number of seeds per pod.

Pod number per plant was determined by counting pods of the five randomly selected plants while number of seeds per pod was recorded by counting the total number of seeds in a pod from ten randomly sampled pods taken from the five randomly selected plants. 1000 Seed weight was determined by taking a random sample of 1000 seeds and adjusted them to 14% moisture content.

Statistical Analysis

All collected data were being subjected to analysis using the SAS (statistical software). The analysis of variance was also performed using the GLM procedure of SAS Statistical Software. Effects were considered significant in all statistical calculations if the P-values were < 0.05. Means were separated using Tukey's Least Significant Difference (LSD) test.

RESULTS AND DISCUSSION

The result of analysis of variance depicted that, plant height and 1000 seed weight were highly significantly different at ($P < 0.001$) (Table 1). This indicates that there exists a linear response of the studied phenological parameters to varieties. The result of analysis of variance for mean squares revealed that, days to flowering and grain yield were significantly different at ($P < 0.05$) (Table 1). The maximum and minimum number of pods plant⁻¹ of (8.51) and (5.73) were recorded for the varieties Wajo and Sari-lima, respectively (Table 2).

In this study, number of days to maturity, pods plant⁻¹ and seeds pod⁻¹ was not significantly

affected due to varieties (Table 1). The maximum and minimum number of seeds pod⁻¹ of (4.73) and (3.00) were noted for the varieties Wajo and Tatu bean, respectively (Table 2). The above findings revealed that the maximum number of pods per plant and the highest number of seeds per pod resulted in the minimum grain yield of (0.03kg/plot) for the common bean variety Wajo which disagree with the finding of Tekle *et al.* (2014) which stated that, the maximum number of pods per plant and the highest number of seeds per pod resulted in the maximum grain yield of (2.1478 t ha⁻¹) for the common bean variety Dinkinesh. In this experiment, grain yield of common bean was significantly different at ($P < 0.01$) (Table 1) and affected by the tested varieties. This finding agrees with the previous findings reported (Fekadu, 2013).

The highest grain yield of (1033.8) was recorded for the variety Tatu and the least grain yield of (31.4) was noted for the local check (Table 2).

Table 1. Mean Square Values for Crop Phenology, Yield and Yield Components of Common Bean as Influenced by Variety at Kako, in 2015. * and *** indicate significance at $P < 0.05$ and $P < 0.001$, respectively and 'ns' indicate non-significant

Source of variation	df	Days to flowering	Days to maturity	Pods (Plant ⁻¹)	Seeds (Pod ⁻¹)	Plant height(cm)	100seed weight	Grain Yield
Replication(R)	2	1.388ns	4.166ns	1.6284ns	0.762ns	84.202ns	194.802ns	9805.61ns
Treatment(Trt)	5	17.555*	11.033ns	2.756ns	1.144ns	3208.68***	132850.735***	427861.45*
Error (E)	10	1.388	5.700	5.663	0.738	67.82356	565.7422	34349.65

Table 2. Crop Phenology, Yield and Yield Components of Common Bean as Affected by Variety at Kako, in 2015.

Varieties	Days to flowering	Days to maturity	Pods (Plant ⁻¹)	Seeds (Pod ⁻¹)	Plant height(cm)	100seed weight	Grain Yield (kg/plot)
Tatu	41.000C	71.000A	7.000A	3.00A	48.93C	451.33C	1.033A
Remeda	43.000BC	74.333A	6.200A	3.13A	81.87B	466.17C	0.959.A
Sari-1	44.667AB	72.667A	5.733A	3.40A	50.53C	535.00B	0.849A
Wajo	48.000A	76.667A	8.516A	4.7333A	131.83A	908.33A	0.031B
Ibado	46.000AB	72.667A	7.133A	3.5333A	57.07C	272.50D	0.918A
Deme	44.000BC	73.667A	7.200A	3.6667A	97.93B	480.93BC	0.555.AB
LSD 0.05	3.336	3.3366	23.436	6.7379	23.316	2.4326	0.524
CV%	2.651	3.248	34.174	24.014	10.554	4.582	25.580

Note: Means with the same letters within the columns are not significantly different at $P < 0.05$.

SUMMARY AND CONCLUSION

Production of common bean by introducing the improved and high yielding varieties could make an important contribution to increase agricultural production and productivity in areas like Kako where there is low practice of using improved varieties of common bean. To this end, using the improved common bean varieties could be one of the options to improve

productivity by small farmers. However, production of common bean using the improved varieties is not yet introduced and studied in the target area. Thus, this research work was initiated to examine the impact of improved varieties on the performance of common bean. This Study carried out at Kakokebele of Benatsemayworeda of South Omo zone of SNNPR, Ethiopia under rain fed condition in

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2015. The objective of the study was to select the best performing varieties that will improve common bean production in the studied area. The experiment was carried out using the randomized complete block design (RCBD) with three replications at Kakokebeles in 2014. Treatments involved in this experiment were six improved common bean varieties. The result of analysis of variance showed that both of the phenological and yield and yield component parameters were significantly affected by varieties.

In this study, there were significant variations observed among the common bean varieties for days to flowering, plant height, 1000 seed weight and grain yield. The effect of varieties on grain yield was significant and the best performing varieties of common bean namely Tatu (1033.8), Remeda (959.0), Sari-1 (849.5) or Wajo (908.33) would be recommended for the specific community and its vicinity even though further study should be carried out including a number of recently released varieties for improved common bean production in the target area and also to put the recommendation on strong basis.

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