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Participatory Evaluations of Mung Bean (Vigna Radiata L. Wilczek) Varieties in Selected Districts of East Shewa Zone, Oromia, Ethiopia

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Abstract

Adaptable Mung bean varieties to East Shewa zone of central rift valley of Oromia, Ethiopia were demonstrated to the farming communities in selected districts of Dugda and Adami Tulu Jiddo Kombocha. Varieties namely shewarobit, Beroda and Rasa N-26 were demonstrated with objectives of evaluating the yield performances of adaptable mung bean varieties under farmers' conditions, to analyse the financial return of Mung bean production under farmers circumstances in the study areas, to improve farmers knowledge and skill on mung bean production and management and to create awareness about the importance of the technology to different stakeholders. Accordingly, twelve trial farmers were selected to establish the demonstration trials. The results indicate that there is no statistically significant yield difference at ($p<0.05$) between the varieties. Better yield was obtained from shewarobit Variety 12.1 ± 1.34 qt/ha followed by Beroda (12.1 qt/ha) and Rasa N-26 (10.4) qt/ha respectively. Furthermore, in-terms of yield gap and technology index a minimum gap between the demonstration yield and the potential yield was recorded for all varieties, revealing a comparable performance and the feasibility of all demonstrated varieties under farmers' circumstances in the study area. Yet, basing other parameters (Financial return, its yield advantage and farmers preference) further scaling up works on Shewarobit variety is recommended for similar agro ecologies Shewarobit variety has also less yield gap when compared with Rasa N-26 Variety.

Keywords: Adaptable; Mungbean; East shewa; Demonstration

Introduction

Mung bean,Vigna radiata (L.) Wilczek, which is also called Green gram or maash is an annual food legume belonging to the subgenus Ceratotropis in the genus Vigna [**1**]. Mung bean is originated from India and it has diversified to East, South, Southeast Asia (China) and some countries in Africa. It is a warm season annual legume which is a drought resistant crop with an optimum temperature range of 27- 30°C for good production. It is early maturing crop, requiring 75–90 days to mature. Best adaptation areas for Mung bean are at 1,000-1,650 meters above sea level; with annual rainfall of 600-750mm.

Mung bean can be produced for food and fodder purposes varying from place to places [**2**]. It is a nutritionally rich crop with significant protein and carbohydrate contents important for human beings. According to Prakit and Peerasak the crops is utilized in several ways, where seeds, sprouts and young pods are consumed as sources of protein, amino acids, vitamins and minerals, and plant parts are used as fodder and green manure. Furthermore, mung bean has a potential to make up the gap of protein shortage since its seeds are rich in protein and amino acids, thus serve as a protein source for human consumption.

In Ethiopian context it is a recently introduced pulse crop produced majorly in the north eastern part of Amhara region (North Shewa, Oromiya special zone and Southern Wollo, Gonder), SNNPR (Gofa area) and pocket areas in Oromiya region (Hararge, Ilubabor), Tigray [**3**]. Mung bean productivity in Ethiopia is estimated to be on average 0.9 ton/ha−1) with a volume of production is increasing year to year; whereas the world average productivity is 1.2ton/ha−1 [**4**].

It is majorly produced as a cash crop to generate income by selling it to exporters (ECX, 2019). Currently, the Ethiopia Commodity Exchange (ECX) also announced the entrance of the crop, Green Mung Bean, into its trade floor. Green Mung bean is the sixth product that ECX is trading. According to ECX In 2015/2016, Ethiopia exported a total of 30,694 MT of green Mung bean with a value of 35.8 million USD. Compared to export performance of to 2014/2015, the export volume and value grew up by 21% and 23%, respectively. The major export destinations for Ethiopian green Mung bean are: Indonesia, India, Belgium, UAE, and Singapore. Other major global players in Mung bean import comprises: USA, Netherlands, UK, Canada, France, Germany, Norway, Sweden, and Malaysia.

Despite increases in potential export markets as well as internal markets, the production is limited to certain areas with no considerable improvement in quantity. Yet, the crop has adaptability to different areas serving both the nutritional benefits as well as cash crop. To this end, adaptability trial of released varieties of mung bean has been conducted by Adami Tulu Agricultural Center for a possible introduction in the farming system of East Shewa zone, the central rift valley area of Oromia, Ethiopia. The study was conducted for two consecutive years across three locations. Accordingly, promising results with no significantly varying productivity have been found indicating adaptability. The results indicated that Shewa Robit variety had higher grain yield (1607.4 kg/ha) followed by N-26 (1542 kg/ha) and Beroda (1466.1 kg/ha). Thus, based on the results, a follow up demonstration and evaluation has been recommended.

Thus, this proposal activity was initiated to evaluate and demonstrate these adaptable mung bean varieties to the farming community of East Shoa zone with the following specific objectives.

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Objectives

To evaluate the yield performances of adaptable mung bean varieties under farmers' conditions in selected districts of East shewa zone.

To analyse the financial return of Mung bean production under farmers circumstances in the study areas

To improve farmers knowledge and skill on mung bean production and management

To create awareness about the importance of the technology to different stakeholders

Materials and Methods

Description of the study areas

The study was conducted in selected districts of East shewa zone. East shewa zone is one the administrative zones of Oromia regional state, Ethiopia. The zone has an area of 10241km2and Adama town is serving as the capital town of the zone. There are 10districts within the zone. among which Dugda and Adami Tulu Jiddo Kombolcha districts are the study districts where this demonstration activity took place.

Dugda district is located at 135km from the capital city of Ethiopia, Addis Ababa and 100km from Oromia region's and East Shewa's zonal capital Adama. The district covers 5.2% of East Shewa zone with area of 751km2. Dugda has 18 Kebele's among which one kebele was used for this study. The district has an average 636mm annual rainfall and 26ocaverage temperature. The major crops produced are wheat, teff and maize

Adami Tulu Jido Kombolcha district is located at 160 km from the capital city of Ethiopia, Addis Ababa and 115 km from Oromia region's and East Shewa's zonal capital Adama. The district lies at latitude of 7.58°N and 38.43°E longitudes. Its altitude ranges from 1500 to 2300 meters above sea level. The mean annual rainfall ranges from 750-1000mm and the distribution is highly variable between and within years. The mean annual temperature ranges from 22-280C. Mixed crop livestock farming system characterizes the agriculture of the district.

Map of the study area (Dugda and Adami Tulu Jiddo Kombolcha)

Site and Farmers selection

Sites were selected in collaboration with district offices of Agriculture. Two districts were involved (Dugda and Adami Tulu Jiddo Kombolcha). In each district 2 Kebele's were selected, so a total of 4 Kebele's were selected in the two districts. One FRG (Farmers research group) having 15 farmers was organised in each Kebele among which 3 were trial farmers. Totally, the demonstration activity involved twelve (12) trial farmers.

Planting materials: Three of the adaptable mung bean varieties (Shewa robit, Rasa (N-26) and Beroda) will be used

Agronomic management

The demonstration was laid out on 12 (Twelve) adjacent (neighbouring farmers' fields) in the 4 kebele's on a land size 10 x 10 per farmer/ per variety. Packaged production and management technologies and practices (seed rate, seed treatment, spacing and weed management) recommended for mung bean were used. Land was prepared by farmer using oxen plow. Seeds were sown at the recommended rate of 25-35 kgha-1 in rows (40cm between rows and 10cm between plants). Plots were kept free of weeds to produce a successful mung bean crop. Fertilizer rate of 100 kg NPS per ha at planting was used. Other agronomic managements were done as per the recommendation.

Knowledge improvement and awareness creation

Training about mung bean production and management was provided before commencing the activity. Field visits and field days among trials farmers were conducted to observe and share their knowledge and experience about the activity as well as mung bean production and management.

Data collected

Grain yield, costs incurred and revenues gained, total number of farmers by gender participated in trainings, and Farmers' feedbacks were collected.

Data analysis

The collected agronomic data was analyzed using SPSS statistical software for possible variances using one way ANOVA.

The collected agronomic data was also analyzed for yield advantage. Yield advantage of the varieties over the other was calculated using the following formula.

$$\text{Yield advantage\%} = \frac{\text{yield of improved variety} - \text{yield of check variety}}{\text{Yield of check variety}} \times 100$$

Furthermore, technology gap and technology index was calculated using the formulas as given by [**5**]. The technology gap shows the gap in the demonstration yield over potential yield i.e the yield expressed during the adaptation trials. The yield gaps can also be further categorized into technology index which is used to show the feasibility of the varieties at the farmer's field. The lower the value of technology index the more the feasibility of the varieties [**6**]. The formulas are as follows

$$\text{Technology gap} = \text{Potential yield qt/ha} - \text{demonstration yield}$$

$$\text{Technology index \%} = \frac{\text{Potential yield} - \text{demonstration yield}}{\text{Potential yield}} \times 100$$

Results

Knowledge improvement and awareness creation training

It is understandable that training is a very important tool for improving farmers' awareness and knowledge. This in turn would contribute to the improvement in productivity. Thus. Before commencing on the actual field planting of the mung bean varieties training was provided for all participating farmers including host and non-host/ follower farmers, DA's and district experts about the overall mung bean production and management. Thus, a total of 98 farmers, 12 DA and 4SMS and 22 other stakeholders participated. Accordingly, from the total of training participants 21.65 % were women.

Yield performance

The demonstrated varieties were compared and evaluated in terms of their yield performances. The yield data was collected from the demonstration fields of all involved trial farmers. The collected data then entered into SPSS and analysed using one way ANOVA.

Table 1: Number of farmers and other participants trained on Mung bean production and management.

Parameter		Farmers	DA's	SMS	Others	Total	
						Frequency	Percent
Sex	M	81	7	4	19	111	78.4
	F	17	5	0	2	24	21.6
	Total	98	12	4	21	135	100.0

Table 2: Yield performance of demonstrated coriander varieties.

Variety	Mean	N	Std. Deviation	Minimum	Maximum	Sig
Beroda	11.21 ± 2.15	7	5.67969	6.00	21.50	ns
Shewarobit	12.1 ± 1.34	7	3.55861	7.50	18.00	
Rasa (N-26)	10.4 ± 1.16	7	3.07108	6.25	15.50	

Table 3: Yield gap, yield advantage and technology index of demonstrated Mung bean varieties.

Varieties	Potential yield/adaptation yield (Qt/ha)	Demo- yield (Qt/ha)	Parameters			
			Yield gap (Qt/ha)	Technology index (%)	Yield advantage over the other varieties (%)	
Shewarobit	16.01	12.1	3.974	24.73	Over Rasa N-26	7.35
					Over Beroda	14.04
Rasa N-26	15.42	11.21	5.02	32.55	Over Beroda	7.22
Beroda	14.66	10.4	3.45	23.53		

Accordingly the combined analysis results indicate that there is no statistically significant yield difference at ($p<0.05$) between the varieties. Better yield was obtained from shewarobit Variety 12.1 ± 1.34 qt/ha followed by Beroda (12.1) and Rasa N-26 (10.4) qt/ha respectively. The following table describes the result

Yield advantage, gap and technology index

Apart from identifying the yield performances of the demonstrated varieties, the study has also tried to further see the variety in terms of yield gap, yield advantage and technology index. This serves to see whether the varieties demonstrated have better chance or feasibility to the study area. Thus, the following table describes the result

According to the results shown on the above table Shewarobit variety has the better yield advantage of 14.4% and 7.35% over Beroda and Rasa N-26 varieties respectively. Rasa N-26 has also better yield advantage of 7.22% over Beroda variety. Interms of technology index lower technology index percentage was recorded from shewarobit variety with 24.73%. Shewarobit variety has also less yield gap when compared with Rasa N-26 Variety.

Financial Return of coriander production

The demonstration activity further evaluated the financial return of mungbean production in the study area with the demonstrated varieties. As the crop is new to the farming system of the area knowing this information could contribute to the demand creation for the production of the crop. Thus, the calculations were done using Ethiopian birr on hectare basis using the current market price of mung bean grain in the study area. All inputs and labor costs were also calculated based on the market price during the production season. Accordingly, the results indicate that a total of 40200, 37200 and 33,450 Ethiopian birr can be gained by producing Shewarobit Beroda and Rasa (N-26) varieties respectively.

Participating farmers' feedback and preference among the demonstrated varieties

The participating farmers were let to rank the varieties according to their own selection criteria's which could be suitable for the farming system of their area. Accordingly, farmers have selected shewarobit variety as their first choice basing its better grain yield, tolerance to diseases. The following **table 1-3** describes the results.

Conclusion and Recommendation

The demonstration activity created an opportunity for farmers to evaluate the performance of the adapted mung bean varieties. Furthermore, through the trainings awareness has been created for all participating farmers, DA's and other stakeholders on how to produce and manage mung bean varieties. The results indicated that there is no statistically significant difference ($P<0.05$) with the varieties compared. Yet, numerically Shewarobit variety gave higher yield. Which resulted in higher yield advantage and financial return. In-terms of yield gap and technology index a minimum gap between the demonstration yield and the potential yield was recorded for all varieties, revealing a comparable performance and the feasibility of all demonstrated varieties under farmers' circumstances in the study area. Yet, basing other parameters (Financial return, its yield advantage and farmers preference) further scaling up works on Shewarobit variety is recommended for similar agro ecologies

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