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Participatory evaluation and selection of improved haricot bean varieties at liben district, lowland agro ecology of Guji zone, Oromia regional state, Ethiopia

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ABSTRACT

The activity was conducted in Liben district to evaluate the yield performance of improved haricot bean varieties. 25 pastorals and agro pastorals were selected from Measa kebele with collaboration of Liben Pastoral and Agro Pastoral Office, Zonal Mobile Supporting Team and kebele leaders. The 25 pastoral and agro pastorals were grouped into one PAPRG. Then 25 PAPRG members were regrouped into three experimental pastorals and agro pastoralists. Training were given for PAPRG members. Exchange visit was arranged to share experience on the work each PAPRG. Haramaya, Awasa Dume, Ebado varieties were evaluated with standard check variety. Descriptive statistics and direct matrix ranking was used to analysis the data. Local variety give the highest yield (31kg/ha). PAPRG criteria for haricot bean production was market demand, color, disease/insect reaction, drought resistance. Accordingly, Ebado variety was preferred by PAPRGs based on marketability while Local check and Awasa Dube were selected as first and second respectively based on drought resistance, number of pod/plant, higher yield and resistance to insects. Haramaya variety was susceptible to insects. Pastoralists and agro pastoralists should use Ebado variety to increase their income and local variety for household consumption.

Contribution/ Originality

Contrary to previous literatures which mostly focused on highland areas this research activity deal with lowland agro pastoral area where agricultural activities challenged by prolonged drought. Most research activities were not indorsed the participation of pastorals and agro pastorals in their research experimentation. This activity, however, emerged from the agro pastorals' problem. Agro pastorals conducted the research on their farm and set preference criteria for haricot bean varieties by themselves.

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1. INTRODUCTION

Haricot bean is the most economically important pulse crop grown in Ethiopia (Wondwosen and Abebe, 2017). Haricot bean is considered as the main cash crop and protein source of many lowlands and mid-altitude zones of Ethiopia. (Alemneh *et al.*, 2017; Abebe, 2009; Ferris and Kaganz, 2008). 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. Haricot bean is an important income source; its straw serves as feed for livestock, and also improves soil fertility by its virtue of nitrogen fixation in the cropping system (Fekadu, 2013).

Ethiopia is one of the top twelve producers of total legumes in the world, third largest producer of haricot bean in COMESA member countries and the leading exporter in Africa (Agete, 2014). On the other hand, the current productivity level of haricot bean falls significantly below the demonstrated potential. The current national average productivity of haricot bean in Ethiopia is 1.48 tons per hectare that is below average research demonstrated productivity potential (3.4 tons per hectare) in the country (Mulugeta *et al.*, 2015). This is attributed to combined effects of edaphic, climatic, disease, and pest problems. Of course, lack of improved varieties is one of the top problems for low yield (Fekadu, 2007). All the released and high yielding varieties were not equally accepted by users due to differences in beneficiaries' preference for the varieties in different localities. This was because the varieties were developed through conventional breeding that did not consider users' criteria (Fekadu, 2013).

Participatory research is the preeminent decision to diligently work with pastoralists and agro pastoralists in order to recognize their interest. Pastoral Participatory research refers to the active participation of pastoralists in identifying their problems, prioritizing and planning their research agenda, implementing research, evaluating the technologies on their farm, adopting the new technologies and rehearsing the activity by themselves in their farming environment. The reasons to promote participatory research according to Gemechu *et al.* (2004) includes improving the efficiency and effectiveness of research through increased adoption rates of technology and techniques, and reduced research extension cost, increasing equity and insurance that stakeholders play a role in activities that affect them and empowering the poor and strengthening their bargaining power.

In terms of pulse production, haricot bean stands first in area coverage with 22qt/ha in Guji Zone (CSA, 2015). In pastoral area of Guji Zone, haricot bean is the major crop produced and used as household consumption and cash crop. The crop is also used for increasing soil fertility. The crop is grown either as a sole crop or intercropped with cereal (maize). This characteristics make it an ideal crop for intensification of existing farming system. The crop can be produced in *Meher* and *Belg* season.

Despite used for household consumption, high nutrition values and increasing soil fertility the yield and production of haricot bean in pastoral and agro pastoral Guji Zone is very low due to poor agronomic practices, lack of drought resistant variety, lack of improved varieties, insect, pest, environmental degradation and etc. (Personal survey, during problem identification), and probably due to the remoteness from the center and inaccessibility of the area.

Most participatory activities were conducted in highland and midland areas of the Ethiopia (Fekadu, 2007; Fekadu, 2013; Abraham *et al.*, 2016; Ayalew, 2017). However, there were no detailed participatory activities conducted in pastoral and agro pastoral of Guji Zone. As a result pastoral and agro pastorals selection preference for haricot bean varieties were not evaluated in Guji Zone. Thus participatory evaluation and selection of haricot bean varieties was initiated (i) to evaluate the yield performance of improved haricot bean varieties (ii) to build pastoral and agro pastoral knowledge and skills on production and management of haricot bean (iii) to assess pastoral and agro pastoral

haricot bean variety preference and (iv) to enhance linkage with participating stakeholders through Pastoral and Agro Pastoral Research Group approach.

2. RESEARCH METHODOLOGY

2.1. Site and number of pastoral and agro pastoral selection

The experiment was conducted at Liben lowland district of Guji Zone. From this district Measa Kebele was selected purposively based on the potentiality of the area to demonstrate haricot bean technologies. The selection of participating pastoralists and agro-pastoralists was carried out by close collaboration with agro-pastoral and pastoral district offices, Zonal Mobile Supporting Team, and kebele administrators.

Considering model, gender and youth, twenty five (25) pastorals and agro pastorals were selected and grouped as one Pastoral and Agro Pastoral Research Group (PAPRG). One chair-person and secretary was selected based on the willingness of members and the selected person/s.

2.2. Research design

The 25 members of PAPRG then regrouped into three having one experimental Pastoral and Agro Pastoral (PAP) in each. The three sub-group members conduct an experiment on experimental Pastorals and Agro Pastorals.

Three improved haricot bean varieties (Haramaya, Awasa Dume and Ebado) were evaluated for their performance on Pastorals' and Agro Pastorals' land with standard check variety. The experiment was planted on plot size of 10m x 10m, 10cm between plant and 50cm between rows. The recommended seed rate of 100kg/ha and 100kg/ha of DAP was used.

Agreement of cost sharing was signed (land, labor and other equipment was delivered by Pastoral and Agro Pastorals while technical advice and inputs were incurred by researchers).

2.3. Data collection and analysis

For this study data was collected by personal observation and measurements, focused group discussion and interacting with Pastoral and Agro pastoral Research members. The collected data was analyzed by descriptive statistics. One way ANOVA was used to test the mean yield difference among haricot bean varieties. Pastoral and agro pastoral assessment on preference of haricot bean variety was analyzed by matrix ranking used [De Boef and Thijssen \(2006\)](#).

3. RESULT AND DISCUSSIONS

3.1. Capacity building

Training was given for PAPRG on packages of haricot bean production. Exchange visit was conducted between the three experimental PAPRGs in order to learn strengthen and weakness of each experimental PAPRG on management practices of demonstrated varieties and in pinpointing progress of haricot bean varieties on their farm. As such one experimental PAPRG (Abdulkadir group) was very good in group working and discussing the progress of varieties among themselves.

3.2. Yield obtained

The yield of haricot bean varieties were presented in table below. Varieties were not showed their maximum potential yield due to lack of shortage of rain fall after vegetative stage. Local variety namely *Warabu* was the leading in yield. Though the seed source is unknown this local variety has the characteristic of improved varieties and difficult to state as local variety rather standard variety. Obviously pastoral and agro pastoral were on border area where exchange of inputs (seed) with other pastoral is high. As discussed during variety evaluation with pastoral and agro pastoral research group, local variety (*Warabu*) was obtained from Somali pastoralist. The yield obtained from Awasa

Dume was 26qt/ha while Haramaya and Ebado varieties were 23qt/ha and 20.5qt/ha respectively. *Warabu* variety has higher pod per plant and seed per pod than all varieties. From expected improved varieties Haramaya variety has higher pod per plant but the pods were not fertile due to lack of rainfall during flowering stage.

Table 1: Yield obtained in 2016 year

Crop characteristics	Variety	Minimum	Maximum	Mean	Std. Deviation
Yield (qt/ha)	Haramaya	18	28	23.00	5.000
	Awasa Dume	25	27	26.00	1.000
	Ebado	20	21	20.50	.500
	Local variety	29	34	31.50	2.500
Pod per plant	Haramaya	21	25	22.87	1.804
	Awasa Dume	18	22	20.20	1.929
	Ebado	19	29	22.53	5.278
	Local variety	25	27	26.00	1.000
Seed per pod	Haramaya	3	5	4.13	0.808
	Awasa Dume	4	5	4.33	0.577
	Ebado	3	5	3.80	1.386
	Local variety	5	6	5.33	0.416

There was mean difference in yield per hectare of demonstrated varieties in study area with F value of 8.299 that was significant at 1% level.

Table 2: ANOVA analysis of yield per hectare of haricot bean varieties in Liben district, 2016

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	203.333	3	67.778	8.299	0.008
Within Groups	65.333	8	8.167		
Total	268.667	11			

3.3. Pastorals' and agro pastorals' preference criteria on haricot bean varieties

Variety selection was conducted by PAPRG based PAPRG criteria of market demand, color, disease and insect reaction, drought resistance (early maturity) and other parameters. Accordingly, Ebado variety was preferred by PAPRGs based on marketability while Local check and Awasa-Dume were selected as first and second respectively based on their early mature (drought resistance), number of pod/plant, higher yield and resistance to insects. Haramaya variety was susceptible to insects. Though PAPRG did not know the name of local varieties being used the local variety has the characteristics of improved seed varieties since Guji pastoralists and agro pastoralists were served by different agents (NGOs) and sometimes market from Somali land.

Ebado variety and Local variety (*Warabu*) was ranked as first and second respectively. Among the improved varieties Ebado variety was the least in yield (20.5qt/ha). But Ebado variety was selected due to its seed color (red dotted) and highly export to Somali market. This result was similar to the result of [Fekadu \(2013\)](#) who reported that among the variety selection the lower yield Ebado and local variety was selected as first and second respectively. This showed that the recommended and high yielding varieties were not correspondingly accepted by pastoral and agro pastoral due to different peculiarity preferences of pastorals and agro pastorals to the varieties. In this study market demand and drought resistant variety was the most trait preferred by pastorals and agro pastorals (Table 3).

Table 3: Direct matrix ranking preference of haricot bean varieties by pastoralists (n =25)

Selection criteria	Drought resistance	Market demand	Disease and insect reaction	Yield	Seed/pod	Straw	Total score	Rank
Relative weight	4	5	2	2	2	3	-	-
Awasa Dume	12 (3)	10 (2)	6 (3)	6 (3)	6 (3)	9 (3)	49	3
Ebado	12 (3)	20 (4)	6 (3)	4 (2)	6 (3)	9 (3)	57	1
Haramaya	8 (2)	10 (2)	2 (1)	6 (3)	6 (3)	9 (3)	41	4
Local variety	16 (4)	5(1)	8 (4)	8 (4)	8 (4)	9 (3)	54	2

Note: numbers in parenthesis indicated the performance rating value of each variety given from 1-5 (5= excellent, 4=very good, 3= good, 2= poor and 1=very poor) and numbers written in the bold indicate total score of a variety as per each selection criteria, which was obtained by multiplying the relative weight of each selection criteria with that of the performance rating number in the parenthesis. The relative weight criteria (4= very important, 3 = important, 2= somewhat important, 1= not important)

**Figure 1: Participatory variety selection at Liben, Measa Kebele, 2016**

4. CONCLUSION AND RECOMMENDATION

Participatory demonstration of haricot bean varieties was conducted in pastoral and agro pastoral. Pastoral and agro pastoralist were capacitated their knowledge and skills on the production of haricot bean by training and exchange visit. The improved varieties (Haramaya, Awasa Dume, and Ebado) being demonstrated were not showing their highest yield potential due to lack of rain. But each of these varieties were preferred by pastoral and agro pastoralist on some crop trait. Even though Ebado was lower yield per hectare the variety was mostly preferred due to its high market demand and export to Somali. *Warabu* (local check) variety has higher in yield than all varieties but it has no market demand. Ebado variety should be disseminated in pastoral and agro pastoral area of Guji

Zone. Pastoralists and agro pastoralists should use Ebado variety to increase their income and Warabu for household consumption.

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