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Full Length Research Paper

Participatory Evaluation of Improved Lentil (*Lens culinaris* Medikus) Varieties in North Shewa, Ethiopia

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Abstract

Farmers had been managed to double their lentil production in the past decade but still the national average productivity is found 1.4t ha^{-1}. Some of the reasons are poor management, low extension service and promotion of improved varieties. Participatory variety selection is an important methodology in order to advocate the promotion of improved varieties. Thus, participatory variety selection of lentil was carried out at Ensaro and Moretina jiru districts of North shewa to select farmers' preferred, best adaptable and yielded varieties. A total of seven varieties were evaluated and two approaches were used in the evaluation. The first one was researcher managed with RCBD design replicated three time but it is carried out on one farmer's field per District. The second was farmers managed and varieties were not replicated per farmers but replication was considered across farmers. Among the tested varieties Derso, Jiru and Dembi were found good performing varieties with average yield of 2928.1, 2466.0 and 2390.3kgha^{-1}, respectively. Derso had showed 1428.1kgha^{-1} yield increment over the current average lentil yield (1500kgha^{-1}) in North shewa. Derso showed yield advantage of 82% over Alemaya whereas 26.3% over the local. Derso, Jiru and Dembi showed superior performance in biomass yield. Derso was early maturing variety among improved varieties and it was the first priority of the farmers with their first selection criteria namely resistant to terminal moisture stress though its overall rank is third. Overall, variety Derso outsmarts in both districts and therefore, better to popularize in large scale.

Key words: Evaluation, *Lens culinary*, Participatory, Variety, Yield

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Introduction

Lentil is an important pulse crop grown widely throughout the Indian Sub continent, Middle East, Northern Africa and East Africa, Southern Europe, North and South America, Australia and West Asia (Taylor *et al*., 2003; Singh and Singh,

2014). It is a primary component for farming systems of those areas (Sarker and Kumar, 2011). The major lentil-growing countries of the world are Canada, India, Turkey, Australia, USA, Nepal, China, and Ethiopia. Ethiopia ranks first in Africa for the volume of lentils produced, even though its share in world production in 2012 was only 3.35 percent (Singh and Singh, 2014). The total production of lentils in the country was 175 143.56 tons in 2017/18 (CSA, 2018), a relatively small volume in comparison with India (1 055 536 ton) or Canada (3 233 800 ton) (FAO, 2018). Lentil production is growing steadily in Ethiopia. It has increased more than two fold from 84,900 tons in 2005 to 175 143.56 tons in 2018. During 2017/18, lentil production in Amhara region was high, accounting for more than 55.3% of national production (CSA, 2018). According to CSA (2017) data North Shewa takes the largest share of lentil production which accounts 42.7% over the total production of Amhara Region.

In terms of total pulse production, the average national share of lentils was only 5.9% in 2017/18 cropping season (CSA, 2018), and it is increasing from time to time. Though the share of lentils in total pulse production is low, lentils are a relatively high-value crop compared to other pulses, such as beans and cowpeas, and smallholder farmers earn substantial income per hectare. It is one of the pulse crops grown in the highlands of Ethiopia and widely used as whole, split in stews, soups and various forms of sandwiches. It is a popular ingredient of every day diet in the majority household. Its local price is the highest as compared to most of pulses. Its cultivation enriches soil nutrient status by adding nitrogen, carbon and organic matter which promotes sustainable cereal-based systems of crop production (Sarker and Kumar, 2011). Lentils often grow in relatively low moisture conditions, require minimal labor and have a short growing period (average of 76 days) in the Ethiopian highlands, making them a less risky crop. In Ethiopia, Its production is not mechanized and produced by small holder farmers with fragmented plots of land mainly for household consumption.

Ethiopian farmers have managed to double their lentil production in the past decade but still the current national average productivity is found to be 1.5t ha^{-1} while 1.4t ha^{-1} in Amhara region (CSA, 2018). The average lentil yield is 1.5t ha^{-1} in North Shewa (CSA, 2017). However, it was reported that improved varieties can yield up to 5t ha^{-1} under research fields and up to 3t ha^{-1} under farmers' fields (EEPA, 2004). The huge productivity gap between farmer's field and on station is due to variability of crop husbandry practices such as soil, crop, fertilizer and water management. Currently, productivity of lentil has change significantly due to the release of improved varieties and modernization of crop husbandry practices in the farming community but its productivity is still low compared to other legumes growing in the nation.

Lentil research was formally started in 1972 and about 11 lentil varieties were released by both national and regional research center. Most of these varieties are rust resistant (Abreham, 2015). Despite the importance and the merit of these varieties, they have not been widely distributed in major lentil growing areas of North Shewa in Amhara region. One of the most tested means of enhancing productivity with minimized cost is through introduction of adapted high yielding crop varieties. Evaluation under farmers' conditions reduces the chances that unwanted surprises would be forthcoming. Lastly, the retained seed provided farmers the opportunity to start multiplying and using any varieties that fit their circumstances. Thus, this research targeted the farmers to involve in the evaluation of released varieties both by national and regional research center so as to select their preferred, best adaptable and high yielder varieties.

Materials and Methods

Participatory variety selection of lentil was carried in 2015 main cropping season at Ensaro and Moretina Jiru which are the major lentil growing districts of North Shewa. Ensaro and Moretina Jiru districts are found about 85km and 60km, respectively west of Debre Birehan the capital of North Shewa Zone of Amhara Regional State. The altitude of Ensaro and Moretina Jiru district is almost similar and 2600 and 2680 masl. The soil is heavy vertisol at both districts. The minimum and maximum temperature of the location as well as the distribution of rainfall throughout the year in both districts indicated in Figure 1 (Enewari) and Figure 2 (Ensaro). The highest rain fall was recorded from June to September in which the growing season falls.

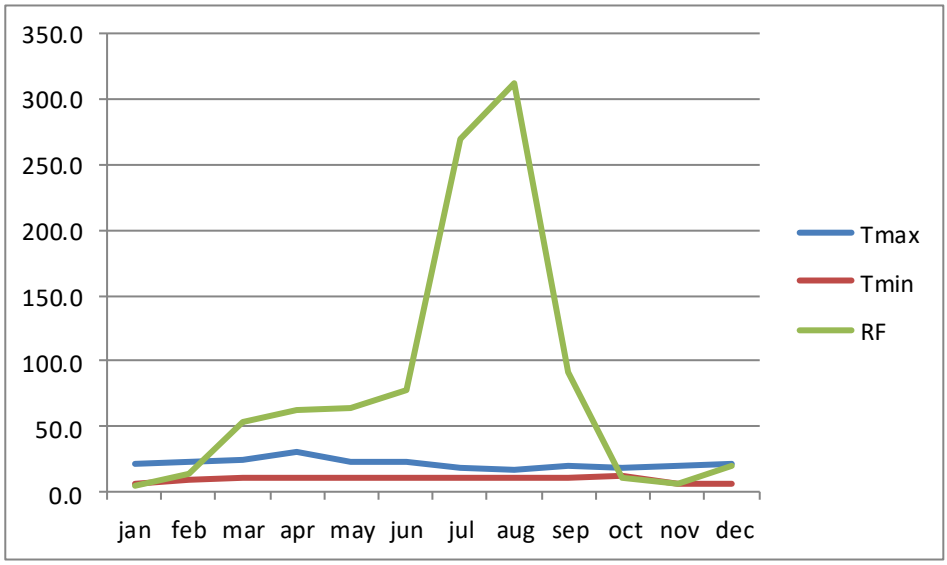

Figure 1: Metrological records at Enewary

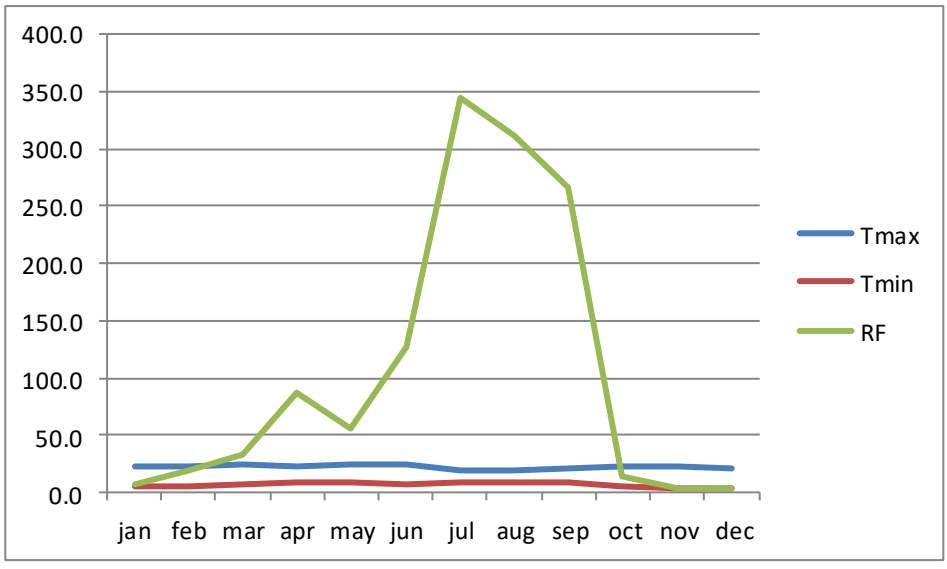

Figure 2: Metrological records at Ensaro

Seven lentil varieties released by the national and regional agricultural Research centers as indicated in Table 1 were evaluated. The research was conducted using two approaches. The first one was researcher managed with RBCD design replicated three times but it is carried out on one farmer's field per district. All the seven varieties were permitted to be evaluated replicated three times. The second was farmers managed and varieties were not replicated per farmers but replication of varieties was considered across farmers. Farmers managed meaning that the farmers followed lentil production package with close follow up by the researcher. Four farmers' land was used to execute the research per district and a total of eight farmers land were used in both districts. In the case of researcher's managed field, each variety was planted on plot areas of 6.4m^2 (one broad bed furrow) containing 4 rows with 4m length and 20cm spacing. In the case of farmers' managed field, each variety was planted on a plot area of 11.2m^2 (two broad bed furrow with 4m length and 0.8m width) using broadcasting method and 85kg ha^{-1} seed rate. Furrow spacing in both cases is 0.4m. Planting was carried out in the first week of August.

Data was collected on days to flowering and days to maturity on plot basis. Biomass and seed yield were collected in gram on plot basis and finally converted to kg per hectare. Plant height in cm, number of pod per plant and number of seed per plant were collected from 5 randomly selected plants and the average of them was taken. Hundred seed weight was taken in gram by weighing 100 randomly selected seeds from each plot yield. Finally the collected data were analyzed by using GenStat software and mean separations were done using least significant difference (LSD). A total of 26 (6 female) farmers were participated in the evaluation of the varieties. Farmers were selected by development agents working at that particular peasant association. Farmers allowed to set their best selection criteria based on their experience; and to pick out the top three varieties moving slowly and observing sharply each of the experimental plots using their criteria. Finally ranking of these varieties were done using direct and pairwise ranking.

Table 1: Details of lentil varieties used for the experiment

Varieties	Year of release	Adaptation		Seed color	1000 Seeds weight (gm)	Yield in ton/ha at time of release	
		Altitude	Rainfall			Research	Farmer
Jiru	2015	2600-2700	900-1100	Light green	33-36	2.6-3.3	1.8-2.8
Dembi	2013	1800-2400	600-700	Golden	28-32	1.7-2.5	1.2-2.0
Derso	2010	1600-2400	400-800	Yellowish	32-37	2.3-3.7	2.0-3.0
Alem Tena	2004	1600-2000	400-600	Gray	29-39	1.7-2.3	NA
Alemaya	1998	1600-2000	500-1200	Brown	25-32.3	1.39	NA
Chekol	1984	1600-2200	400-600	Dark brown	30-40	1.5-2.2	1.4-1.6
Local	NA	2600-2700	900-1100	Gray	NA	-	1.2-1.8

NA-not available

Results and Discussion

Significant variation was observed among the varieties for all traits in the case of researchers managed field at Moretina Jiru (Table 2). Alike to this research Edossa *et al*. (2011) depicted that there is significant variation among lentil varieties for all traits. Another study by Gupta *et al.* (2012) revealed that there is significant variation among lentil germplasms for most of the traits. However he reported unlike to the finding of this research in the case of pod per plant and number of seed per plant. This indicates the existence of

phenotypic diversity in Ethiopian lentil varieties and also high potential for genetic improvements. Variety Jiru almost in all traits had showed better performance. It showed longest plant height, hundred seed weight, biomass as well as seed yield with record value of 47.4cm, 3.7gm, 8080kgha^{-1} and 3340.2kgha^{-1}, respectively. However this variety takes relatively long period (96 days) to mature than the other varieties but still it is lower than 117 days mentioned by Yasin Goa (2015) for lentil varieties. Variety Derso had showed highest biomass and seed yield with record of 8122.4kgha^{-1} and 3448.3kgha^{-1}, respectively. Biomass is an important trait as lentil straw has high protein concentrates for animal feeds. With this reason Derso and Jiru can take the advantages over the other varieties. Derso took 90 days to mature and it is earlier by 6 days than Jiru and Dembi. The local variety (farmers' variety) took 80 days which is very early compared with the improved varieties. Its yield also very comparative to the improved one but it was easily devastated by rust when it occurs as mentioned by Abraham (2015). Luckily, the rust did not occur during experimental period. The local variety has got the highest number of pod per plant (61) and seed per plant (134) followed by Dembi as revealed in table 2. However, Dembi and local have low seed weight compared with Derso and Jiru.

Table 2: Agronomic performance of lentil varieties from researchers' managed field at Moretina Jiru

Variety	DF	DM	PH	PPP	SPPl	HSW(gm)	Bkgha^{-1}	Sykgha^{-1}
Jiru	63	96	47.4	47.1	60.9	3.7	8080.0	3340.2
Alem Tena	60	89	35.5	38.2	41.4	3.4	6033.1	2375.7
Dembi	61	96	44.5	56.5	93.3	2.5	78.61.2	2973.5
Alemaya	58	94	38.5	32.1	39.1	3.3	7064.4	2334.9
Chekol	61	87	38.1	50.3	73.8	2.5	5792.2	2284.0
Derso	60	90	42.9	45.2	72.2	3.3	8122.4	3448.3
Local	56	80	39.5	61.4	133.6	2.8	6261.5	2988.5
Mean	60	90	40.9	47.3	73.5	3.1	7030.7	2820.7
LSD	1.6	5.8	5.9	17.6	37.7	0.4	1816.0	926.1ns
CV	1.5	3.6	8.1	20.9	28.8	7.1	14.5	18.5

DF-days to flowering, DM-days to maturity, PH-plant height, PPP-pod per plant, SPPl-seed per plant, HSW-hundred seed weight, Bkgha^{-1} biomass in kilogram/ per hectare, Sykgha^{-1} seed yield in kg per hectare

According to MoA (1984-2015), the yield of varieties of any crop is much lower on farmers' field with farmers' management practice than on research field. This study also indicated that the yield of each variety was lower on farmers farming practice than researchers managed. The average yield of all varieties is 2285.6kgha^{-1} on farmers managed field which is 535.1kgha^{-1} lower than the average yield of all varieties on researchers managed field (Table 3). Table 3 showed the mean performance of tested varieties on farmers' managed field at Moretina Jiru worda. Statistically no significant different was observed among the varieties for all the traits except hundred seed weight, biomass and seed yield. Derso has superior performance with mean value of 3.1gm, 6606.2kgha^{-1} and 2940kgha^{-1} of hundred seed weight, above ground dry biomass and yield, respectively. Jiru and Dembi are the next high performed varieties in both biomass and yield (Table 3). Varieties with high biomass were found high yielder indicating that there is high positive correlation between yield and biomass. Tesfamicael *et al*. (2015)

reported that there is high positive correlation between yield and biomass of chickpea which can agree with the result of the present study. Derso and local varieties matured early with only one day difference while Jiru and Dembi take longer time to mature. Here, Derso is a unique variety because of its earliness combined with high yield and biomass.

Table 3: Mean performance of lentil varieties combined all farmers' managed field at Moretina Jiru

Variety	DF	DM	PH	PPP	SPPl	HSW(gm)	Bkgha^{-1}	Sykgha^{-1}
Jiru	58	89	37.6	33.3	48.1	2.8	6207.3	2417.3
Alem Tena	58	86	33.5	41.0	55.1	3.2	4787.3	1900.0
Dembi	59	93	37.4	42.0	82.3	2.4	6145.9	2501.1
Alemaya	56	87	32.9	47.7	57.4	2.8	5519.1	2124.1
Chekol	58	85	35.2	44.0	78.7	2.2	4264.6	1744.4
Derso	57	85	39.7	39.5	54.5	3.1	6606.2	2940.0
Local	56	84	33.7	48.2	75.0	2.4	4809.8	2372.3
Mean	58	87	35.7	42.0	64.0	2.7	5477.2	2285.6
LSD	NS	NS	NS	NS	NS	0.6	569.7	369.2
CV	1.7	4	5.5	28.3	25.3	9.1	4.3	6.6

NS-not significant, DF-days to flowering, DM-days to maturity, PH-plant height Cm), PPP-pod per plant, SPPl-seed per plant, HSW-hundred seed weight, Bkgha^{-1}- biomass in kg per hectare, Sykgha^{-1} seed yield kg per hectare

In the case of Ensaro, significant variation was observed for days to maturity, hundred seed weight and seed yield. Fikru *et al.* (2014) showed that the above mentioned traits of lentil could significantly vary. Alike to Moretina Jiru, variety Derso was the highest yielder varieties with mean yield of 2407.9kgha^{-1} in the case of researchers managed field. The second highest yielder variety was Dembi followed by the local and Jiru (Table 4). However, the local variety was found superior in biomass yield which is about 5214.5kgha^{-1} followed by Jiru and Dembi nevertheless that the variation was not statistically significant. Consistence of performance was observed among these varieties at both districts. Derso, Jiru and Alemaya together with Alem Tena have greater than 3gm per 100 seed. Still the local is the earliest variety for harvest at Ensaro while Derso matured early as compared to the other improved varieties.

Table 4: Agronomic performance of lentil varieties from researchers' managed farmers' field at Ensaro

Variety	DM	PH	PPP	SPPl	HSW(gm)	Bkgha^{-1}	Sykgha^{-1}
Jiru	90	29.1	28.1	34.9	3.3	4506.8	1591.9
Alem Tena	88	26.9	23.1	33.9	3.3	3370.0	1177.4
Dembi	92	29.9	34.9	45.9	2.4	4386.1	1807.0
Alemaya	93	25.3	28.1	31.5	3.0	2932.9	868.0
Chekol	95	28.1	26.3	49.2	2.2	2668.4	704.2
Derso	89	29.7	29.9	42.4	3.0	4370.3	2407.9
Local	81	27.8	29.9	48.7	2.9	5214.5	1657.6
Mean	90	28.1	29.0	41.0	2.9	3921.3	1459.1
LSD	3.4	NS	NS	NS	0.4	NS	427.0
CV	2.1	7.2	21.1	24.7	7.0	37.5	16.4

NS-not significant, DM-days to maturity, PH-plant height (Cm), PPP-pod per plant, SPPl-seed per plant, HSW-hundred seed weight, Bkgha^{-1}- biomass in kg per hectare, Sykgha^{-1} seed yield kg per hectare

No significant variation was observed among varieties for all traits except seed weight in the case of farmers' managed field at Ensaro. Though the overall mean yield of all varieties on farmers' managed fields were low compared to researchers' managed field, both Jiru and Derso were still high yielder and their mean yield were 1562.5 and 1463.8kgha^{-1}, respectively (Table 5). Similarly, their biomass yields were superior to the other varieties and it is 3751.9 and 3629.2kgha^{-1} for Derso and Jiru, respectively. Their hundred seed weight is still greater than 3gm for 100 seed and they are superior to the other varieties except Alem Tena.

Table 5: Mean performance of lentil varieties combined all farmers' managed field at Ensaro

Variety	PH (cm)	PPP	SPPL	HSW (gm)	Bkgha^{-1}	Sykgha^{-1}
Jiru	29.3	30.6	38.3	3.1	3629.2	1562.5
Alem Tena	26.1	22.7	25.5	3.7	2863.4	1040.1
Dembi	29.1	35.5	43.1	2.6	3412.1	1278.2
Alemaya	25.9	27.7	28.7	2.8	3497.5	1279.4
Chekol	27.7	28.8	42.9	2.1	2526.4	778.9
Derso	29.0	35.1	45.8	3.1	3751.9	1463.8
Local	27.8	39.0	59.1	2.7	2833.6	1290.0
Mean	27.8	31.0	40.0	2.9	3216.3	1241.8
LSD	NS	NS	NS	0.4	NS	NS
CV	7.6	30	38.8	7.2	21.8	24.7

NS-not significant, DF-days to flowering, DM-days to maturity, PH-plant height (Cm), PPP-pod per plant, SPPl-seed per plant, HSW-hundred seed weigh (gm)t, Bkgha^{-1}- biomass in kg per hectare, Sykgha^{-1}- seed yield kg per hectare

The overall mean yields were 2820.7 and 1459.1kgha^{-1} for Meretina Jiru and Ensaro districts, respectively so that their yield difference is about 1361.6kgha^{-} based on the data obtained from researchers' managed field. Similarly, the mean yields were 2285.6 and 1241.8kgha^{-1} at Moretina jiru and Ensaro districts, respectively in the case of farmers managed field. This revealed

that the potential of ensaro for lentil was much lower than Moretina Jiru.

Analysis of variance showed that variance of researchers' managed field at both districts is homogenous and hence the data of the two worda can be pooled. The pooled analysis indicated that tested varieties vary significantly for all traits as indicated in table 6. Highest yield was recorded for variety Derso followed by Jiru. The mean yield of Derso, Jiru and Dembi was 2928.1, 2466 and 2390.3kgha^{-1}, respectively and it indicated that if farmers manage their lentil land as per the recommendation they can fetch high yield. The study showed, farmers can double their current lentil yield by using improved varieties with full production package. Derso, Jiru and Dembi have yield advantage of 82, 53.4 and 42.4% over Alemaya whereas 26.3, 6.5 and 3% over the local, respectively. Derso has showed about 1428.1kgha^{-1} yield increment over the current average lentil yield (1500kgha^{-1}) at North shewa. Jiru and Dembi also showed a yield increment of 966 and 890.3kgha^{-1} over the current average yield of lentil in the area. The highest biomass was recorded for Jiru, Derso and Dembi all the three gave greater than 6000kgha^{-1}. Except Dembi, both Jiru and Derso weigh greater than 3gm per 100 seeds. Long plants were observed for variety Dembi and Jiru while large number of pod was recorded from Dembi and the local (Table 6). The local have showed highest number of seed per plant, pod per plant and it matures earlier than improved varieties. However, among improved varieties Derso is earlier and it takes 89 days to mature.

Table 6: Combined means performance of lentil varieties from researchers' managed farmers' field over the two districts North Shewa

Variety	DM	PH	PPP	SPPl	HSW(gm)	Bkgha^{-1}	Sykgha^{-1}
Jiru	93	38.3	37.6	47.9	3.5	6293.4	2466.0
Alem Tena	88	31.2	30.6	37.7	3.4	4701.6	1776.6
Dembi	94	37.2	45.7	69.6	2.5	6123.7	2390.3
Alemaya	93	31.9	30.1	35.3	3.2	4998.6	1601.5
Chekol	91	33.1	38.3	61.5	2.4	4230.3	1494.1
Derso	89	36.3	37.6	57.3	3.1	6246.4	2928.1
Local	81	33.6	45.7	91.1	2.8	5738.0	2323.1
Mean	90	34.5	38	57	3	5476.0	2139.9
LSD	4.3	5.2	14.2	29.4	0.4	2013.4	754.3
CV	3	7.9	21.6	29	6.9	23.1	18.9
Variety(V)	**	**	*	**	**	*	**
Location(L)	NS	**	*	*	NS	**	*
V x L	**	NS	NS	**	NS	NS	NS

NS-not significant, DF-days to flowering, DM-days to maturity, PH-plant height, PPP-pod per plant, SPPl-seed per plant, HSW-hundred seed weigh (Cm)t, Bkgha^{-1} - biomass in kg per hectare, Sykgha^{-1} - seed yield kg per hectare

Yield has positively and highly associated with all the traits mentioned here except days to maturity (Table 7). The finding of Gupta *et al.* (2012) is alike with this finding except plant height. This revealed that improvement of any traits can positively affects yield of lentil. Especially biomass and plant height highly correlated with yield. As mentioned in the previous discussion varieties with high biomass and plant height have high seed yield. A similar task by Rasheed *et al*. (2008) indicated that increment of biomass weight increases yield. However, the finding of

these scholars is unlike regard to plant height. In this study prolonged maturity of lentil varieties has no significant effect on seed yield. Similar result was obtained by Mohammed *et al*. (2016). Prolonged maturity was also has no significant effect on Pod per plant, seed per plant, hundred seed weight and biomass which is unlike to the finding of Pankaj *et al*. (2017).

Table 7: Correlation of agronomic traits

	DM	PH	PPP	SPPl	HSW	Bqtha^{-1}	SYkgha^{-1}
DM	-						
PH	0.2587*	-					
PPP	-0.0581	0.6921**	-				
SPPl	-0.2178	0.5379**	0.8825**	-			
HSW	-0.0101	0.208	-0.0716	-0.2318	-		
Bqtha^{-1}	0.1647	0.7929**	0.5751**	0.4015**	0.2646*	-	
SYqtha^{-1}	0.0815	0.8279**	0.6536**	0.4861**	0.2557*	0.8503**	-

DM-days to maturity, PH-plant height, PPP-pod per plant, SPPl-seed per plant, HSW-hundred seed weight, Bqtha^{-1} - biomass in quintal per hectare, Syqtha^{-1} - seed yield quintal per hectare

Variety evaluation result of farmers

Farmers at both districts have the same experience in lentil production and lentil has used as major cash crops. The most common variety grown in both districts is local. Farmers in Moretina Jiru district seldom used Alemaya variety. Lack of market demand for Alemaya compared to the local variety is one of the justification of the farmers for unwilling to produce the variety (personal communication). Seed coat and *kik* (split of seed) color are important criteria for marketing of lentil seed. Farmers prefer gray seed coat and red *kik* color.

Farmers were set the same selection or evaluation criteria. Twenty six (6 females) were participated to evaluate the varieties in each of the districts and the most preferred traits of the farmers were Pod Per Plant (PPP), Resistant to Terminal Moisture Stress (RTMS), Tillering capacity (Til), Seed color (SC), Vigority (V), Seed Size (SS) and Earliness to maturity (ER). Based on farmers' evaluation criteria out of the seven varieties, Local, Alemaya and Derso were found the first three preferred varieties.

Using pair wise ranking method, farmers' selection criteria were prioritized to identify the most important attributes desired by farmers. Hence, the best selection criteria's of the farmers were found Resistance to Terminal moisture stress (RTMS) followed by pod per plant and seed size (Table 8). Derso, Alemaya and local variety scored 5 out of 5 in Resistant to Terminal Moisture Stress (RTMS); and local and Alemaya variety scored 5 out of 5 in pods per plant while Derso got a score of 3.5 out of 5. Based on the seed size (third best criteria), both Alemaya and Derso scored 5 out 5 but local scored 4 out of 5 (Table 9). However, only Derso was among farmers preferred varieties showed the highest yield. Alemaya and local were not superior in their yield but due to their poding ability they have got highest rank by the farmers. However, farmers agreed that no compromise on the yield performance of the varieties and they preferred varieties with highest yield.

Table 8: Pair wise matrix ranking of farmers selection criteria

	PPP	Til	V	ER	RTMS	SS	SC	Cum	Rank
PPP		PPP	PPP	PPP	RTMS	PPP	PPP	5	2
Til			V	TIL	RTMS	SS	Til	2	5
V				V	RTMS	SS	V	3	4
ER					RTMS	SS	SC	0	7
RTMS						RTMS	RTMS	6	1
SS							SS	4	3
SC								2	6

PPP - Pod Per Plant, R TMS- Resistant to Terminal Moisture Stress, Til - Tillering capacity, SC - Seed color, V - Vigority, SS - Seed Size and ER - Earliness to maturity

Table 9: Direct ranking of the varieties by the selected evaluation criteria

Varieties	Selection criteria/Preferences							
	RTMS	V	PPP	SS	Til	ER	SC	Rank
Derso	5	5	3.5	5	5	3.5	3.5	3
Alemay	5	5	5	5	4.3	3.5	3.5	2
Local	5	4	5	4.3	5	5	5	1

5= excellent, 4= very good, 3= good, 2= poor and 1= very poor.

Conclusion

Productivity of Ensaro was found much lower than Moretina Jiru and 1043.8 to 1361.6kgha^{-1} yield variation were observed between the two districts. Among the tested varieties Derso, Jiru and Dembi were found good performing varieties with average yield of 2928.1, 2466 and 2390kgha^{-1}, respectively. Derso, Jiru and Dembi have yield advantage of 82, 53.4 and 42.4% over Alemaya whereas 26.3, 6.5 and 3% over the local, respectively. Moreover, they have showed about 1428.1, 966 and 890.3kgha^{-1} yield increment over the current average lentil yield (1500kgha^{-1}), respectively at North shewa. All the three varieties showed superior performance in biomass yield. Jiru and Derso are bold seeded greater than 3gm per 100 seeds. In addition to the above mentioned merits Derso was early maturing variety among improved varieties without any expense on yield and it was the first priority of the farmers with their first selection criteria namely resistant to terminal moisture stress. Overall variety Derso out smart all the other varieties in both districts and better to popularize. Following Derso variety Jiru can be popularized to Moretina Jiru, Ensaro and areas with similar agro-ecology.

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Conflict of Interests

Authors have not declared any conflict of interests.

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