



Evaluation of Lentil (*Lens culinaris Medikus*) varieties to the yield performance under rain fed condition in highland area of Ari Zone, South Ethiopia

Temesgen Jerjero* and Wondimu Adila

Department of plant breeding , South Ethiopia Agricultural Research Institute, Jinka Agricultural Research Center, Jinka, Ethiopia.

*Corresponding Author

Temesgen Jerjero

Email: temejer@gmail.com.

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Abstract: Lentil is grouped under legumes and cultivated in most parts of Ethiopia and used as food crop. The production and productivity of the crop was challenged due to improved varieties. The objective of this study was to select the best performing varieties in Debube Ari District at Geder kebele during 2022 and 2023 cropping seasons. The research experiment was done using randomized complete block design with three replications. Five recently released varieties including famer used local cultivar were evaluated. The recently released varieties which were evaluated in the experiment were: - Jihru, Alemaya, EL-142, Bareda, Derash and one local cultivar. The analysis of combined result indicates as , statically there were significant variation were recorded to the days to maturity, number of pod per plant , number of seed per pod , grain yield and thousand seed weight. While, none significant difference variation were recorded to the parameters height of plant and primary branches per plant number. .From evaluated varieties, variety Bareda (893.42 kg/ha) and variety Alemaya (798.39kg/ha) records the maximum grain yield and yield components while variety Derash (517.33 kg/ha) records the minimum yield. Therefore, these varieties Bareda and Alemaya were recommended for the production. Further research will be very important on evaluation of different recently released varieties and making strong recommendation and conclusion for the target areas to increase the production of lentil.

Keywords: Evaluation, growth parameter, improved varieties and grain yield.

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1. Introduction

Lentil (*Lens culinaris Medikus*) is one of the most nutritious food legumes and cultivated in many parts of the worlds and used as food crop (Erskine et al., 2011).Lentil is sixth in production after dry bean, pea, chickpea, fabba bean, and cowpea as among pulse crops (FAO, 2010). Ethiopia is considered as a center of diversity for lentil and currently lentil is an important pulse crop in the country (Fikiru et al., 2007). Ethiopia one of the leading lentil-producing from African country (FAOSTAT, 2017). It is listed in the top ten countries in the world (FAOSTAT, 2018). Lentil is grown as a source of protein; 23-24% (Addise et al., 1993) for human consumption and also a rich source of minerals and vitamins for human nutrition and the straw is valuable for animal feed. It is a potential export and cash crop that has the highest price in domestic and international markets compared to other food leguminous crops and cereals (Geletu et al., 1996). The crop had a significant impact for human and animal nutrition and it is used for

soil fertility improvements practices. Lentil crop had a role in crop rotation and fix atmospheric nitrogen (Geja, 2019). The crop has role in human, animal and soil health improvement processes (Yasin, 2015) and it has a great role in nitrogen fixation improves and increase soil nutrient status (Abraham, 2015; Yasin, 2015). The consumption and use of lentil at the local level have been investigated within nutrition surveys in Ethiopia (Ghosh, 2004). Lentil crop has higher contents of protein, carbohydrate and calories crop compared to other consumed food legumes (Iqbal et al., 2006) and it is consumed in every day diet in Ethiopian people (Hanelt, 2001). The crop is grown in the highland areas of Ethiopia. (Sarker and Kumar, 2011). It's national production status was about 5.9% in 2017/18 cropping season (CSA, 2018). The crop is mostly cultivated in the area of highlands parts of Ethiopia. (Jarso et al., 2009) .The crop is affected by high moisture stress and sensitive to water logging areas (Mulugeta, 2009; Brennan et al., 2002). From sand to clay loam soil is suitable for lentil crop production (Janzen et al., 2014; Mulugeta, 2009) and altitude range



of 1700-2400 meters above sea level with annual rainfall ranging from 700-2000 mm in Ethiopia suitable for lentil crop production (Korbu, 2009). Lentil crop is capable of germinating at a temperature above freezing point but germinate at optimum temperature range of 18-21°C. (Abraham, 2015). Cultivation of pulses are important for restoring degraded soils and can contribute significantly to achieving the twin objectives of increasing productivity as well as improving the sustainability of cereal-based cropping systems (Das et al. 2016). Lentils is purposively used in Ethiopia in a stew, like a dish called kick, or kick wot, one of the dishes people eat with Ethiopians national food called Injera flatbread (Yirga et al., 2018). Considering the above major importance, in Ari Zone the crop area coverage was too low (115 hectare) and yield production (1462 quintal) as well as the productivity of lentil was too low (13.5 %) compared to other pulse crops (Ari Zone Agricultural Office Data, 2023). The reduced production of lentil crop includes low yielder local cultivar and use of traditional cultivation practices as well as none evaluation and promotion of released improved varieties. Therefore, the study was designed with the objective of evaluating improved lentil varieties for their yield and yield-related traits under rain fed condition and recommend for lentil growing areas of Debube Ari District of Ari Zone.

2. Materials and Methods

2.1 Description of The Experimental Site

The field trial experiment was conducted in Drbube Ari District of Ari Zone at Geder kebele during the main cropping seasons from 2022 and 2023 under rain fed condition. The study site is located at an altitude of 2210 meters above sea level (masl) with geographical coordinates of longitude 036°38'48'' E' and Latitude 05°53' 22.429'' N. The study site has a bi-modal rainfall pattern with the shorter rainy season from March-May and the longest rainy season from August through November. The total annual rainfall is 1852.2 250.7 mm. The annual mean minimum and maximum temperatures are 15.5±0.9°C and 18.7 ±1.4°C, respectively.

2.2 Treatments and Experimental Design

Five improved varieties (Jihru, Alemaya, EL-142, Bareda, Derash) including one local check were arranged in a randomized complete block design in three replication and tested for two consecutive year of 2022 and 2023 in main cropping season . The experiment was done in a plot area of 4m x 5m (20 m²) and separated by a distance of 1m between plots and 1.5 m between replications. A spacing of 20 cm between rows and seed rate of 85 kg ha⁻¹ was used.

2.3 Data Collection and Analysis

The following important data were collected ; maturity duration , height of plant, primary branches per plant number , pod number per plant , seeds number per pod , yield and thousand seeds weight were collected and measured . The collected data were to analyzed using SAS software version 9.2 (SAS, 2008) and means were separated using least significant differences (LSD) test at 5%.

3. Results and Discussions

3.1 The Combined Mean Value of Yield and Yield Related Traits over Two Years

From the combined analyzed results: Days to maturity duration: days to maturity duration among the evaluated varieties varied starting 107.17 days to 117.33 days. The local cultivar and EL-142 variety were the earliest to maturity while Derash and Jihru varieties took longest day to maturity with the difference of 10.16 days (Table.3). The variation days to maturity duration were due to genetic potential of the treatments and other abiotic factors that affecting the days to maturity durations (Yasin, 201); Yirga and Zinabu, 2018). Plant height: height of plant is has a great role to the yield potential of the varieties indication. From the combined mean result, plant height had none significant different in all varieties .From the tested varieties, variety Jihru (35.63 cm) records the longest plant height and variety EL-142 (27.63 cm) measured short height. This research result finding is in line to the research finding result of Geja (2019); Yirga and Zinabu (2018). Primary branches number per plant: The combined results indicate that, there were none significant difference among the evaluated varieties in primary branches number per plant. Derash variety records maximum primary branches number per plant (4.53) while minimum primary branches number was recorded to EL-142 (3.73) variety. Number of pod number to plants: The combined result indicted there as a significant differences among the varieties . From the evaluated varieties, varieties Bareda and Alemaya records the maximum primary branches number (33.60 and 33.60) and minimum primary branches number was recorded to local variety (26.53). This research result finding was in line to (Yasin, 2015; Tilahun, 2016). Seed number in pod: the evaluated varieties were statically significantly different to seeds number produced per pod. The seeds were ranged in interval of 1.13 - 1.66. From the varieties, variety Bareda (1.66) records maximum seeds while Derash variety records the minimum seeds per pod (1.13). Yield: Statistically there were significant different variations observed. The best yield were produced by varieties Bareda (893.42 kg ha⁻¹) and Alemaya (798.39 kg ha⁻¹) respectively while the lowest yield of 517.33 kg ha⁻¹ to variety Derash. This result is in contradicted with the research finding of Tilahun (2016); However, Alemaya recorded statistically high yielder. With the research finding reported by Bogale et al. (2015). This research finding result is similar to the research finding of Yasin (2015). The maximum yield result was contradicts with the finding of Geja (2019), he reported that, the maximum yield was recorded to the variety EL-142. Thousand seeds weight: Statistically there were a significant difference variation result was recorded to varieties. Thousand seed weight was ranged from local cultivar (20.66g) to Bareda (29.41 g). The highest weight of thousand seeds was recorded to variety Bareda (29.41 g). However, the lowest weight of thousand seeds was recorded to local cultivar (20.66g). The observed significant differences among the evaluated varieties might be due to inherent genetic potential and existing environmental condition and other factories. The result is consistent with the findings of result of Yasin (2015); Yirga and Zinabu (2018) and the result finding of Geja (2019).

Table 1. The mean grain yield and yield related traits in 2022

Treatments	DM	PH (cm)	NPBPP	NPPP	NSPP	GY(kgha ⁻¹)	TSW(g)
Bareda	112.00 ^c	37.33 ^{abc}	3	26.53 ^{ab}	1.66 ^a	1451.00 ^a	35.50 ^a
EB-142	105.00 ^d	32.80 ^c	2	19.73 ^b	1.66 ^a	1035.70 ^e	23.66 ^d
Alemaya	118.33 ^a	38.8 ^{abc}	3	32.73 ^{ab}	1.66 ^a	1394.00 ^{ab}	29.66 ^c
Jihru	120.67 ^a	44.00 ^a	3	36.33 ^{ab}	1.73 ^a	1051.00 ^e	32.73 ^a
Derash	112.00 ^c	35.46 ^{bc}	4	40.40 ^a	1.26 ^b	909.70 ^e	31.50 ^{bc}
Local	114.00 ^{bc}	40.00 ^{ab}	4	38.40 ^a	1.60 ^{ab}	1070.70 ^{de}	24.66 ^d
CV (%)	2.18	11.18	18.26	19.0	12.57	5.96	5.12
LSD(p<0.05)	4.34	7.33	NS	17.01	0.34	122.79	2.73

DM = days maturity, PH = plant height (cm), NPBPP = number of primary branches per plant, Nppp = number of pods per plant, NSPP = number of seeds pods, GY = grain yield, TSW = thousand seeds, weight (g), NS = none significance. Means with the same letters within the columns are not significantly different at p<0.05.

Table 2. The mean grain yield and yield related traits in 2023

Treatments	DM	PH (cm)	NPBPP	NPPP	NSPP	GY(kgha ⁻¹)	TSW(g)
Bareda	111.00 ^{ab}	25.40 ^a	4.73	27.53 ^{abc}	1.66 ^a	335.83 ^a	23.33
EB-142	112.00 ^{ab}	22.46 ^{ab}	4.60	17.00 ^{bc}	1.00 ^b	127.78 ^c	20.00
Alemaya	107.67 ^{ab}	23.40 ^{ab}	4.66	32.73 ^{ab}	1.3 ^{ab}	202.78 ^a	19.66
Jihru	27.267 ^a	44.00 ^a	4.86	30.86 ^{ab}	1.00 ^b	72.22 ^d	22.33
Derash	118.67 ^a	23.80 ^{ab}	4.73	14.46 ^c	1.00 ^b	125.00 ^c	19.00
Local	100.33 ^c	20.13 ^b	4.46	14.66 ^c	1.00 ^b	134.72 ^c	16.66
CV (%)	7.14	11.64	32.11	37.92	1.30	10.13	21.58
LSD(p<0.05)	14.36	5.02	NS	15.92	0.66	30.65	NS

DM = days to maturity, PH = plant height (cm), NPBPP= number of primary branches per plant Nppp = number of pods per plant, NSPP = number of seeds pods, GY = grain yield, TSW = thousand seeds, weight (g), NS = none significance. Means with the same letters within the columns are not significantly different at p<0.05.

Table 3. The combined mean grain yield and yield related traits in 2022 and 2023

Treatments	DM	PH (cm)	NPBPP	NPPP	NSPP	GY (kgha ⁻¹)	TSW(g)
Bareda	111.50 ^{ab}	31.36	3.96	33.60 ^a	1.66 ^a	893.42 ^a	29.41 ^a
EL-142	108.50 ^b	27.63	3.73	18.36 ^b	1.33 ^{ab}	581.72 ^{bc}	21.83 ^b
Alemaya	113.00 ^{ab}	31.10	4.23	33.33 ^a	1.50 ^{ab}	798.39 ^a	24.66 ^{ab}
Jihru	117.33 ^a	35.63	4.16	27.03 ^{ab}	1.36 ^{ab}	561.61 ^{bc}	27.53 ^{ab}
Derash	115.33 ^{ab}	29.63	4.53	27.43 ^{ab}	1.13 ^b	517.33 ^{bc}	25.25 ^{ab}
Local	107.17 ^b	30.26	4.43	26.53 ^{ab}	1.30 ^{ab}	602.69 ^b	20.66 ^b
CV (%)	6.13	2.88	7.05	4.10	5.76	7.51	4.89
LSD(p<0.05)	14.36	NS	NS	13.99	0.45	667.78	7.47

DM = days to maturity, PH = plant height (cm), NPBPP = number of primary branches per plant, Nppp = Number of pods per plant, NSPP = Number of seeds pods, GY = grain yield, TSW = thousand seeds, weight (g), NS = none significance. Means with the same letters within the columns are not significantly different at p<0.05.



Fig. 1. Field status of the experiment in both years

Conclusion and Recommendation

Five improved lentil varieties were evaluated for adaptation and evaluation of high yielding performance in Debube Ari District of Ari Zone. The highest yields were recorded to varieties Bareda and Alemaya to yield of 893.42 kg ha⁻¹ and 798.39 kg ha⁻¹ respectively. Therefore, these varieties Bareda and Alemaya could be recommended to the study area. Further research on evaluation of different recently released varieties will be needed and making strong recommendation and conclusion for the target areas and other similar agro ecologies.

Conflicts of interest

No conflicts regarding the publication of this Article

Availability of data

The data supporting of this research result finding are available within the research article and its supplementary materials.

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