

Evaluation and Selection of Black Cumin(*Nigella sativa* L) Varieties at Mid Highland of West Hararghe Zone, East Ethiopia

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Abstract

Black cumin (*Nigella sativa* L) is an annual flowering plant investigated recently for its potential for exportable commodity in Ethiopia at the study area the yield potential of local varieties is low so it is important to adapt other varieties to the area in order to maximize productivity of the crops. An experiment was conducted at Oda bultum, Habro and Mechara on station in west Hararghe zone, East Ethiopia, in 2014 cropping season, to identify adaptable, high yielding and pest resistant Black cumin varieties to the area. four varieties of Black cumin Eden, Dirshaye, Darbera and Local check were used. An experiments were designed in randomized complete block (RCBD) with 3 replications. at plant height, the analyzed result revealed that significance difference found at $p \leq 0.05$, among varieties, but Dirshaye was the highest mean of 41.5cm, followed by Eden, 41.43c, respectively. and at 50% flowering date, local variety was the lowest mean 47.73 and Eden was the highest mean 50.33, the maturity date, analysis result showed that local variety was the lowest by 114 date followed by Dirshaye 115 date. at number 1000 seed and total yield significance difference found and Dirshaye and Eden varieties were the highest mean of total yield 587 kg ha⁻¹ and 547 kg ha⁻¹ respectively so those two varieties were selected for further promotion and dissemination to mid altitude of Oda bultum and Habro and Mechara districts and similar agro ecology of the area.

Keywords: Black cumin, capsule per plant, flowering date, local check, pest reaction and variety.

1. INTRODUCTION

Black cumin (*Nigella sativa* L) is a flowering plant in the family of Ranunculaceae (. Gharib-Zahedi SMT, 2010) which is native from the east Mediterranean to India. Originally cultivated in Iran and the Mediterranean region but, particularly grown in south Europe, the Balkans, North Africa and Indian. Today, the plant is mostly grown in China, Uzbekistan, Tajikistan, Iran, Turkey, Morocco, Egypt, Mexico, Chile, India and some part of Ethiopia (Peirce et al, 1999,). The Black cumin is generally a short, lived annual, typical of grown on disturbed soil or natural communities of semi arid areas, which a dominance of therophytes.

In a natural form, flowers are bluish, with a variable number of sepals and characterized by the presence of nectarine. The gynoecium composed of a variable number of multi ovule carpel's developing into a follicle after pollination, with a single fruit particularly connected to a capsule structure. Seed, of generally small size (1-5mg), dark grey or black color and with corrugated integument, represent the use full product (Ceylon, A. 1997).

The Black cumin is extensively used in traditional medicines, for healing various respiratory and gastro intestinal disease in the various countries, particularly in Turkey. The whole seed or their extracts have anti diabetic and anti thiamine (Baytop, T, 1984). Cumin seeds are used as a spice for their distinctive flavor and aroma. It is globally popular and an essential flavoring in many cuisines, particularly South Asian, Northern African and Latin American cuisines.

In Ethiopia, the dried cumin seeds are powdered and used in different forms like, to add warming and good aromatic feeling to food like in bread, making it a staple in certain stews and soups, as well as spiced gravies such as chili. It is also used as an ingredient in some pickles and pastries.

In Ayurvedic system of medicine, dried Cumin seeds are used for medicinal purposes and processed with ghee (a semi-fluid clarified butter). It is used internally and sometimes for external application also. It is known for its actions like enhancing appetite, taste perception, digestion, vision, strength, and lactation. It is used to treat diseases like fever, loss of appetite, diaharea, vomiting, abdominal distension, edema and puerperal disorders. Black Cumin's distinctive flavor and strong, warm aroma are due to its essential oil content.

In Ethiopia, Black cumin was adapted and grown in particularly Bale, Arsi and South Gonder Zones. Nationally, in adapted area, the productivity of newly released variety has 0.9-1.6 ton/ha⁻¹ on research station and 0.8- 1.2 ton/ha⁻¹ on farmers field (MOARD, 2009) however, in West Hararghe, productivity of local variety is less than 0.3 ton/ha⁻¹ (personal observation). Taking into consideration of its use and the suitable agro ecology of West Hararghe zone, there was no any research activity conducted in relation to crop.

In order to boost its productivity and increase the income of the farmers, it is important to evaluate the adaptability of improved black cumin varieties to the area. Therefore, this study was initiated with the objective of selecting at least 1 - 2 the best adaptive black cumin varieties to the area.

2. MATERIALS AND METHODS

2.1 Description of the Study area

The experiment was conducted three location, at Darolabu/Mechara on station/, Habro and Oda bultum districts West Hararghe zone, East Ethiopia from July – November (Meher) during the main cropping season, in 2014.

Darolabu/Mechara on station/district is located in Eastern part of country lying between 8.34 N latitude and 40.20' E longitude. The altitude of the area is about 1760 m.a.s.l. The mean maximum and minimum temperature are 31.8°C and 14°C, respectively for Mechara Agricultural Research Center.

Whereas, Oda bultum is one of the districts found in west Hararghe zone. It is located 362 km to the east of Addis Ababa, it is located at 8°54', 31'80"N, 40°21'E. Its Altitudinal range is from 1040 - 2500 m.a.s.l), the average altitude of the district is 1770 m.a.s. The annual rain fall is 900 mm-1100 mm). It has a mean maximum and mean minimum temperature of 28°C and 25°C; respectively. The maximum rainfall and minimum rainfall is 1200mm and 900 mm (DOA, 2012) respectively.

Habro district is one of West Hararghe zone in east Ethiopia, its place is located at 8°51'N and 40°39' E at an altitude of 1728 meters above sea level. Gelemso town is the administrative seat of the district. Physiographically plateaus, mountains, hills, plains and valleys characterize the district.

2.2 Land preparation, sowing and treatment design

Land was ploughed three times with oxen, which is similar to farmers' practice. The experimental field was divided into five blocks each having four plots. The width and length of individual plot was 3m and 3m, respectively, with each plot sub divided into forthin rows.

The spacing between plots and blocks was maintained to be 0.5 m and 1 m, respectively. The study was conducted using randomized complete block design with five replications. The varieties were assigned as treatments. The improved seeds were collected from Kulumsa Agricultural Research Center and the local seeds of black cumin were taken from farmers of the respective testing sites. The seeds were sown by drilling in rows as soon as the rains started. The spacing between each row was 30 cm. Dap and Urea were used at 50 kg of ha⁻¹ and 40 kg ha⁻¹ rates, respectively.

2.3. Data collection

Data were recorded on some growth, yield and yield component parameters including plant height (cm), number of branches (branches/plant), number of pods (pods/plant), seed yield (kg⁻¹) flowering date were recorded on randomly selected ten plants and plot basis depending on the traits to be measured.

2.3.1. Growth parameters

2.3.2. Days to 50% flowering: The number of days elapsed between date of sowing and date of 50% flowering was computed and expressed as average number of days to flowering.

2.3.3. Plant height (cm): Plant height was measured in centimeters at physiological maturity from the ground level to the tip of plant from ten randomly selected plants in each plot. The values are expressed as mean values.

2.3.4. Number of branches per plant: Number of primary and secondary branches per stem was randomly counted from selected ten middle row plants at final harvest.

2.3.5. Number of pods per plant: On individual plant basis, number of pods in the tagged plants counted manually. The mean pods per plant taken for each treatment.

2.3.5.1000 seed weight (g): The seeds obtained from each of the ten-tagged plants were dried in the sun to around 8.0% moisture content, weighed and counted with a seed counter. Their weight measured by an Analytical balance and the average weight was expressed in grams.

2.3.6. Seed yield per hectare (kg): Grain yield was determined by harvesting plants from the net middle plot area to avoid border effects. Seeds, which were obtained from the corresponding net plot were cleaned manually. After drying to around 8.0% moisture, weighed using sensitive balance and recorded as mean values of seed yield per hectare in kilograms.

2.3.7. Biological yield (kg): At maturity, the whole plant parts, including leaves, stems and seeds from the net plot area were harvested and dried for three days. Finally, weight of dried plants was recorded.

2.4. Data analysis:

All the data were checked for normality and subjected to analysis of variance using statistical software package (SAS 9.1.3). The differences between treatment means were compared using Least Significance Difference (LSD) test at 5% level of significance. Simple Pearson's correlation was done to determine the relationship among response variables

3. RESULTS AND DISCUSSION

3.1. Plant height

From analysis of result average over location showed that significance difference found among varieties at $p \leq$

0.05, and Dirshaye was the highest mean of plant height with 41.5 cm followed by 41.43cm, 37.07cm, Eden, and Darbera varieties respectively(table 1 and 2), but local varieties was the least mean of plant height with 32 cm. At all location, combined analysis of mean result showed that significance difference found among varieties on plant height and Dirshaye and Eden varieties were the highest mean 41.5 cm and 41.43 cm, respectively. but regarding location, Bareda and Oda baso PAs, the highest mean of plant height was recorded, this result may be related to weather and good moisture condition in that area. So, that cool air and moisture availability are positive relation with increase of plant height. Genetic factor also one the variation to the plant height among varieties.

3.2.50% of flowering date

From below table. 1 analysis of variance result showed that, at Oda bultum non significance difference among varieties on 50% flowering date, but at two location there was significance difference found at Habro and Mechara on station. Local varieties was the early flowering date by 47.73, followed by 50.2, 50.3 and 50.6 Eden, Dirshaye and Darbera, respectively. This result confirmed that significance variation found among varieties and this may be due to genetic variation factors.

Table 1. Mean of data analysis plant height, maturity date, no. capsule p/plant, 1000 seed weight and total yield Black cumin at Oda bultum, Habro and Mechara/Daro labu districts on station in 2014

VRT	Oda bultum							Habro							Mechara/ Daro labu						
	PH	FPFD	PMB	MD	NCPP	TSW	TY	PH	FPFD	PMB	MD	NCPP	TSW	TY	PH	FPFD	PMB	MD	NCPP	TSW	TY
Eden	45.2a	50a	6.2a	118.3a	15.3a	2.85a	616b	47.3a	54.6a	4.1a	117a	13.6a	2.6a	532ab	31.8a	46.3ab	5.07a	115b	12.5a	2.43a	493a
Dirshay	44.5a	50a	5.7a	119a	19.3a	2.85a	631a	46.4a	54.3a	4.4a	117a	14.1a	2.1a	601a	33.6a	46.3ab	4.47a	116a	12a	2.4a	529a
Darbera	38.6b	50a	5.7a	119a	14.3a	2.5 a	572c	39.4b	55 a	3.9a	116a	13a	2.4a	652a	33.2a	47a	5.06a	116a	10a	2.60a	433b
Local	34.5c	49.6a	5.5a	114b	13.4b	2.8a	369d	34.1c	48.3b	3.6a	110a	11.a	2.7a	356c	30.3a	45.3b	4.93a	111c	9.2a	2.43a	313c
Mean	40.71	50	5.8	117.6	15.6	2.76	547	41.81	53.08	4	115	13.1	2.45	507	32.25	46.25	4.88	114	10.9	2.46	442.5
CV	4	1.5	9.9	0.5	18.5	10	5.9	3.9	1.85	11.68	1.2	22.5	17	6.7	15.5	1.2	6.79	0.4	21.7	8.9	7.5
LSD	3.5	1.5	1.1	1.3	5.8	0.57	65.9	3.32	1.97	0.94	2.8	5.79	0.8	69.5	9.99	1.15	0.66	0.99	5.9	0.38	66.4
P-v	*	ns	ns	*	*	ns	*	*	*	ns	ns	ns	ns	*	Ns	*	ns	*	ns	ns	*

PH, plant height, FPFD, 50% flowering date, PMB, primary main brunch, NCPP, Number of capsule per plant, TSW, thousand seed weight, TY, total yield, Ns, non significance difference between treatment, *, significance difference found $P \leq 0.05$

Table 2. The mean Combined analysis of Agronomic and growth data for all sites on Black cumin at Oda bultum, Habro and Mechara on station in 2014

Varieties	Plant height	50% flw date	No primary brunch	No of cap/plant	Maturity date	1000 seed weight	Disease rxn	Total yield
Eden	41.43a	50.32a	5.12a	15a	117a	2.72a	2.3a	547ab
Dirshaye	41.5a	50.2a	4.85a	16a	115ab	2.46a	2.2a	587a
Darbera	37.07ab	50.66a	4.88a	13.3ab	116ab	2.46a	2.3a	514b
Local	32.96b	47.73b	4.67a	13.4ab	114b	2.5a	2.3a	346b
Mean	38.25	49.77	4.89	14.4	115.8	2.56	2.25	498
CV	7.8	1.51	9.45	8.9	1.02	9.3	2.9	11.4
LSD	5.60	1.54	0.9	2.43	2.37	0.47	0.45	60.2

PH, plant height, FPFD, 50% flowering date, PMB, primary main brunch, NCPP, Number of capsule per plant, TSW, thousand seed weight, TY, total yield, Ns, non significance difference between treatment, *, significance difference found $P \leq 0.05$

3.3. Number of primary brunches

At Number of primary brunches, there were none significance difference at ($p \leq 0.05$) varieties, but Eden and Dirshaye varieties were the highest mean of primary main brunch with 5.12 and 4.48 respectively. and the lowest mean number of primary brunches were recorded at local variety with 4.6.(fig 1).

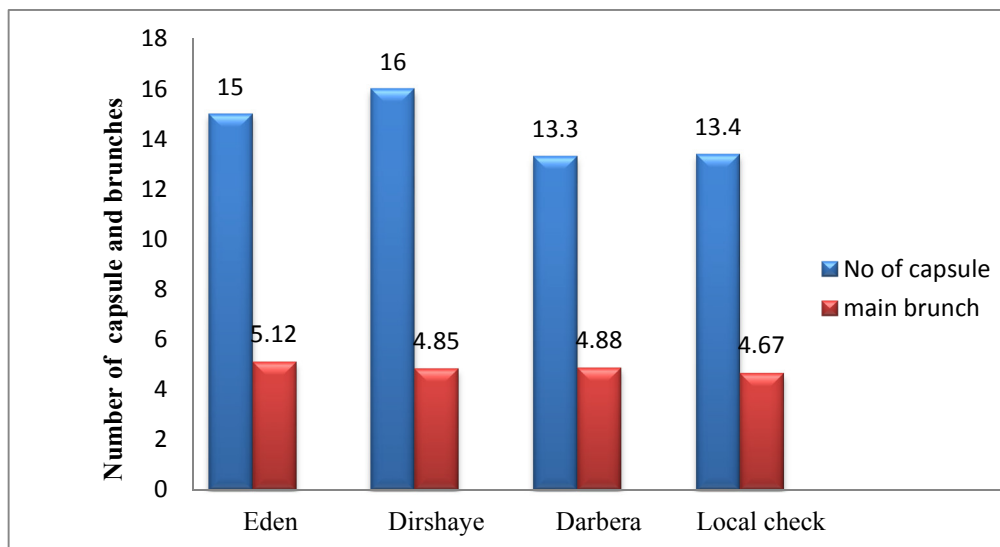


Figure 1. Number of capsules and main branches on Black cumin varieties

3.4. Number of capsule/plant

The number of capsule/ plant, the mean of three sites combined analysis result showed that there was none significance difference among varieties at all location, but Dirshaye and Eden varieties were the maximum number of capsules per plant with 16 followed 15, respectively.(fig 1) but, local variety was the least mean of capsules per plant.

3.5. Maturity date

Maturity date, Analysis of result revealed that, there was significance difference found among variety, but Local variety was the lowest mean of maturity date by 114 followed by 115 Dirshaye variety. Darbera and Eden varieties was the highest mean of maturity date by 116 and 117 respectively. Local check varieties was early matured and when compared to other varieties.

3.6. Thousand Seed

In Thousand seed, from table 2. analysis variance(ANOVA) showed that there was none significance difference among varieties but, highest mean of thousand seed weight was recorded by Eden variety with 2.72 gm followed by 2.46 gm on Darbera. The lowest mean of thousand seed weight was recorded by Local, 2.43 gm.

3.7. Disease reaction

In table 2. there were none significance difference at($P \geq 0.05$) among varieties on disease reaction, but, Dirshaye variety was more disease resistance when compared to other varieties, Eden and Darbera and Local check.

3.8. Total yield

From table 2, the combined data analysis result over location showed that there was significance difference among varieties at all locations, and Dirshaye and Eden were the highest mean of total yield with 587 kg ha⁻¹ and 547 kg/ha⁻¹ respectively. But Local variety was the lowest mean of total yield by 346 kg/ha⁻¹. At Oda baso PAs(Oda bultum) and Bareda FTC (Habro) all yield parameter were good due to good weather condition. But, at Mechara on station, weather condition was not good, due that the yield was decreases.

4. CONCLUSION AND RECOMMENDATION

Based on above result and discussion, over three location, Dirshaye and Eden varieties were showed better yield advantage over local variety with 69% and 58%, respectively. at the same time they were high disease resistance over local varieties.

Therefore, those two varieties, Dirshaye and Eden were adaptable to mid altitude at Oda Bultum and Habro districts and further demonstration and scaling up should be under taken to the study areas and similar agro-ecology.

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