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Evaluation of Germplasm of *Cuminum cyminum* Linn. under subtropics of Jammu, India

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ABSTRACT

Cuminum cyminum (Cumin) is valuable seed spice with diverse usage in cosmetic, medicinal and food industries. An experiment was conducted to evaluate performance of different cumin genotypes for their growth and yield parameters under Jammu subtropics so as to get information on variability present in them and to identify superior genotype(s) for subtropics of Jammu region. Although moderate seed germination percentage (48.60-74.37%) was recorded, but survival percentage of crop was very poor (5.67% -12.33%) resulting in low seed yield plant^{-1}(0.21g -0.98g) which ultimately lead to low yield per hectare (7.42kg-77.42kg). All characters and combinations were positively and significantly correlated with each other except for trait pairs number of umbels plant^{-1} vs. plant height, 1000 seed weight vs. plant height and 1000 seed weight vs. number of umbels plant^{-1} which were positively correlated but non-significant. Seed yield plant^{-1} was significantly and positively correlated with number of seeds plant^{-1} ($r = 0.923$, $p = 0.01$), number of seeds umbel^{-1} ($r = 0.842$, $p = 0.01$) survival percentage ($r = 0.825$, $p = 0.01$), number of umbels plant^{-1} ($r = 0.787$, $p = 0.01$), germination percentage ($r = 0.750$, $p = 0.01$) and number of branches plant^{-1} ($r = 0.710$, $p = 0.01$). Higher seed yield plant^{-1} was observed in genotype GC-4 (0.98g) compared to other genotypes. The overall performance of different genotypes was poor, however, the genotype GC-4 performed better than others. Due to poor survival, growth and yield performance, cumin crop is not commercially suitable for Jammu subtropics.

Key words: *Cuminum cyminum, Quantitative traits, Germplasm, Correlation, Seed spice*

Introduction

Cuminum cyminum (Cumin) belonging to family Apiaceae is an industrially important seed spice crop cultivated for food, drugs and essential oil due to presence of metabolites (Heidari and Sadeghi, 2014). It is a tropical or subtropical crop widely cultivated in arid and semi-arid regions in the world due to its low water requirement (Tavoosi, 2000). Seeds contain volatile oil (2.5–5%) composed of aldehydes and hydrocarbons. Due to diuretic, carminative and antispasmodic properties of seeds, cumin has role in traditional medicine to cure different diseases (Ravi *et al.*, 2013). Cumin fruits are well known appetizers that are extensively applied as a conventional spice in food industries. Being a cash crop,

cumin has provided wide alternative to the farmers. In Jammu and Kashmir, *Kandi* area is 811 km^2 which stretches between longitude $74^0 21´$ to $75^0 45´$ E and latitude $32^0 22´$ to $32^0 55´$ N covering Jammu, Samba and Kathua. 57 per cent of the total area of these three districts is under Kandi belt and it is about 10-30 km wide strip stretching from Akhnoor in the West to Kathua in the East. Undulating topography, steep, irregular slopes, erodible, low water retentive soils, badly dissected terrain by numerous gullies, marginal, small and fragmented land holding in the *Kandi* is making agriculture non-profitable venture in present situation of unreliable weather conditions. Cumin, which is in large demand by pharmaceutical and food industries, can be better option for crop diversification in this area, so this study was conducted to assess its growth and yield potential under subtropical conditions of Jammu region.

Materials and Methods

The present investigation was carried out at Agroforestry farm, Sher- e- Kashmir University of Agricultural Sciences and Technology, Jammu during 2018-19. The Seeds of 8 genotypes/ varieties of cumin were procured from Sri Karan Narendra Agriculture University, Jobner, Rajasthan (Table 1). Experiment was laid in Randomized Block Design with eight genotypes which were replicated thrice. Each genotype was sown in lines at a depth of 1.5 cm in raised bed of 1.5mx1.0m with spacing of 30cmx5cm in sandy loam soil on 16th November, 2018 on an area of 0.05 hectare. At time of sowing, basal doses of DAP, Urea and Ammonium phosphate at the rate of 130.4, 101.15 and 66.66 kg per ha^{-1}, respectively were added. Seeds were first treated with Carbendazim and Mancozeb at the rate of 2 g/ kg of seed before sowing. All cultural and plant protection practices were followed from sowing till harvesting which was done on 20th March 2019. Agromorphological traits were assessed during growing season and were determined by randomly choosing 5 plants of each genotype per plot. The studied parameters included Germination percentage (%), Survival percentage (%), Plant height (cm), number of branches $plant^{-1}$, number of umbels $plant^{-1}$, number of seeds $umbel^{-1}$, number of seeds $plant^{-1}$, 1000 seed weight (g), seed yield $plant^{-1}$ (g), seed yield $plot^{-1}$ (g), and estimated seed yield (kg/ ha). The plants were hand harvested to determine 1000 seed weight (g) and seed Yield (kg ha^{-1}). and data pertaining to various characters were statistically analyzed using statistically package of programme OPSTAT (Sheoran, 2006).

Table 1. List of genotypes

S.No.	Variety/ Genotype
1	GC- 4
2	RZ-19
3	RZ-209
4	RZ-223
5	RZ-341
6	RZ-345
7	UC-231
8	UC-198

Results and Discussion

Seeds of all genotypes were germinated after 18 days of sowing. Flower initiation, 50%, 100% flowering and fruit maturity were observed at 63, 67, 69 and 105 days after sowing, respectively. Significant differences were detected among genotypes for all noted morphological characteristics on basis of mean performance (Table 2) as mean performance helps to identify superior genotype among existing populations and also serves as a primary criteria for selection of desirable plants (Kumar, 2018). Although moderate seed germination percentage (48.60-74.37%) was recorded, but survival percentage of crop was very poor (5.67% -12.33%) resulting in low seed yield $plant^{-1}$(0.21g - 0.98g) which ultimately lead to low yield per hectare (7.42kg-77.42kg). Among the eight genotypes evaluated, RZ-209 recorded the highest significant value (81.98%) for germination percentage and values for survival percentage ranged between 5.67 per cent-12.33 per cent which is extremely low, highest being in genotype GC-4. The highest of the branches (3.47), umbels per plant (10.91), seeds per plant (313.25), and seed yield per plant (0.98g) were recorded in the genotype GC 4 and the lowest number of these parameters was recorded in the genotype RZ-345. Differences in the plant height and 1000 seed weight were not significant but varied from 25.59 cm (RZ-345) to 30.13cm (GC-4) and 2.82g (RZ-345) to 3.12g (GC-4), respectively.

The potential of these genotypes/varieties ranges from 560-1250 kg ha^{-1} in Rajasthan and Gujarat as reported by Kumar (2018). All the growth and yield parameters of the cumin recorded in the present

study falls on the lower side of the range as compared to earlier reports of Bairwa *et al*., 2015; Jat and Singh, 2016 and Meena *et al*., 2015. This might be due to higher rainfall, low temperature and frost occurrence in this region (Fig. 1). There was continuous rains from the month of January to April 2019, i.e. the growth period of the crop which resulted in the stagnation of the water in the beds resulting in mortality of the crop/low survival percentage. The highest rainfall of 67.8 mm was received in the second fortnight of February, 2019 which resulted in less flowering and thereby reduction in the seed yield per plant and ultimately decreases in seed yield per hectare.

The interrelation between different traits was carried out by calculating correlation coefficients (Table 3). All characters and combinations were positively and significantly correlated with each other except for trait pairs number of umbels plant^{-1} vs. plant height, 1000 seed weight vs. plant height and 1000 seed weight vs. number of umbels plant^{-1} which were positively correlated but non-significant.

Seed yield plant^{-1} was significantly and positively correlated with number of seeds plant^{-1} (r = 0.923, p = 0.01), number of seeds umbel^{-1} (r = 0.842, p = 0.01) survival percentage (r = 0.825, p = 0.01), number of umbels plant^{-1} (r = 0.787, p = 0.01), germination percentage (r = 0.750, p = 0.01) and number of branches plant^{-1} (r = 0.710, p = 0.01). In the present investigation, germination percentage, survival percentage, number of branches per plant, number of umbels per plant, number of seeds per umbel, number of seeds per plant, seed yield per plant and seed yield per plot showed high positive association with seed yield per plant, thus suggesting that these characters are important yield components and the effective improvement in yield can be achieved through selection based on these characters, therefore, selection for these attributes would bring about desirable improvement in the species under study for seed yield.

These results are in agreement with the findings of Bairwa *et al*., 2015; Jat and Singh, 2016 and Meena *et al.*, 2016 who have reported positive correlation of seed yield with above mentioned characters in

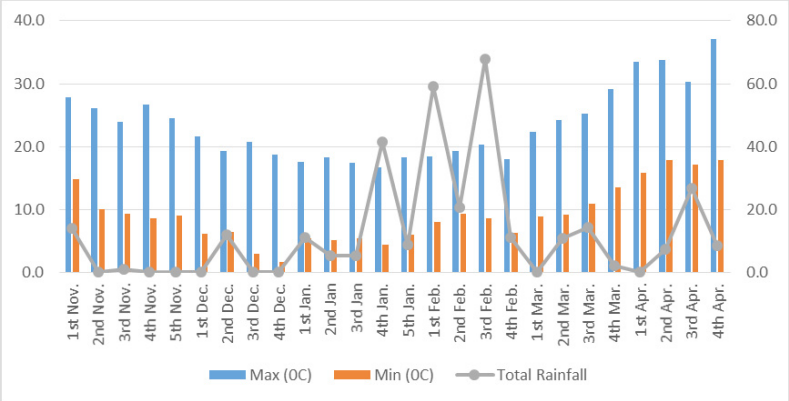

Fig. 1. Weekly meteorological data w. e. f. November, 2018 to April, 2019

Table 2. Mean performance of growth and yield parameters in different genotypes

Genotypes	Germination %	Survival percentage (%)	Plant height (cm)	Number of branches plant^{-1}	Number of umbels plant^{-1}	Number of seeds umbel^{-1}	Number of seeds plant^{-1}	1000 seed weight (g)	Seed yield plant^{-1} (g)	Seed yield plot^{-1} (g)	Estimated seed yield (kg/ha)
RZ-341	56.01	6.33	26.47	2.42	6.88	13.33	90.92	2.95	0.25	1.64	10.93
RZ-345	48.60	5.67	25.59	2.23	6.61	11.20	74.95	2.82	0.21	1.11	7.42
GC-4	74.37	12.33	30.13	3.47	10.91	28.79	313.25	3.12	0.98	11.61	77.42
RZ-223	67.05	9.67	30.31	3.23	8.32	23.98	200.57	2.99	0.60	5.45	36.36
UC-231	57.41	8.00	28.31	2.66	7.12	15.89	113.78	2.97	0.33	2.47	16.49
RZ-209	81.98	11.67	29.99	3.33	9.62	25.14	240.20	3.02	0.73	8.57	57.10
UC-198	61.29	7.33	29.19	2.93	7.66	18.87	145.38	2.99	0.45	3.52	23.44
RZ-19	62.38	8.00	28.27	3.13	7.77	21.66	169.84	3.00	0.52	3.79	25.26
$CD_{0.05}$	12.57	2.95	NS	0.75	2.31	5.30	54.17	NS	0.14	1.37	9.97

Table 3. Correlation between different growth and yield parameter

Characters	Germination percentage (%)	Survival percentage (%)	Plant height (cm)	Number of branches per plant	Number of umbels per plant	1000 seed weight (g)	Number of seeds per umbel	Number of seeds per plant	Seed yield per plant (g)	Seed yield per plot (g)
Germination percentage	1									
Survival percentage	0.776**	1								
Plant height	0.422*	0.570*	1							
Number of branches per plant	0.529*	0.530*	0.487*	1						
Number of umbels per plant	0.481*	0.578*	0.342	0.561*	1					
1000 seed weight	0.406*	0.438*	0.255	0.455*	0.328	1				
Number of seeds per umbel	0.679**	0.758**	0.645**	0.670**	0.692**	0.473*	1			
Number of seeds per plant	0.749**	0.809**	0.510*	0.716**	0.851**	0.451*	0.831**	1		
Seed yield per plant	0.750**	0.825**	0.537*	0.710**	0.787**	0.473*	0.842**	0.923**	1	
Seed yield per plot	0.746**	0.826**	0.535*	0.625**	0.815**	0.514*	0.878**	0.911**	0.920**	1

cumin under arid conditions of Rajasthan. Kahrizi *et al.* (2011) also reported positive correlation between yield and number of seeds per plant, number of umbels per plant, number of seeds per umbel, 1000 seed weight and biological yield in Iran.

Conclusion

An appraisal of data revealed that overall performance of crop was not good when compared with standard yield of these varieties which ranged from 550-1250 kg/ha. Genotypes GC-4 and RZ-209 performed better than other genotypes due to their wider adaptability and appear genetically distinct from the others as far as the characters of the plant contributing to economic yield are concerned.

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