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Effect of seed priming treatment on cumin [*Cuminum cyminum* (L.)] yield and component characters

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Abstract
The investigation on the effect of seed priming treatment on cumin [*Cuminum cyminum* (L.)] yield and component characters was carried out at Seed Spices Research Station Farm, Sardarkrushinagar Dantiwada Agricultural University, Jagudan, during Rabi 2019-20. Four varieties were taken under consideration, *viz.*, Gujarat Cumin-1, Gujarat Cumin-2, Gujarat Cumin-3 and Gujarat Cumin-4 were obtained from Centre for Seed Spices Research Station, SDAU, Jagudan. Seeds of four varieties were treated with five treatments *viz.*, Control, -1.4 MPa PEG, -1.0 MPa PEG, 0.2% KNO_3 and 0.4% KNO_3. The experiment was laid out in randomized block design (factorial concept) with three replications comprising five treatment combinations. The combined effect of pre-sowing seed treatment and varieties showed a significant effect for yield and component characters. An experiment of the data under field conditions revealed the maximum plant height (38.72 cm), with treatment 0.4% KNO_3 and variety GC-2 combination. At the same treatment (0.4% KNO_3) and variety GC-4 combination, the yield attributing characters like maximum number of umbels per plant (82.28), the maximum number of umbellets per umbel (6.37), maximum number of seeds per umbellet (7.37), the maximum number of seeds per umbel (43.64), maximum 1000 seed weight (4.69 g) also show highest mean value, that significantly correlated with seed yield per plant (6.70 g) and seed yield per plot (166.98 g) as compared to the other treatments.

Keywords: Cumin, pre-sowing treatments, yield

Introduction
Cumin (*Cuminum cyminum* L.) is a rabi crop and drought tolerant, tropic, or semi-tropic crop. In India, cumin is sown from October until the beginning of December and harvesting start from February. Cumin is grown from seeds. It requires less water and is colder for its better growth with an ideal temperature of 25° to 30° C. Cumin crop is highly sensitive to rain, as the incidence of rain during harvesting time badly affects cumin quality due to the occurrence of fungal disease. It will turn black and will fetch the lowest price in the market.

The cumin plant grows to 30-40 cm tall and has a diameter of 3-5 cm. Each branch has two to three sub-branches. The stem is colored grey or dark green. The leaves are 5-10 cm long. The flowers are small, white or pink, and borne in umbels. Each umbel has five to seven umbellets. The fruit is 4-5 mm long, containing two mericarps with a single seed. Cumin seeds have eight ridges with oil canals. They are oblong in shape, longitudinally ridged, and yellow-brown in color, like other members of the family Apiaceae. Cumin seeds have an aromatic fragrance due to cuminol. The aromatic oil of cumin seeds is also used for flavoring curries, liquor, cordials and has great use in perfumery industries. It has medicinal properties and is used as carminative, stomachic, astringent and is useful against diarrhea and dyspepsia. Cumin seeds are very useful in curing digestive disorders like biliousness, morning sickness, indigestion, atonic dyspepsia, malabsorption syndrome and flatulent colic. Cumin is valuable in relieving sleeplessness. Dilute cumin water is an antiseptic beverage and Introduction 3 is very useful in treating common cold and fevers, which is associated with a sore throat (Lal *et al*., 2014) [4].

The characteristic cumin aroma is due to the presence of cumin aldehyde pmenth-3 en-7-al and p-menth, 1,3 dien 7al. The oil also contains many other hydrocarbons and oxygenated compounds. Pandey and Goswami (2000) [7] reported the presence of 15 compounds in the cumin oil of which 12 have been identified that constitute 86.4% of the oil. The major compounds were cumin aldehyde (32.6%), pcymene (14.7%), p-mentha 1, 4 dien -7al (13.5%) and beta-pinene (12.7%). Seeds must germinate and seedlings emerge, quickly and uniformly throughout the field so that light, water and soil nutrients may be used for maximum efficiency. Unfortunately, this seldom occurs in the marginal environment of the semi-arid tropics (Saxena *et al*. 2015) [8].

Seed priming is the process of controlled hydration of seed to a level that permits pre- germinative metabolic activity to proceed but prevents actual emergence of the radical. It has been successfully demonstrated to improve germination and emergence in seeds of many crops, particularly seeds of vegetables and small-seeded grasses. However, reports on pre-sowing seed priming studies on cumin seed yield and quality are scanty.

Materials and Methods

An experiment was conducted at Seed Spices Research Station Farm, Sardarkrushinagar Dantiwada Agricultural University, Jagudan during *Rabi* 2019-20. Geographically, Jagudan is situated at 23˚ - 52′ North latitude 72′ - 43′ East longitude with an elevation of 90.60 m above mean sea level. It is located in the North Gujarat Agro-climatic Zone of Gujarat State. This zone is characterized as a semi-arid climate having dry cold winter and dry hot summer. Four varieties were taken under consideration, *viz*., Gujarat Cumin-1, Gujarat Cumin-2, Gujarat Cumin-3 and Gujarat Cumin-4 were obtained from Centre for Seed Spices Research Station, SDAU, Jagudan, Gujarat. The cumin Seeds of four varieties were treated with five treatments *viz*., Control, -1.4 MPa PEG, -1.0 MPa PEG, 0.2% KNO_3 and 0.4% KNO_3. Five normal plants were selected from each replication and observation were recorded for plant height (cm), number of branches per plant, number of umbels per plant, number of umbellets per umbel, number of seeds per umbellet, number of seeds per umbel, 1000 seeds weight (g), seed yield per plant (g) and seed yield per plot (g).

The data obtained from various observations were analyzed by using Randomized Block Design (Factorial concept).

Results and Discussions

Plant height (cm)

The plant height was recorded and compared among the varieties; the highest plant height was found in variety V_2 (36.66 cm) and it was at par with the variety V_4 (35.12 cm). Among the treatments mean highest plant height was found in treatment T_5 (37.16 cm) along with treatment T_3 (36.85 cm). Interaction between treatments and varieties was recorded. It was highest in variety V_4 (GC-4) and treatment T_4 (0.2% KNO3) combination (39.15 cm) followed by combinations V_2T_5 (38.72 cm), V_1T_5 (38.56 cm), V_2T_2 (38.47 cm), V_1T_3 (37.80 cm), V_3T_3 (37.68 cm), V_3T_5 (36.98 cm), V_4T_3 (36.51 cm) and V_2T_1 (36.25 cm) for the plant height. The result confirmed the reports of Khoshvaghti *et al.* (2013) [3] in dill seed, Agawane *et al.* (2015) [1] in soybean, Sowjanya and Dutta (2020) [9] in coriander.

Number of branches per plant

The maximum number of branches per plant was observed in the variety, V_4 (5.55) while in the case of treatment, T_5 (6.15) observed more number of branches per plant, compared to the rest of the treatments. The interaction between pre-sowing treatments and varieties was found non-significant. The results are in agreement with the findings of Khoshvaghti *et al.* (2013) [3] in dill seed, Agawane *et al.* (2015) [1] in soybean and Sowjanya and Dutta (2020) in coriander [9].

Number of umbels per plant

The highest mean value of a number of umbels per plant was recorded with the variety V_4 (69.81) as compared to the mean performance of the varieties, while in treatment it was observed in the highest T_5 (72.62) followed by the treatment T_4 (68.60). Interaction between treatments and varieties was found highest in variety V_4 (GC-4) and treatment T_5 (0.4% KNO_3) combination (82.28) along with V_4T_3 (78.50), V_3T_4 (76.49), V_2T_5 (74.43) and V_4T_4 (73.36) for the number of umbels per plant. Similar results findings were reported by Sowjanya and Dutta (2020) in coriander [9].

Number of umbellets per umbel

The superior value of the number of umbellets per umbel was recorded in the variety V_4 (5.57) and it was found at par with the variety V_3 (5.31). Among the treatments, T_5 showed the highest number of umbellets per umbel *i.e.*, 5.85 compared to the rest of the treatments. The maximum number of umbellets per umbel was found in the variety V_4 (GC-4) and treatment T_5 (0.4% KNO_3) combination (6.37) which is at par with V_2T_5 (6.15) for pre-sowing treatments and varieties regarding interaction. Record similar results for Sowjanya and Dutta (2020) in coriander [9].

Number of seeds per umbellet

The maximum number of seeds per umbellet was recorded with the variety V_4 (6.56) and it was at par with the variety V_3 (6.22). For comparison between the treatments, T_5 expressed the highest number of seeds per umbellet *i.e.*, 6.71 followed by T_3 (6.48) as compared to the rest of the treatments. The variety V_4 (GC-4) and treatment T_5 (0.4% KNO_3) combination (7.37) gave the highest number of seeds per umbellet followed by the combination V_3T_5 (7.13), V_4T_4 (6.73) and V_4T_3 (6.70). The results are supported by the findings of Sowjanya and Dutta (2020) in coriander [9].

Number of seeds per umbel

The number of seeds per umbel was recorded in which the variety V_4 showed the highest number of seeds per umbel *i.e.*, 35.15 as compared to the rest of the varieties, while the treatment T_5 showed the highest number of seeds per umbel *i.e.*, 39.32 compared to the rest of the treatments. Interaction between treatments and varieties was recorded and the highest number of seeds per umbel was shown by variety V_4 (GC-4) and treatment T_5 (0.4% KNO3) combination (43.64) followed by V_3T_5 (40.02) combination. The result confirmed the reports of Sowjanya and Dutta (2020) in coriander [9].

1000 seed weight (g)

When compared, the appraisal means data of 1000 seed weight was found highest in variety V_4 (4.29 g) and it was at par with varieties V_3 (4.27g) and V_2 (4.25g). The treatment T_5 showed the highest 1000 seed weight 4.37g and it was found at par with the treatment T_4 (4.25g) and T_3 (4.25g). 1000 seed weight was found highest in variety V_4 (GC-4) and treatment T_5 (0.4% KNO_3) combination (4.69 g) followed by V_3T_4 (4.66g) combination respectively. Similar results were reported by Sowjanya and Dutta (2020) in coriander [9].

Seed yield per plant (g)

Maximum seed yield per plant was recorded in the variety V_4 (4.41g) as compared to the rest of the varieties. Again, a perusal of the data indicated the highest seed yield was noticed in treatment T_5 (5.06g) and it was at par with treatment T_3 (4.29g). The interaction between treatments and varieties has shown a significant variation. The highest seed

yield per plant was recorded for variety V_4 (GC-4) and treatment T_5 (0.4% KNO_3) combination (6.70g) compared to the rest of the other interactions. Similar results finding were reported by Alishavandhi *et al.* (2014) [2] in cumin, Nego *et al.* (2015) [2] in onion, Mustafa *et al.* (2017) [5] in cotton, Sowjanya and Dutta (2020) [9] in coriander.

Seed yield per plot (g)

The highest seed yield per plot was noticed in variety V_4 (142.82g). Among all the treatments means highest seed yield per plot was found in T_5 (145.12g) along with the treatment T_4 (137.04g). The resemblance between treatments and varieties had shown a significant variation in seed yield per plot. Maximum seed yield per plot was expressed in variety V_4 (GC-4) and treatment T_5 (0.4% KNO_3) combination (166.98g) followed by combinations V_4T_3 (153.83g), V_1T_4 (153.69g), V_4T_1 (151.29g), V_1T_5 (140.58g) and V_2T_4 (140.46g). The results are supported by the findings of Alishavandhi *et al.* (2014) [2] in cumin, Nego *et al.* (2015) [6] in onion, Mustafa *et al.* (2017) [5] in cotton, Sowjanya and Dutta (2020) [9] in coriander.

Table 1: Effect of pre-sowing seed treatment on plant characters

	Plant height (cm)	Branches per plant	Umbels per plant	Umbellets per umbel	Seeds per umbellet	Seeds per umbel	1000 seed weight (g)	Seed yield per plant (g)	Seed yield per plot (g)
Variety									
V_1	34.87	5.05	60.21	4.83	5.98	28.88	4.06	3.31	114.34
V_2	36.66	4.96	63.72	5.23	5.88	31.22	4.25	4.04	121.73
V_3	34.27	4.98	64.55	5.31	6.22	33.01	4.27	3.68	127.25
V_4	35.12	5.55	69.81	5.57	6.56	35.15	4.29	4.41	142.82
S.Em±	0.54	0.08	1.49	0.10	0.11	0.58	0.04	0.12	4.37
CD 5%	1.54	0.25	4.28	0.31	0.34	1.66	0.13	0.35	12.51
Treatment									
T_1	32.94	4.55	57.33	4.71	5.50	25.56	4.08	3.05	113.29
T_2	34.18	4.46	61.22	4.88	5.90	28.41	4.15	3.14	115.80
T_3	36.85	5.52	63.09	5.29	6.48	35.09	4.25	4.29	121.42
T_4	35.01	4.81	68.60	5.46	6.22	31.94	4.25	3.76	137.04
T_5	37.16	6.15	72.62	5.85	6.71	39.32	4.37	5.06	145.12
S.Em±	0.60	0.10	1.67	0.12	0.13	0.64	0.05	0.13	4.88
CD 5%	1.73	0.28	4.79	0.35	0.38	1.85	0.14	0.39	13.99
Interaction									
V_1T_1	30.24	4.45	57.29	3.87	5.83	22.82	3.90	3.04	82.19
V_1T_2	33.77	4.65	61.90	4.08	5.12	21.12	4.05	3.07	100.67
V_1T_3	37.80	5.52	54.00	5.18	6.22	32.42	4.22	4.06	94.56
V_1T_4	33.97	4.52	60.53	5.51	6.38	31.86	3.95	3.17	153.69
V_1T_5	38.56	6.10	67.33	5.52	6.37	36.13	4.18	3.24	140.58
V_2T_1	36.25	4.37	60.34	4.30	5.06	23.02	4.25	3.08	106.57
V_2T_2	38.47	4.65	60.35	5.14	6.01	30.35	4.37	3.16	131.70
V_2T_3	35.40	5.34	59.46	5.18	6.50	35.00	4.28	4.21	107.50
V_2T_4	34.48	4.46	64.03	5.41	5.85	30.23	4.13	4.32	140.46
V_2T_5	38.72	5.97	74.43	6.15	5.99	37.51	4.22	5.43	122.44
V_3T_1	31.91	4.59	59.32	5.61	5.46	28.52	3.98	3.00	113.11
V_3T_2	32.31	4.53	60.08	5.08	6.11	30.11	4.00	3.11	116.65
V_3T_3	37.68	5.38	60.40	5.15	6.49	35.95	4.35	4.17	129.80
V_3T_4	32.45	4.79	76.49	5.37	5.91	30.45	4.66	3.25	129.81
V_3T_5	36.98	5.63	66.45	5.36	7.13	40.02	4.38	4.86	126.23
V_4T_1	33.36	4.80	52.37	5.08	5.63	27.89	4.18	3.10	151.29
V_4T_2	32.19	4.72	62.54	5.22	6.35	32.06	4.18	3.23	114.19
V_4T_3	36.51	5.85	78.50	5.64	6.70	36.99	4.17	4.71	153.83
V_4T_4	39.15	5.46	73.36	5.56	6.73	35.18	4.26	4.31	127.81
V_4T_5	34.40	6.91	82.28	6.37	7.37	43.64	4.69	6.70	166.98
GM	35.23	5.13	64.57	5.23	6.16	32.06	4.21	3.86	126.53
S.Em±	1.20	0.20	3.34	0.24	0.26	1.29	0.10	0.27	9.77
CD 5%	3.46	NS	9.58	0.70	0.76	3.71	0.29	0.79	27.99
CV%	5.94%	6.74%	8.98%	8.10%	7.49%	7.00%	4.21%	12.36%	13.38%

Treatments: T_1- (Control), T_2- (-1.4 MPa PEG), T_3- (-1.0 MPa PEG), T_4- (0.2% KNO_3) and T_5- (0.4% KNO_3)

Conclusion

Since cumin is a tiny seed crop. Seed germination, seedling vigour and other seed characters are crucial for healthy crop cultivation. Almost all plant characters are positively improved by the pre-sowing seed treatment of 0.4% KNO_3 and the variety GC-4 had responded higher to 0.4% KNO_3 pre-sowing treatment as compared to GC-1, GC-2 and GC-3. Therefore, it is found that pre-sowing seed treatment can be useful for better cumin crop cultivation.

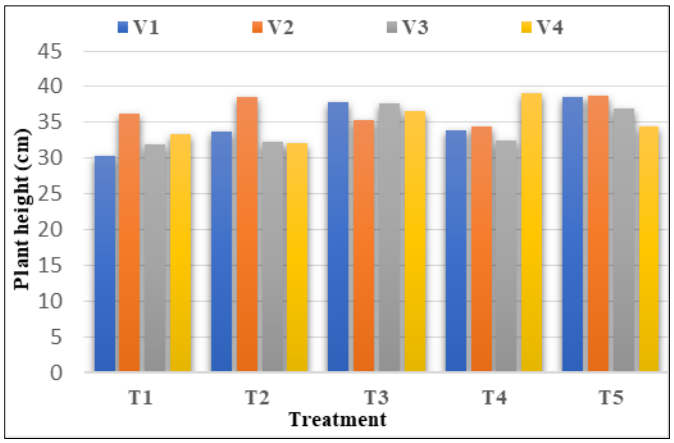

Fig 1: Influence of different pre-sowing treatments and varieties on average plant height (cm)

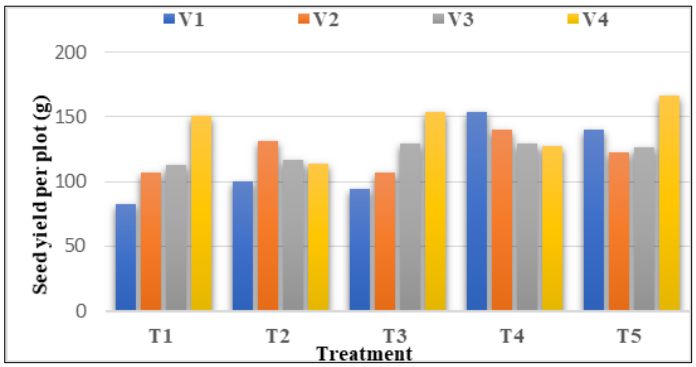

Fig 2: Influence of different pre-sowing treatments and varieties on seed yield per plot (g).

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