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Effect of pre-sowing seed treatment on seed emergence and yield parameters in cumin (*Cuminum cyminum* L.)

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Abstract

The investigation on effect of pre sowing seed treatment on seed yield and influence on seed quality parameters under different temperature and ageing treatment in cumin (*Cuminum cyminum* L.) was carried out at Agronomy farm, B.A. College of Agriculture, AAU, Anand. Two varieties viz., Gujarat Cumin-1 (GC-1) and Gujarat Cumin-4 (GC-4) were obtained from Centre for Seed Spice Research Station, SDAU, Jagudan. Seeds of both the varieties were treated with different growth hormones, bio control agents and seed protection chemicals and their combined effect on growth and yield contributing attributes was studied. The experiment was laid out in factorial randomized block design. The combined effect of pre-sowing seed treatment and varieties showed significant effect for growth and seed yield characters of cumin. The variety GC-1 was significantly superior than the variety GC-4 for field emergence and growth while GC-4 showed significantly higher seed yield parameters.

Key words : Bio-agents, cumin, growth hormones, pre-sowing treatments, seed yield.

Introduction

Cumin (*Cuminum cyminum* L.) is a small, slender annual herbaceous plant, with a glabrous, branched stem 20-30 cm tall with a diameter of 3-5 cm tending to hang down under its own weight. Cumin is native to Egypt and the Mediterranean region. A hot climate is ideal, but it can be grown in cooler regions, if grown under glass in spring and sandy soil is most suitable. It is extensively cultivated in India, China, South Russia, Japan, Indonesia, Iran, Morocco, Turkey, Egypt and Argentina. India is the largest producer, consumer and exporter of cumin in the world. It is widely grown in Rajasthan & Gujarat. The demand for cumin is fairly increasing in the domestic as well in international market which plays an important role in national economy. However, the production and productivity of cumin is decreasing year after year due to several reasons *viz.,* non-availability of good quality seed, slow and uneven germination and low adoption of seed production technologies are the major obstacles in production and productivity of cumin (Trivedi *et al.*, 2018). Seed production potential of cumin is also greatly affected due to degradation of seed quality due to microbial load, heavy infestation of diseases and pests, traditional harvesting & processing, unscientific and unhygienic handling at post-harvest and storage. Poor physical purity and seed germination directly affects the establishment of plant population causing diseases in the field conditions leading to poor seed yield in cumin. Seed treatment is one of the methods adopted for quality seed production as it not only reduces the deleterious effects of damage to seed viability and vigour but also provides better avenues for their establishment, growth and development of seedlings. However, reports on pre-sowing seed treatments studies on cumin are very scanty. In view of this an experiment was designed to study the effect of different pre sowing seed treatments on yield attributing characters of cumin.

Materials and methods

The experiment was conducted at Agronomy farm, BACA, AAU, Anand. Seeds of cumin variety, Gujarat Cumin-1 and Gujarat Cuimin-4 were obtained from the Centre for Seed Spices Research Station, S. D. Agricultural University, Jagudan, Gujarat. The cumin seed of both the varieties were treated with two growth hormones, GA_3 (100 ppm) and KNO_3 (0.3%); three biocontrol agents, *Trichoderma harzianum* (6g kg^{-1} seeds single coat), *T. asperellum* (6g kg^{-1} seeds single coat) and *T. viride* (6g kg^{-1} seeds single coat); one fungicide bavistin @ 2g kg^{-1} seed and untreated seeds were used as a control. After pre conditioning the seeds were sown in the field during *rabi* season in three replications with 4.0 × 2.0 m plot size in RBD (Factorial) design. Seeds were sown at 45 cm row to row spacing. The growth and seed yield attributing characters *viz.,* field emergence (%), plant

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height (cm), number of umbel plant^{-1}, number of seeds plant^{-1}, seed yield plant^{-1} (g), 1000 seed weight (g) and seed yield plot^{-1} (g) were recorded. The observed data was statistically analysed by appropriate statistical procedures as suggested for Randomized Block Design (Factorial) by Steel and Torrie (1960).The standard error of mean (S.Em ±), and Critical difference (CD) at 5% level of probability were worked out.

Results and discussion

The plant growth and seed yield attributing characters were significantly influenced by varieties, seed treatments and their interactions (Table 1).

The varieties showed significant difference for different growth as well as yield characters of cumin irrespective of seed treatments. Maximum field emergence (69.20%) and plant height (37.23 cm) was recorded by the variety GC-1 which was significantly higher than GC-4. The significantly highest numbers of umbels plant^{-1} (84.57), number of seeds plant^{-1} (1252.90), seed yield plant^{-1} (5.78 g), 1000 seed weight (4.60 g) and seed yield plot^{-1} (221.28 g) was recorded by the variety GC-4 over the variety GC-1.

Different pre-sowing seed treatments also showed significant effect on growth and yield attributing characters of cumin irrespective of varieties. Among the different seed treatments, GA_3 (100 ppm) recorded significantly highest field emergence (71.88 %) and was at par with seed treatment with KNO_3 (0.3%), *Trichoderma harzianum* @ 6g kg^{-1} seed and *T. asperellum* @ 6g kg^{-1} being 70.46 cm, 67.74 cm and 68.92 cm respectively. The GA_3 and KNO_3 may be involved in seed germination enhancement and cell enlargement, stimulated RNA & DNA synthesis, repair of RNA and protein synthesis there by leading to enhanced growth and development. The result was in confirmation with the earlier findings of Bardia & Rai (2007) for cumin and Hossein *et al.,* (2012) for black cumin and Reza & Mehdi (2012) for maize. The significantly higher plant height (38.63 cm) was recorded by the seed treatment with *T. asperellum* (6g kg^{-1} seeds single coat) as compared to other seed treatments. The maximum numbers of umbel plant^{-1} (87.00) and (86.66) were recorded by seed treatment with Bavistin @ 2g kg^{-1} seed and *T. asperellum* respectively when compared to the control (64.00). The cumin seed treated with *T. asperellum* @ 6g kg^{-1} seed recorded significantly highest) numbers of seeds plant^{-1} (1402.08), seed yield plant^{-1} (6.40 g), 1000 seed weight (4.75 g) and yield plot^{-1} (247.80 g) as compared to other treatments. These results were in close agreement with the earlier findings of Shah (2007), Bardia & Rai (2007) and Khare *et al.,* (2014) in cumin.

Interaction effect of varieties and different pre sowing seed treatments also recorded significant effect on growth, yield and its related characters in cumin. The maximum field emergence (74.82) recorded by GC-1 when treated GA_3 was at par with KNO_3 0.3% (71.61 %) and *Trichoderma harzianum* (69.50 %). The variety GC-4 treated with GA_3 (100 ppm) and KNO_3 (0.3%) also recorded at par field emergence (68.95%) and (69.31 %) respectively. Significantly highest plant height was attended by GC-1 (38.86 cm) which was at par with *T. asperellum* (38.40 cm), the greater plant height has been recorded due to early protection of seed and seedling from wilt in accordance with *Trichoderma spp*. This ultimately helped in cell enlargement, internodal elongation, thereby leading to enhanced growth and development. The results confirmed the reports of Bardia & Rai, 2007 in cumin. Significantly highest numbers of umbel (101.33), numbers of seeds plant^{-1} (1610.60), seed yield plant^{-1} (7.45 g) and seed yield plot^{-1} (300.35g) were recorded by the variety GC-4 (84.57) when treated with *T. asperellum.* This was because affected the rhizosphere around the seedling and protected it from wilt and die back during initial stage which enhanced the vigour indirectly and in later stages from cumin blight and powdery mildew. Seed treatment with bavistin and *Trichoderma spp.* resulted in lowest disease incidence and highest increase in seed yield. The *F. oxysporum f. sp. cumini* was highly sensitive to bavistin. This may be one of the reasons for getting excellent control of cumin wilt when both carbendazim (Bavistin) and *Trichoderma spp.* were used for seed treatment in isolation (Bardia & Rai 2007 & Jadeja and Nandoliya 2008). The number of seeds plant^{-1} with the *T. asperellum* treatment was found superior, it was dependent on the no. of umbels similarly there was correlation between the seed yield plant^{-1} (g) and seed yield plot^{-1} (g). These results were in agreement line with the earlier findings of Tewfik and Allam (2004) Bardia & Rai (2007), Khare *et al.,* (2014) Lal *et al.,* (2014) in cumin.

Conclusion

It could be concluded that the seed treatment with *T. asperilium* and bavistin resulted in highest number of umbels. It may be due to effective control of wilt and die back disease during initial stage growth resulting in enhanced seedling vigour and low incidence of cumin blight and powdery mildew in later stage culminating in higher in seed yield.

Table 1. Effects of pre-sowing treatments on seed quality parameters

Variety	Field emergence (%)	Plant height (cm)	Number of umbel plant^{-1}	Number of seeds plant^{-1}	Seed yield plant^{-1} (g)	1000 seed weight (g)	Seed yield plot^{-1} (g)
V_1	69.20	37.23	67.38	1029.10	4.50	4.36	182.70
V_2	62.32	33.83	84.57	1252.90	5.78	4.60	221.28
SEm	0.84	0.42	1.57	14.54	0.42	0.04	6.66
CD	2.47	1.24	4.61	42.52	1.24	0.12	19.49
Treatment							
T_1	71.88	35.45	75.67	1,085.30	4.54	4.15	194.37
T_2	70.46	36.05	74.66	1,240.40	5.54	4.44	179.49
T_3	67.84	34.71	71.16	1,106.50	5.09	4.50	182.41
T_4	68.92	38.63	86.66	1,402.80	6.40	4.75	247.80
T_5	64.41	35.66	72.66	1,076.60	5.14	4.63	235.34
T_6	58.63	35.65	87.00	1,159.00	5.35	4.63	194.58
T_7	58.19	32.60	64.00	916.60	3.91	4.28	179.93
SEm	1.58	0.79	2.95	27.21	0.79	0.08	12.47
CD	4.62	2.33	8.63	79.56	2.33	0.23	36.46
Interaction							
$V_1 T_1$	74.82	38.66	65.00	1,011.30	4.24	4.26	172.01
$V_1 T_2$	71.61	38.06	63.00	965.80	4.25	4.39	178.49
$V_1 T_3$	69.50	36.46	63.00	956.00	4.06	4.23	180.40
$V_1 T_4$	74.27	38.86	72.00	1,195.00	5.34	4.59	195.26
$V_1 T_5$	72.68	37.66	71.66	1,041.00	4.87	4.61	196.70
$V_1 T_6$	60.86	38.63	83.33	1,245.60	5.52	4.43	188.13
$V_1 T_7$	60.67	32.30	53.66	789.30	3.19	4.04	167.84
$V_2 T_1$	68.95	32.23	86.33	1,159.30	4.84	4.05	216.73
$V_2 T_2$	69.31	34.03	86.33	1,515.00	6.83	4.50	180.48
$V_2 T_2$	66.17	32.96	79.33	1,257.00	6.12	4.76	184.42
$V_2 T_4$	63.57	38.40	101.33	1,610.60	7.45	4.90	300.35
$V_2 T_5$	56.15	33.66	73.66	1,112.30	5.40	4.66	273.98
$V_2 T_6$	56.40	32.66	90.66	1,072.30	5.19	4.83	200.97
$V_2 T_7$	55.71	32.90	74.33	1,044.00	4.64	4.51	192.02
GM	65.76	35.53	75.97	1141.05	5.14	4.48	201.99
SEm	2.23	1.12	4.17	38.49	1.12	0.11	17.64
CD	6.53	3.30	12.20	112.51	3.30	0.33	51.56
CV %	5.88	5.50	9.51	5.84	5.39	4.40	15.12

V_1: Gujarat Cumin-1; **V_2**: Gujarat Cuimin-4

P_1: GA_3 (100 ppm), **P_2**: KNO_3 (0.3%), **P_3**: *Trichoderma harzianum* @ 6g/kg seed, **P_4**: *T. asperilium* @ 6g/kg seed, **P_5**: *T. viride* @ 6g/kg seed, **P_6** :Bavistin @ 2g/kg seed and **P_7**: Control

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