The Bioscan 16(2): 91-94, 2021
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
www.thebioscan.com

EFFECT OF SEED PRIMING TREATMENT ON SEED QUALITY PARAMETERS IN CUMIN (*Cuminum cyminum*)

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KEYWORDS
Cumin
Priming
Germination
Seedling vigour index

Received on :
29.11.2020

Accepted on :
03.03.2021

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ABSTRACT
The present investigation deals with five varieties of cumin *i.e.*, GC 1, GC 2, GC 3 and GC 4, collected from Centre for Research on Seed Spices, Sardarkrushinagar Dantiwada Agricultural University, Jagudan and var. RZ 209 was obtained from National Research Centre on seed Spice, Ajmer. All the five varieties were subjected to different priming treatments *i.e.* -1.2 MPa PEG, -0.8 Mpa, PEG, 0.1% KNO_3 and 0.2 % KNO_3 and control for two consecutive years. The data obtained from various observations were analyzed by using Factorial Completely Randomized Design (FCRD). The results revealed that there was significant effect of priming treatments and varieties on germination per cent and other seed quality parameters like seedling vigour index I and II.

INTRODUCTION

India is the biggest producer of Cumin Seeds in global spice market. Almost 85% of the cumin produced in India is grown in Gujarat, Rajasthan and Haryana during Rabi season out of which Rajasthan state alone contribute around 52% of the total national production (Mahajan *et al.*, 2013). The other major producers of cumin seed are Syria and Turkey which together with India contributes almost 90% of the world cumin productions (Annonymus 2015). In India, Gujarat state alone contributes around 65% of the total national production. In India, cumin is sown from October to until beginning of December and harvesting starts from February (Trivedi *et al.*, 2018). 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 many reasons. Non availability of good quality seed, slow and uneven seed germination, low adoption of seed production technologies, degradation of quality due to microbial load, heavy infestation of diseases and pests, traditional harvesting and processing, unscientific and unhygienic handling post harvest storage are the major problem in realizing the production potential of cumin. Poor planting value of seeds directly affects the establishment of plant population and causing diseases in the field conditions leading to poor seed yield in cumin (Mahajan *et al.*, 2013). Hence, 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. Various seed enhancement priming treatments before sowing have also been devised to improve the rate and uniform seed germination as well as vigour in a number of crop species. 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 environments of the semi-arid tropics (Saxena *et al.*, 2015). Jadeja and Nandoliya (2008) studied chemicals and biocontrol agents' treatment under field condition at Junagadh (Gujarat) for the management of wilt disease of cumin.

Seed priming is the process of controlled hydration of seeds to a level that permits pre-germinative metabolic activity to proceed, but prevents actual emergence of the radicle. It has been successfully demonstrated to improve germination and emergence in seeds of many crops, particularly seeds of vegetables and small seeded grasses. Poor physical purity and seed germination directly affects the establishment of plant population and causing diseases in the field conditions leading to poor seed yield in cumin. Hence, seed treatment is one of the method 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 priming studies on cumin seed yield and quality are scanty. Keeping these in view the present investigation was undertaken to enhance seed germination and improve seedling vigour of cumin.

MATERIALS AND METHODS

The experiment was carried out at the Department of Seed

Science and Technology, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat. Five cumin varieties *i.e.*, GC 1 (V_1), GC 2 (V_2), GC 3 (V_3) and GC 4 (V_4) were obtained from Centre for Research on Seed Spices, Sardarkrushinagar Dantiwada Agricultural University, Jagudan and var. RZ 209 was obtained from National Research Centre on seed Spice, Ajmer. The seeds of five varieties were stored for different periods *i.e.* 3, 6 and 9 months (D_1, D_2, and D_3) after each storage periods seeds were primed with different treatments *i.e.*, Control (T_1), -1.2 MPa PEG (T_2), -0.8 Mpa PEG (T_3), 0.1% KNO_3 (T_4) and 0.2 % KNO_3 (T_5) and kept for germination using between the paper method as per ISTA procedure. Ten normal seedlings were randomly selected from each replication and observations were recorded for germination percentage, root length (cm), shoot length (cm), dry weight of seedling (gm) and seedling vigour indices. The vigour indices were calculated using the procedure suggested by Adbul- Baki and Anderson (1973)

Vigour index-I = Germination (%) × Seedling length (cm)

Vigour index- II = Germination (%) × Seedling dry weight (gm)

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

RESULTS AND DISCUSSION

The effect of different priming treatments, storage periods and varieties were studied for two consecutive years to determine seed and seedling quality parameters. The pooled results of both the years revealed that there was significant effect of such treatments and their combinations on germination per cent. During the study, it was recorded that variety GC 4 recorded highest germination percentage i.e. 79.02% in GC 4 compare to other varieties (Table 1). Similar results were observed by Saxena *et al.* (2015) where GC-4 variety is more responsive towards priming treatments compared to other varieties used *i.e.* RZ-209.

Germination is complex process with regulatory network of many metabolic, cellular and molecular events inside the seed residing at below ground. Seed germination is usually the most critical stage in seedling establishment, determining the success of crop production especially under adverse field conditions. Seed priming is one the improved seed invigoration techniques are used in the world to reduce the germination time, to synchronize germination, to improve germination rate and increase overall plant stand (Yanglem *et al.*, 2016). Among the priming treatments, seeds primed with -0.8 MPa PEG recorded significantly highest germination of 82.89 % during pooled year analysis (Table 1). Nagarajan *et al.* (2015) also reported that improvement of germination by priming with PEG might be directly related to the modification of seed water relations.

Germination potential decreases with increase in storage periods. The pooled analysis revealed that there is a negative effect of storage period on germination potential where it gradually decreased from 81.56% to 56.91% from three months to nine months respectively (Table 1). The pooled year effect of varieties, priming treatments and storage period showed combination of three seed of variety GC 4 primed with -0.8 MPa PEG recorded 100 % germination whereas, significantly lowest germination (27.00 %) was recorded by the variety RZ-209 stored for nine months stored seeds without any priming treatment (Fig. 1). During the study it was revealed that seeds of all the varieties could maintain the germination percentage above the Indian Minimum Seed Certification Standards (2013). But as ageing continues the germination percentage reached to 56.91% which is below standards (Table. 1). The same variety recorded highest root length (5.08 cm), shoot length (4.29cm) and seedling length (9.37 cm) when pooled over the years. Among the treatments -0.8 MPa PEG

Table 1: Effect of seed priming, storage period and varieties on seed quality parameters of cumin (Pooled)

Factors	Germination (%)	Root length (cm)	Shoot length (cm)	Seedling length (cm)	Fresh weight (mg)	Dry weight (mg)	Vigour Index (I)	Vigour Index (II)
Variety								
V_1: GC-1	74.95	4.16	3.69	7.85	182.28	2.95	588	221.1
V_2: GC-2	74.67	5.08	4.29	9.37	205.34	3.86	700	288.2
V_3: GC-3	75.21	4.56	3.73	7.93	207.73	4.61	596	346.7
V_4: GC-4	79.02	4.2	3.47	8.03	190.81	3.34	635	263.9
V_5: RZ-209	49.34	2.81	2.49	5.3	165.18	3.22	262	158.9
S.Em ±	0.191	0.024	0.025	0.04	1.372	0.028	4.82	2.394
CD @ 5 %	0.529	0.067	0.069	0.115	3.804	0.078	13.36	7.089
Treatment								
T_1: Control	56.38	2.65	2.4	5.05	132.85	2.95	311.38	166.3
T_2: -1.2 MPa PEG	77.54	4.9	4.03	8.94	216.38	3.86	729.37	299.3
T_3: -0.8 MPa PEG	82.89	5.61	4.62	10.24	247.54	4.61	888.92	382.1
T_4: 0.1% KNO_3	64.69	3.56	3.06	6.63	165.4	3.34	459.73	216.1
T_5: 0.2% KNO_3	71.71	4.09	3.58	7.68	189.03	3.22	584.58	230.9
S.Em ±	0.191	0.031	0.025	0.04	1.372	0.028	4.82	2.376
CD @ 5 %	0.529	0.067	0.069	0.11	3.804	0.078	0.11	6.547
Duration								
D_1: 3 months	81.56	4.97	4.32	9.31	239.23	7.17	792.19	584.8
D_2: 6 months	73.45	4.23	3.42	7.65	187.24	3.49	592.86	256.3
D_3: 9 months	56.91	3.29	2.86	6.16	144.34	0.14	399.34	8
S.Em ±	0.148	0.022	0.019	0.031	1.063	0.022	3.73	1.759
CD @ 5 %	0.41	0.061	0.053	9.31	239.23	0.06	10.348	5.187

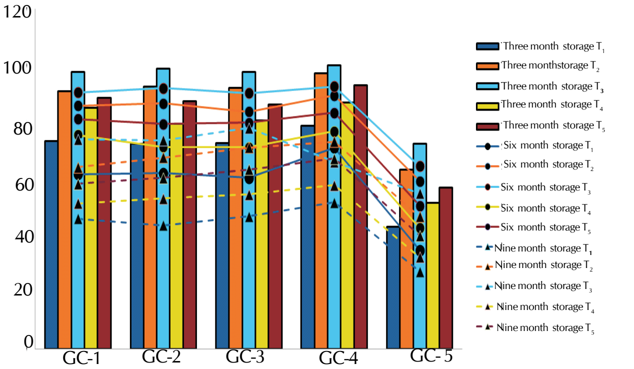

Figure 1: Interaction effect of varieties, priming treatments and storage period on germination (percent) of cumin

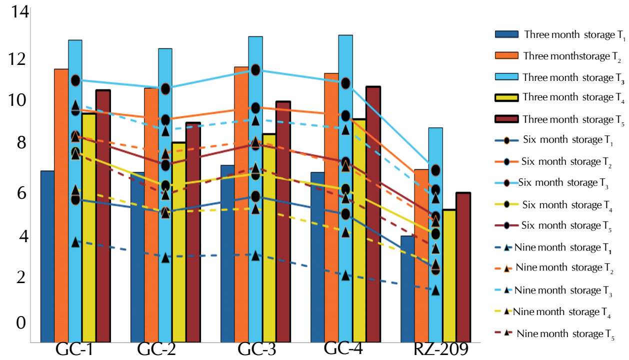

Figure 4: Effect of varieties, priming treatments and storage period on seedling length (cm) of cumin

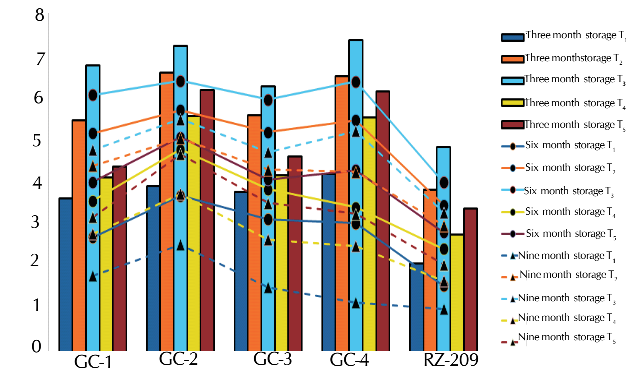

Figure 2: Effect of varieties, priming treatments and storage period on root length (cm) of cumin

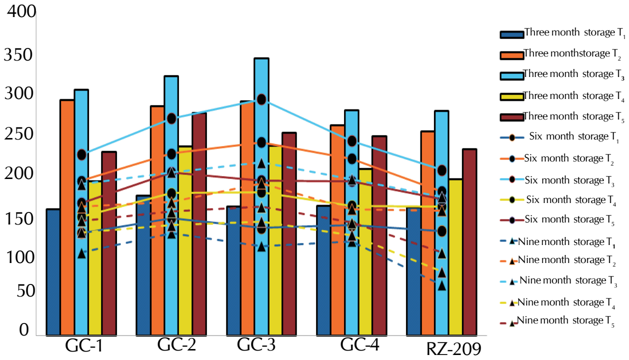

Figure 5: Effect of varieties, priming treatments and storage period on fresh weight (mg) of cumin

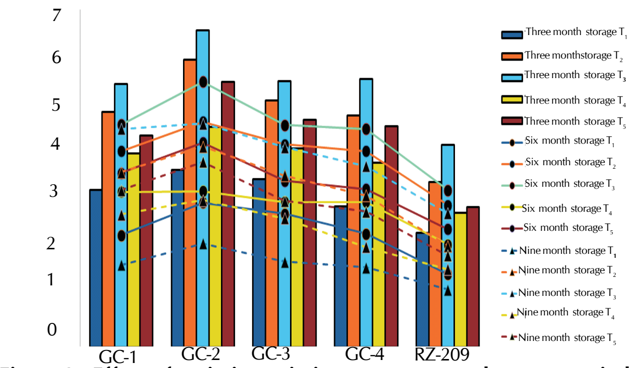

Figure 3: Effect of varieties, priming treatments and storage period on shoot length (cm) of cumin

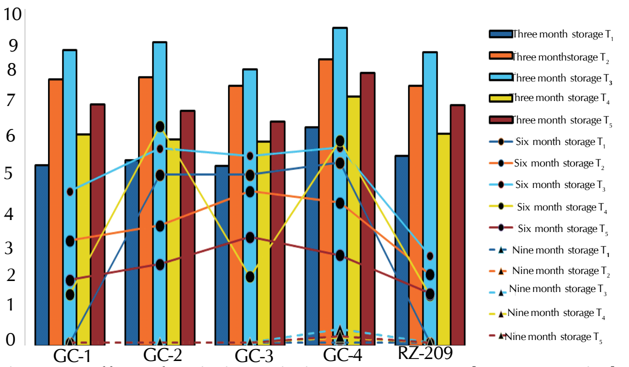

Figure 6: Effect of varieties, priming treatments and storage period on dry weight (mg) of cumin

recorded significantly highest root, shoot and seedling length. Pooled year effect showed highest root length (5.61 cm), shoot length (4.62 cm) and seedling length (10.24 cm) by the same variety. Among the different storage periods effect on seedling characters revealed that three months stored seed recorded significantly highest root, shoot and seedling length during both the years and their pooled effect. Three months stored seed recorded significantly highest seedling length of 9.31 cm. The pooled interaction effect revealed that three months stored seeds of the variety GC 2 when primed with -0.8 MPa PEG recorded significantly highest seedling length (12.82 cm) and its ancillary characters (Fig. 2, 3, 4). The present result corroborates with results of Trivedi *et al.* (2018), where seed germination and other seedling quality parameters reduced as the seeds ages either artificially of naturally. The decrease of quality is due to loss of membrane integrity in ageing process and leading to more loss of electrolytes into the imbibing medium. The main cause for membrane deterioration would be lipid peroxidation according to Parrish and Leopold (1978). A large number of reactive oxygen species are generated in the seed during ageing which causes lipid peroxidation (McDonald 1999). This free radical induced non-enzymatic peroxidation, has the potential to damage membrane and is the major cause of seed deterioration in storage. This result was in agreement with Vashisth and Nagarajan (2009) in maize, Khan *et al.* (2004) and Amjad and Anjum (2002) in onion.

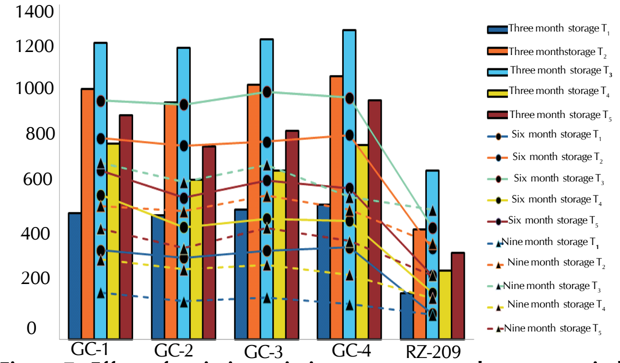

Figure 7: Effect of varieties, priming treatments and storage period on vigour index I of cumin

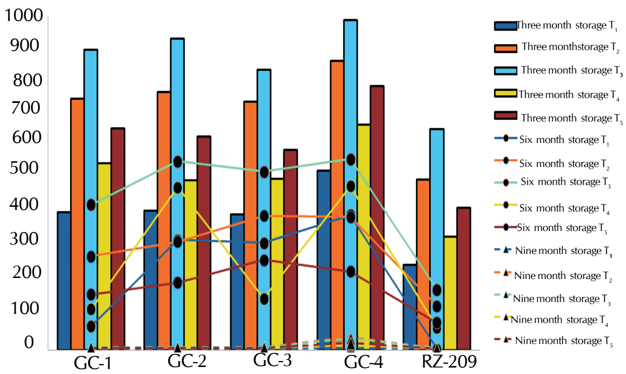

Figure 8: Effect of varieties, priming treatments and storage period on vigour index II of cumin

The three months stored seeds primed with -0.8 MPa PEG also recorded significantly highest seedling fresh weight 239.23 mg and 247.54 mg respectively for the pooled year effect. The pooled interaction of variety, priming treatments and storage periods revealed that the three months stored seed of variety GC 3 primed with -0.8 MPa PEG recorded the highest seedling dry weight (9.39 mg) and (341.61 mg) respectively (Fig. 5,6). Seedling vigour of cumin also significantly affected by varieties, priming treatment and storage period the variety GC 2 recorded highest vigour index I in both years as well as recorded vigour index I (700) in pooled year effect (Fig. 7). The three months stored seeds primed with -0.8 MPa PEG also recorded significantly highest vigour index I (792) and (889) respectively. The three months stored seeds of variety GC 2 primed with -0.8 MPa PEG also recorded highest vigour index I (1354) in the pooled year interaction. Vigour index II was significantly highest in the three months stored seed of the variety GC 3 primed with -0.8 MPa PEG. The same treatment combination recorded the highest vigour index II (936.0) in the pooled year interaction effect of variety, priming treatments and storage period in cumin (Fig. 8). The present result matches with the result of Mirmazloum *et al.* (2020) where PEG treatment showed enhancing seed germination compared to other treatments in *Carum carvi* L. seeds.

In conclusion, in this study, the effect of various seed priming treatments on three different storage period showed varied results in the seed germination quality of cumin seeds. However, seeds treated with -0.8 MPa PEG recorded highest germination compared to others. The study also revealed that as the storage period increases the germination quality decreases.

REFERENCES

Annonymus,2015.ITCmarket insider spices report. *www.intracen.org/ .../ITC%20 Market %20 Insider %20 Spices%20 report %20 Oct%20 2015.*

Mahajan, S.S., Henry, A., Bhatt, R.K. 2013. Effect of pre- sowing seed treatments on seedling emergence, seed yield and yield attributes of cumin (*Cuminum cyminum* L.). *Int J Seed Spi*. **3(1):** 36-40.

Trivedi, V., Kalyanrao, Sasidharan, N., Patel, D. A. 2018. Influence of seed quality parameters under different temperature and artificial ageing treatment in cumin (*Cuminum cyminum* L. *Ind J Agril Sci.* **88(1):** 121-124.

Adbul Baki, A. A., Anderson, J. D. 1973. Vigour determination in soybean seed by multiple criteria. *Crop Sci*. **12:** 630-633.

McDonald, M. B. 1999. Seed deterioration; physiology, repair and assessment. *Seed Sci Technol*. **27:** 177–237.

Mirmazloum, I., Attila, K., Eva, E., Marta L., Eva Z .M., Radacsi, P. 2020. The Effect of Osmopriming on Seed Germination and Early Seedling Characteristics of *Carum carvi* L. *Agriculture*. **10:** 1-11.

Nagarajan, S., Pandita, V.K., Joshi, D.K., Sinha, J.P., Modi, B.S. 2015. Characterization of water status in primed seeds of tomato (*Lycopersicon esculentum* Mill.) by sorption properties and NMR relaxation times. *Seed Sci Res*. **15:** 99-111.

Parrish, D. J., Leopold, A. C. 1978. On the mechanism of ageing in soybean seeds. Pl Physiol. **61:** 365–8.

Saxena, S. N., Kakani, R.K., Sharma, L.K., Agarwal, D., Rathore, S.S. 2015. Usefulness of hydromatrix seed priming in cumin (*Cuminum cyminum* L.) for hastening germination. *Int J Seed Spi*. **5(1):** 24-28.

Indian Minimum Seed Certification Standards. 2013. The central seed certification board department of agriculture and Cooperation, Ministry of Agriculture, Govt. of Indian New Delhi.

Vashisth, A., Nagarajan, S. 2009. Germination characteristics of seeds of maize (*Zea mays* L.) exposed to magnetic fields under accelerated ageing condition. *J Agri Physics*. **9:** 50–8.

Yanglem, S.D., Ram, V., Rangappa, K., Devi, M.H., Singh, N.J. and Singh, A.K. 2016. Effect of seed priming on germination and initial seedling growth of pea (*Pisum sativum* L.) cultivars. The Bioscan. 11(4): 2625-2630.

Khan, M. M., Iqbal, M., Abbas, M., Raza, H., Waseem, R., Ali, A. 2004. Loss of vigour and viability in aged onion (*Allium cepa* L.) seeds. *Int J Agril Bio*. **6(4):** 708-11.

Amjad, M., Anjum, M. A. 2002. Effect of relative humidity and ageing period on the quality of onion seed. *Int J Agril Biol*. **4(2):** 291–296.