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Effect of Pre-Sowing Seed Treatments on Seed Yield and Seed Quality Parameters in Ajwain [*Trachyspermum ammi* (L.)]

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ABSTRACT: The present investigation, entitled "Effect of pre-sowing seed treatment on seed yield and seed quality parameters in Ajwain [*Trachyspermum ammi* (L.)]", was carried out with the objectives to study the improved germination for better crop stand through pre sowing treatments. The experiment was conducted at Seed Technology Research Unit and laboratory of Department of Agricultural Botany, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, during *Rabi,* 2022–2023. A Randomised Block Design (RBD) with two replications was used to assess the experimental material. Two genotypes of Ajwain variety Local and AA-1-19 were sown and seven pre-sowing treatments GA_3 (100 ppm), KNO_3 (0.3%)**,** *T. asperilium* (6g kg seeds single coat), *T. harzianum* (6g/kg seeds single coat), *T. viride* (6g/kg seeds single coat), Bavistin (2g/kg seeds) and Control were studied. Observations were recorded on following characters *viz*., field emergence (%), plant height (cm), number of umbel per plant, 1000 seed weight (g), seed yield per plant (g) and seed yield per plot (g). It was observed in the present study that the maximum field emergence was observed with treatment GA_3 in both the varieties. The maximum plant height, maximum number of umbel per plant, maximum seed yield per plant, maximum 1000 seed weight, maximum seed yield per plot was noticed by seed treatment with (*Trichoderma spp*.) i.e *T.harzianum*.

Keywords: Ajwain, pre-sowing seed treatment, seed yield, seed quality and *Trichoderma spp*

INTRODUCTION

The Ajwain belongs to the family Apiaceae (Umbelliferae). It is a cross-pollinated, aromatic and annual herbaceous plant. Ajwain is commonly grown as medicinal plant in Iran, India, Egypt and Europe. India is the world's largest spice producer. It is also the largest consumer and exporter of spices. The major ajwain growing states in the country are Madhya Pradesh, Uttar Pradesh, Gujarat, Rajasthan, Maharashtra, Bihar and West Bengal. Ajwain grows well in a variety of soil types, but it thrives in well-drained, loamy soils. It is a cold-loving crop and is mainly grown during the *rabi* season in India. In some pockets of the country, it is also grown as a *kharif* crop. Moderately cool and dry climates favor good plant growth and flowering.

A more important use of Ajwain is medicinal, and it is a household remedy for indigestion. The plant is used traditionally as a stimulant, carminative, flatulence, atonic dyspepsia, abdominal tumors, pile, and bronchial problems, lack of appetite, galactogogue, asthma, and amenorrhea. The seeds of ajwain are used for flavoring foods and as preservatives. The essential oil from seeds is used in perfumery, essences and medicinal preparations. Ajwain seed is considered a hot medicine and is used for relief of pain in the human digestive tract and as an anti-blot.

The global market has seen an increase in demand for plant-based medications and pharmaceuticals. As a result, the demand for Ajwain is rising in both the local and foreign markets, and it plays an essential role in the national economy. However, ajwain productivity and yield are declining year after year owing to a variety of factors, including a lack of excellent-quality seed, slow and uneven germination and a lack of adoption of seed production technology, which are the key barriers to production and productivity. Poor physical purity and seed germination directly affect the establishment of plant populations, causing diseases in the field. Leading to poor seed yield. 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. Ajwain quality seed production should be organized in accordance with all the package of practices, with some treatment arrangements employing excellent quality seeds. The observations were recorded and statistically analyzed, and the results are summarized here.

Germination poses a significant challenge in spice cultivation, with varying degrees of dormancy affecting germination rates or percentages under different conditions [1]. Ajwain, in particular, faces a severe threat from fusarium wilt, a disease thriving in warm, dry environments. To enhance seedling emergence and overall plant population in the field, seed treatments involving biocontrol agents have proven effective and are recommended before planting [2].

The utilization of plant growth hormones (PGRs) represents a promising avenue for augmenting horticultural crop production by addressing various impediments, whether of genetic or environmental origin. Among these hormones, GA_3 (gibberellic acid) and KNO_3 plays crucial roles in stress reduction and the promotion of flower bud initiation. This research focuses on leveraging plant growth hormones to enhance seed production. Gibberellic acid, in particular, has emerged as a primary strategy for boosting productivity and improving seed quality across various seed spices, including fenugreek, fennel, coriander and cumin [3].

Studies on pre-sowing seed treatment for ajwain, cumin, coriander, and fennel are scarce, limiting the understanding of effective cultivation practices for these seed spices. The potential for introducing seed spices to new areas and enhancing yields through innovative technologies remains largely unexplored. Addressing the gap in research, particularly on the impact of pre-sowing seed treatment and temperature levels on ajwain, can unveil new opportunities for investigating the performance of organically grown ajwain with plant growth hormones, bio-control agents, and fungicides. Ajwain, with its established and potential therapeutic benefits, deserves scientific exploration.

MATERIAL AND METHODS

The present investigation, entitled “Effect of pre-sowing seed treatment on seed yield and seed quality parameters in ajwain [*Trachyspermum ammi* (L.)]”, was carried out with the objectives to study the improved germination for better crop stand through pre sowing treatments. The experiment was conducted at Seed Technology Research Unit and laboratory of Department of Agricultural Botany, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, during *Rabi,* 2022–2023. A uniform piece of land was selected and brought to a fine tilth by ploughing and harrowing. A Randomised Block Design (RBD) with two replications was used to assess the experimental material. Two genotypes of Ajwain variety: V_1- Local and V_2- AA-1-19 were sown and seven pre-sowing treatments : i.e. T_1- GA_3 (100 ppm), T_2- KNO_3 (0.3%), T_3 -*T. asperilium* (6g/kg seeds single coat), T_4- *T. harzianum* (6g/kg seeds single coat), T_5- *T. viride* (6g/kg seeds single coat), T_6- Bavistin (2g/kg seeds) and T_7- Control were studied. After seeding, a mild irrigation was applied. Sowing was done at 90 cm and 45 cm spacing between rows and plants, respectively. Dibbling was the method of seeding. In each replication, two rows indicate one treatment. One plant per hill was maintained by

Table 1. Treatment details

S.N.	Treatments combinations	Variety	Pre- sowing Treatments
1	V_1T_1	Local	GA_3 (100 ppm)
2	V_1T_2	Local	KNO_3 (0.3%)
3	V_1T_3	Local	*T. asperilium* (6g/kg seeds single coat)
4	V_1T_4	Local	*T. harzianum* (6g/kg seeds single coat)
5	V_1T_5	Local	*T. viride* (6g/kg seeds single coat),
6	V_1T_6	Local	Bavistin (2g/kg seeds)
7	V_1T_7	Local	Control
8	V_2T_1	AA-1-19	GA_3 (100 ppm)
9	V_2T_2	AA-1-19	KNO_3 (0.3%)
10	V_2T_3	AA-1-19	*T. asperilium* (6g/kg seeds single coat)
11	V_2T_4	AA-1-19	*T. harzianum* (6g/kg seeds single coat)
12	V_2T_5	AA-1-19	*T. viride* (6g/kg seeds single coat),
13	V_2T_6	AA-1-19	Bavistin (2g/kg seeds)
14	V_2T_7	AA-1-19	Control

thinning 15 days after sowing. All other cultural practices were implemented to ensure a healthy harvest. Observations were recorded on following characters *viz*., field emergence (%), plant height (cm), number of umbel per plant, 1000 seed weight (g), seed yield per plant (g) and seed yield per plot (g).

RESULTS AND DISCUSSION

Field emergence (%)

When the field emergence of variety was compared and observations were made, in variety AA-1-19 the maximum field emergence was recorded in T_1 (86.60%) followed by T_4 (85.00%) and T_2 (83.30%) while minimum field emergence was recorded in T_7 (70.00%) followed by T_6 (71.60%) and T_3 (78.30%). In Local variety the maximum field emergence was recorded in T_1 (80.00%) followed by T_2 (75.00%) and T_4 (71.60%) while minimum field emergence was recorded in T_6 (61.60%) followed by T_5 (63.30%) and T_7 (65.00%). The best result was found in GA_3 as it is responsible for expansion and cell division in shoot elongation, flowering and seed germination. Higher GA_3 concentrations may have been needed to activate the synthesis of proteins and other metabolites required by the embryo for germination. It is a growth promoting hormone it could have been involved in cell enlargement, stimulated RNA and DNA synthesis, repair of RNA and protein synthesis and there by leading to enhanced growth and development The results confirmed the reports of earlier findings in black cumin [4,5], cumin [6], coriander [7] and amaranth [8].

Plant height (cm)

The data revealed that pre sowing seed treatment significantly increased plant height as compared to control. When the plant height of variety was compared and observations were made, in variety AA-1-19 the maximum plant height was recorded in T_4 (113.5cm) followed by T_3 (106.5cm) and T_1 (105.8) while minimum plant height was recorded in T_7 (99.9cm) followed by T_6 (101.6cm) and T_5 (102.4cm). In Local variety the maximum plant height was recorded in T_4 (107.0cm) followed by T_1 (103.8cm) and T_3 (103.5cm) while minimum plant height was recorded in T_7 (96.2cm) followed by T_6 (98.7cm) and T_7 (99.5cm). The plant height was the maximum shown by treatment *T. harzianum* and the minimum in control. The seed treatment with *T.* harzianum showed a superior result over the other treatments. The greater plant height has been recorded as lower percentage of the disease infection was produced by seed treatment with the *T.harzianum*, due to early protection of seed and seedling from wilt. The reduction of disease incidence can be expected to enhance the plant stand and consequently the seed yield per unit area especially when supported by enhanced plant productivity (seed yield per plant). This resulted in cell expansion, intermodal elongation, increased RNA and protein production, and improved growth and development. The results confirmed the reports of earlier findings in cumin [9] , groundnut [10] and cumin [11].

Number of umbels per plant

The results clearly indicated that application of pre-sowing treatments significantly influenced the number of umbels per plant. In variety AA-1-19 the maximum number of umbels per plant was recorded in T_4 (216) followed by T_6 (213) and T_3 (211) while minimum number of umbels per plant was recorded in T_5 (144) followed by T_1 (148) and T_7 (160). In Local variety the maximum number of umbels per plant was recorded in T_4 (144) followed by T_6 (134) and T_1 (130) while minimum number of umbels per plant was recorded in T_3 (85) followed by T_2 (93) and T_7 (94). The results were in confirmation with the earlier reports in cumin [11], *Vigna radiate* [12], fennel [13] and ajwain [14].

1000 seed weight (g)

When compared, the appraisal of mean data pertaining to 1000 seed weight of the two varieties found that AA-1-19 the maximum 1000 seed weight was recorded in T_4 (1.41g) followed by T_6 (1.21g) and T_3 (1.11g) while minimum 1000 seed weight was recorded in T_7 (0.96g) followed by T_2 (0.98g) and T_5 (1.02g). In Local variety the maximum 1000 seed weight was recorded in T_3 (1.08g) followed by T_6 (1.03g) and T_4 (1.02g) while minimum 1000 seed weight was recorded in T_1 (0.90g) followed by T_7 (0.91g) and T_5 (0.96g). It was observed that the treatment with the maximum 1000 seed weight was *Tricoderma spp*. The results confirmed the reports of earlier findings in cumin [11] and in lentil [15].

Seed yield per plant (g)

When compared, the data showed a significant effect of pre-sowing treatments for the varieties AA-1-19 the maximum seed yield per plant was recorded in T_4 (4.20g) followed by T_3 (3.33g) and T_6 (3.18g) while minimum seed yield per plant was recorded in T_7 (2.20g) followed by T_1 (2.35g) and T_5 (2.38g). In Local variety the maximum

Table 2. Effect of different pre-sowing treatments and variety on seed yield and seed quality parameters

S.N.	Treatments	Field Emergence (%)	Plant Height (cm)	Number of Umbel per Plant	1000 Seed Weight (g)	Seed Yield per Plant (g)	Seed Yield per Plot (kg)
1	V_1T_1	80.0	103.8	130	0.90	2.24	124.33
2	V_1T_2	75.0	102.2	93	0.97	2.50	126.67
3	V_1T_3	68.3	103.5	85	1.08	1.61	155.33
4	V_1T_4	71.6	107.0	144	1.02	3.23	166.33
5	V_1T_5	63.3	99.5	117	0.96	2.20	161.33
6	V_1T_6	61.6	98.7	134	1.03	1.78	124.67
7	V_1T_7	65.0	96.2	94	0.91	1.61	121.33
8	V_2T_1	86.6	105.8	148	1.03	2.35	168.13
9	V_2T_2	83.3	104.1	162	0.98	2.67	141.67
10	V_2T_3	78.3	106.5	211	1.11	3.33	199.65
11	V_2T_4	85.0	113.5	216	1.41	4.20	283.95
12	V_2T_5	81.6	102.4	144	1.02	2.38	159.73
13	V_2T_6	71.6	101.6	213	1.21	3.18	147.67
14	V_2T_7	70.0	99.9	160	0.96	2.20	139.41
S.E±	2.99	1.92	2.72	0.05	0.14	4.77	
CD @ 5%	8.66	5.57	7.88	0.16	0.41	13.82	
CV (%)	6.96	3.22	3.21	8.82	9.75	5.21	

seed yield per plant was recorded in T_4 (3.23g) followed by T_2 (2.50g) and T_1 (2.24g) while minimum seed yield per plant was recorded in T_7 (1.61g) followed by T_6 (1.78g). The results confirmed the reports of earlier findings in cumin [9,11] , fennel [13]and green gram [16].

Seed yield per plot (g)

When data was compared, it was shown that pre-sowing treatments had a significant influence on the varieties AA-1-19 the maximum seed yield per plot was recorded in T_4 (283.95g) followed by T_3 (199.65g) and T_1 (168.13g) while minimum seed yield per plot was recorded in T_7 (139.41g) followed by T_2 (141.67g) and T_6 (147.67g). In Local variety the maximum seed yield per plot was recorded in T_4 (166.33g) followed by T_5 (161.33g) and T_3 (155.33g) while minimum seed yield per plot was recorded in T_7 (121.33g) followed by T_1 (124.33g) and $_{T6}$ (124.67g).

CONCLUSION

The results concluded that the *T. harzianum* treatment showed maximum number of umbels. This was because it may have affected the rhizosphere around the seedling and protected it from wilt. Seed treatment with Trichoderma *spp*. resulted in minimum disease incidence and maximum improvement in seed yield. The number of seed yield per plant also showed the treatment with the *T. harzianum* was superior, it was dependent with the number of umbels similarly there was correlation between the seed yield per plant (g) and seed yield per plot (g). Hence in the study of pre -sowing seed treatments the maximum field emergence was observed with treatment GA_3 in both the variety. The maximum plant height, maximum number of umbel per plant, maximum seed yield per plant, maximum 1000 seed weight, maximum seed yield per plot was noticed by seed treatment with (*Trichoderma spp*.) i.e *T.harzianum*.

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