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Effect of pre-sowing seed treatments on seedling emergence, seed yield and yield attributes of cumin (*Cuminum cyminum* L)

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ABSTRACT

The experiment was conducted at Central Arid Zone Research Institute (Rajasthan) during *rabi* 2009-10. The cumin seed variety RZ-209 were given pre-sowing treatment with two fungicides, carbendazim and captan (3 g per kg seed); one growth hormone, ethephon (Ethrel) (800 ppm); two biocontrol agents, *Aspergillus versicolar* and *Trichoderma harzianum* (4 g per kg seed); water soaking/priming (3 hours) followed by shed drying and untreated control. The results revealed that pre-sowing seed treatments had improved the seedling emergence, seed yielding attributes and seed yield in cumin. The pre-sowing seed treatments with priming, ethephone, *T. harzianum* and *A. versicolar* had significant effect on plant height, branches per plant, seeds per umbel, seed yield and speed of germination and seedling emergence. About 26% higher emergence was observed due to priming followed by 23% 20% and 18.46 % with *T. harzianum*, ethephon and *A. versicolar* as compared to control. The mean germination time was non-significant but had reduced to 13.15 days and 13.61 days in case of primed seed and ethephon, respectively as compared to 14.31 days in control. A higher number of seeds germination, a higher number of plants survivals and a lower number of plants infections by cumin wilt, blight and powdery mildew were observed with the pre-sowing seed treatments with *T. harzianum*, *A. versicolar*, carbendazim and captan as compared to the other treatments and control. The incidence of powdery mildew was highest (43.2 %) followed by wilt (3.86 %) and blight (3.42 %) in control.

Key words : Cumin, seed treatment, emergence, seed yield and yield attributes.

INTRODUCTION

Cumin commonly known as *Jeera* (*Cuminum cyminum* L.) is grown extensively in Rajasthan, Gujarat and Haryana during *rabi* season and together accounts for over 85% of the total production of cumin seed, out of which Rajasthan state alone contribute around 52% of the total national production. It covers and contribute 1.5 lakh ha area and 23666 tons production in the state respectively (Anonymous, 2). Cumin seeds and oils are used in culinary preparations for flavouring vegetable, pickles, soup, sauces, cheese and seasoning of breads, cakes and biscuits (Behera *et al*., 4). It is also valued for its typical pleasant aroma from its volatile or essential oil (2.3 to 4.8%) (Agrawal and Sharma, 1). Apart from its culinary value, cumin is also extensively used in ayurvedic medicines.

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. Non availability of good quality seed, slow and uneven germination, low adoption of seed production technologies, degradation of quality due to microbial load, heavy infestation of diseases and pests, traditional harvesting & processing, unscientific and unhygienic handling post harvest storage are the major problem in realizing the production potential of cumin (Bhati, 5). 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 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 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 (Mandal and Basu, 11, Dey and Mukherjee, 6, Khan *et al*., 8 and Neamatollahi, 12). However, reports on pre-sowing seed treatments studies on cumin seed yield are scanty. Keeping these in view the present investigation was undertaken to enhance seed germination, improve plant establishment and increase seed yield of cumin.

MATERIALS AND METHODS

The experiment was conducted at Central Arid Zone Research Institute (Rajasthan) during *rabi* 2009-10. The required amount of cumin seed variety RZ-209 were

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treated with two fungicides, carbendazim and captan (3 g per kg seed); one growth hormone, ethephon (Ethrel) (800 ppm); two biocontrol agents, *Aspergillus versicolar* and *Trichoderma harzianum* (4 g per kg seed); water soaking/ priming (3 hours) followed by shed drying and untreated control. After pre conditioning the seeds were sown in the field on 12.11.2010 in 28 plots in four replicates of plot size 4.0 x 2.0 m having row to row spacing of 25 cm in RBD followed by first irrigation. The second, third, fourth and fifth irrigation was given on 7th, 30th, 55th and 70th days, respectively after sowing. The fertilizers schedule and weeding operations were followed according to the recommended practices. The per cent emergence of seedlings was counted on 10th, 13th, 15th, 18th and 21st days after sowing and vigour index viz., speed of germination and mean germination time was conducted as per Maguire (10), Nichols and Heydecker (13), respectively. The per cent disease incidence was calculated as number of diseased plants in one square metre quadrant. The yield attributes were recorded on five randomly selected representative plants and final seed yield by combined harvested plants in a plot.

RESULTS AND DISCUSSION

Pre-sowing seed treatments had direct influence on seedling emergence in the field. The seedling emergence was highest in case of primed seed followed by *T. harzianum*, ethephon and *A. versicolar* (Fig. 1). About 26% higher emergence was observed due to priming effect as compared to control. Similarly, pre-sowing seed treatment with *T. harzianum*, ethephon and *A. versicolar* increased the emergence by 23% 20% and 18.46 % as compared to the control. The speed of germination and seedling emergence was significantly highest in primed seed followed by seed treatments with ethephon, *T. harzianum* and *A. versicolar*. The mean germination time was non-significant but had reduced to 13.15 days and 13.61 days in case of primed seed and ethephon, respectively as compared to 14.31 days in control. Seed treatment with ethephon and priming recorded early seedling emergence due to prior activation of germination processes. Tawfik and Noga (16) also found similar results with seed priming of cumin. Pre-sowing seed treatments had always been found to be the beneficial effect on early and healthy seedling emergence and their establishments in the field. Omer, *et al*., (14) also reported that soaked seeds in plant growth regulators like, ethephon had significantly increased the number of germinating seeds and the number of surviving plants. More so, pre-washing of cumin in running water for 30 minutes improved germination from 71% in control to 82%. Fungicide pre-sowing seed treatment increased both the percentage germination and the vigour and yield whereas; captan reduced the plant vigour and yield (Singh, 15 and Ghasolia & Jain, 7). The bio-control agents also improved the germination (Vyas and Mathur, 17) which confirms the results. Seed priming with water (8 hrs), GA_3 (100 & 250 ppm) and thiourea (250 & 500 ppm) improved the emergence index of cumin as compared to the control (Anonymous, 3).

A higher number of seeds germination, a higher number of plants survivals and a lower number of plants infections by cumin wilt, blight and powdery mildew were observed with the pre-sowing seed treatments with *T. harzianum*, *A. versicolar*, carbendazim and captan as compared to the other treatments and control (Fig. 2). The incidence of powdery mildew was highest (43.2 %) followed by wilt (3.86 %) and blight (3.42 %) in control. Whereas, it was lowest in seeds treated with fungicides and bio-control agents. Omer, *et al*., (14) reported significant increase in the number of germinating seeds and the number of surviving plants and decrease in the number of wilted plants by soaked seeds in plant growth regulators. Further they have concluded that seeds of cumin should be soaked in ethephon at 800 ppm to increase plant resistance to cumin wilt and promote essential oil content. Similar findings with bio-control agents were also reported by Ghasolia and Jain (7) and Vyas and Mathur (17). Kishor Chand *et. al.* (9) studied pathogenecity of *Alterneria* with mancozeb, which gave highest seed germination (94%) and maintained minimum pre and post emergence mortality (2.0 & 1.5%) followed by captan, thiram and carbendazim.

Pre-sowing seed treatments improved the seedling emergence, seed yielding attributes and seed yield in cumin. The pre-sowing seed treatments with priming, ethephone, and *T. harzianum* had significant effect on plant height, branches per plant, seeds per umbel, seed yield and speed of germination (Table 1). Seed priming with water (8 hrs), GA_3 (100 & 250 ppm) and thiourea (250 & 500 ppm) increased the seed yield of cumin as compared to the control (Anonymous, 4). All the pre-sowing seed treatments with fungicides, carbendazim, captan, biological agents *Trichoderma harzianum* and *Aspergillus versicolar*; and plant growth hormone, ethrel; seed priming hot water and solar radiation, applied as seed treatment resulted in higher seed germination, root and shoot length and vigour index and lower pre-emergence and post-emergence mortality compared to the control (Ghasolia and Jain, 7).

Table 1. Seed yield and yield attributes of cumin

Treatments	Plant height, cm	Branches /plant	Umbels /plant	Seeds /umbel	Seeds yield kg/ha	Mean Germination Time	Speed of Germination
Captan	30.95	5.75	16.16	13.36	382.50	14.64	4.99
Bavistin	29.85	6.75	19.52	14.12	321.88	14.22	4.84
T. harzianum	30.95	6.80	20.52	15.09	401.25	14.61	5.83
Ethephone	31.20	7.51	20.19	15.00	427.50	13.61	5.96
A. versicolar	29.85	6.85	17.32	12.93	358.13	14.22	5.75
Priming	31.85	7.35	20.08	15.19	416.88	13.15	6.64
Control	28.90	6.02	18.84	12.22	346.88	14.31	4.78
SEm (±)	0.56	0.37	1.08	0.50	11.43	1.12	0.12
Cd (0.05)	1.65	1.07	3.17	1.47	33.96	1.35	0.36
CV (%)	4.14	12.18	12.90	8.07	6.03	1.90	5.00

Fig. 1. Field emergence and rate of emergence of cumin

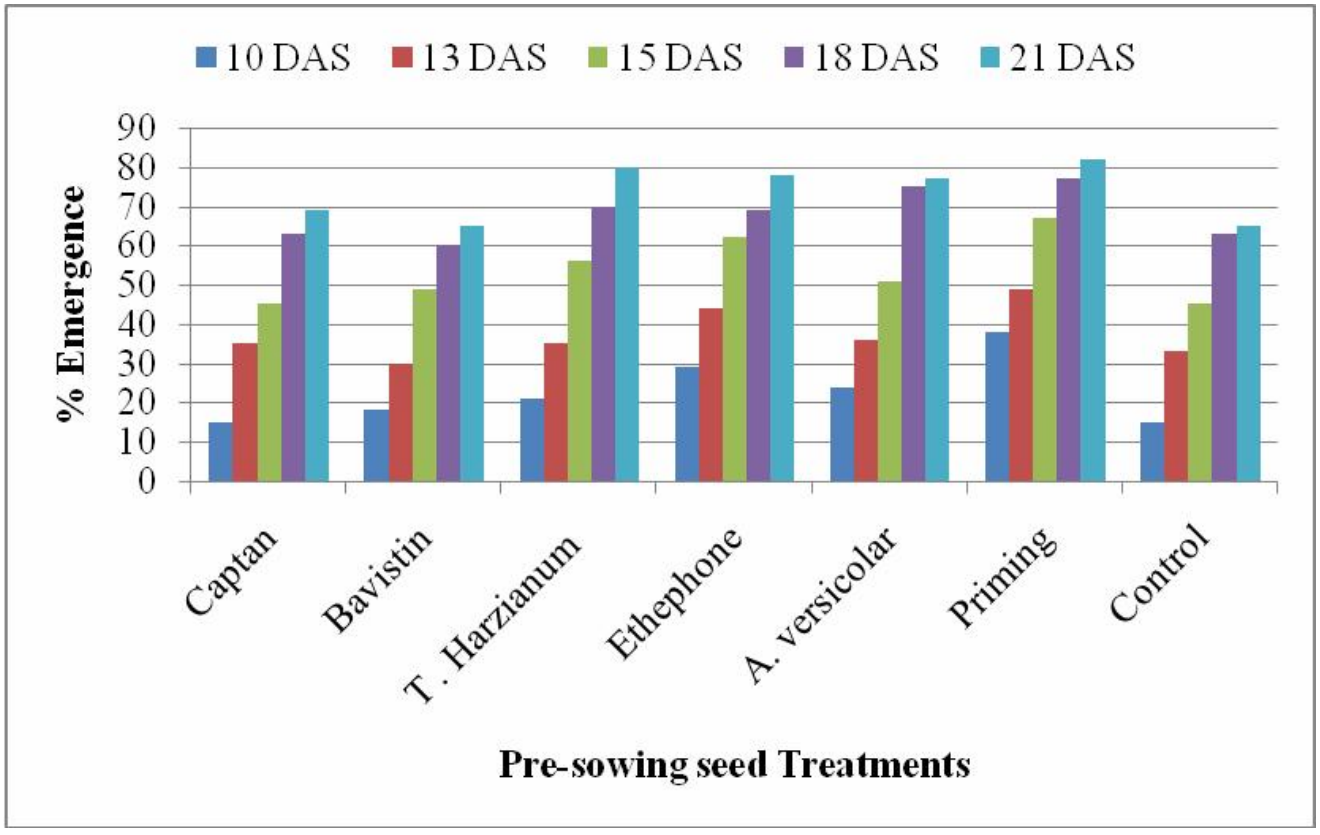
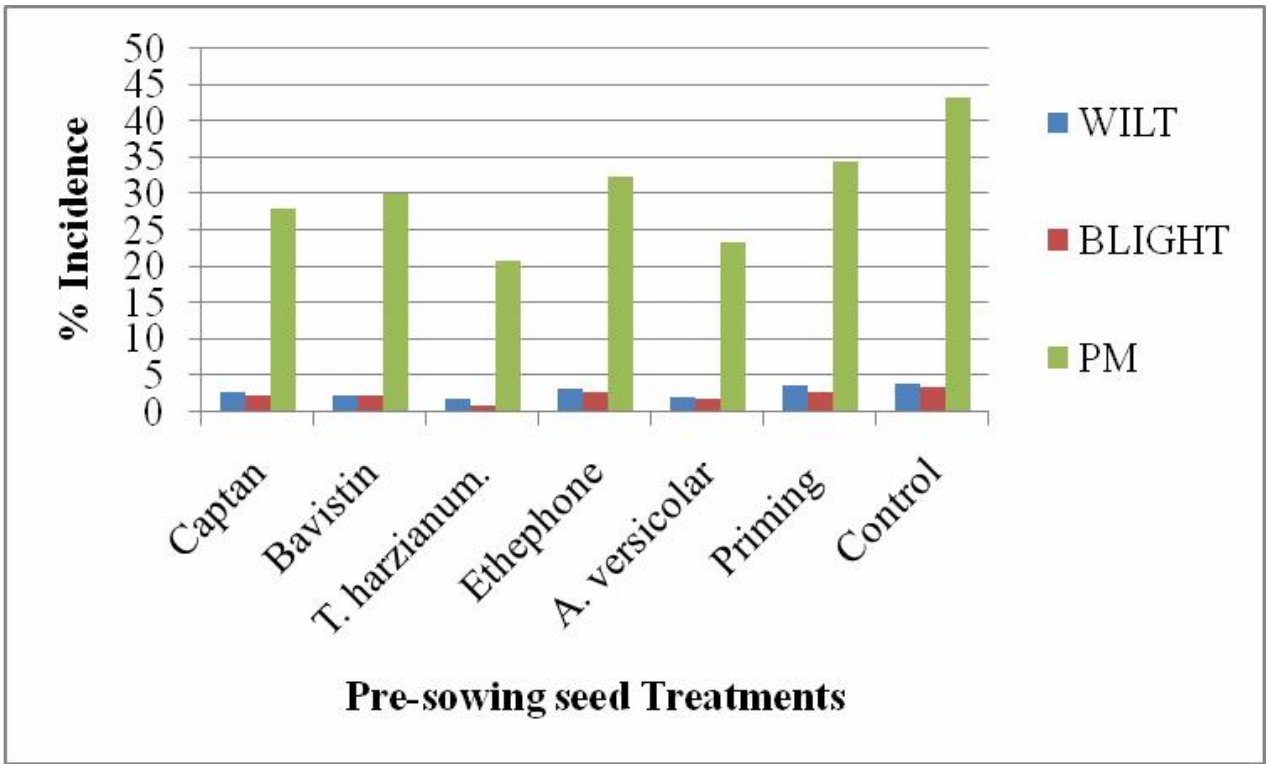


Fig. 2. Diseases incidence of cumin in the field



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