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Effect of Seed Priming with Micronutrients on Germination of Coriander (*Coriandrum sativum* L.) var Jawahar Dhaniya-1

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ABSTRACT: In order to evaluate the effects of seed priming with micronutrients on germination performance of the Coriander, an experiment was carried out under laboratory condition at the Department of Horticulture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh during *Rabi* season of 2020-2021. The experiment was laid out in Completely Randomized Design (CRD) with three replications and seven treatments *viz*. Cu @ 150 ppm, Cu @ 300 ppm, Cu @ 450 ppm, Mn @ 150 ppm, Mn @ 300 ppm, Mn @ 450 ppm and control. On the basis of mean performance for germination parameters *viz*., germination percentage, mean germination time, shoot length, root length, vigour index-I and vigour index-II, seed priming with 450 ppm Manganese significantly influenced all the germination parameters. Seed priming had significantly improved the germination parameters and seedling vigour. As the major constraints in successful crop production are poor germination and inappropriate crop stand which can be mitigated by the use of seed priming.

Keywords: Micronutrients, germination parameters, Manganese, mitigated etc.

INTRODUCTION

Spices apart from adding rich flavour, taste and colour to the food also has medicinal values. Coriander (*Coriandrum sativum* L.) also known as *Cilantro*, Chinese parsley or *Dhaniya* is one the important spice crop utilized daily in one form or the other. It belongs to the family Apiaceae and is native of Mediterranean region. It is an annual herbaceous plant best grown between October and February. In early stage of growth, the plant requires a cool climate and warm weather at maturity. It's tender aerial parts stem, leaf, fruits are used due to aromatic flavour. The entire plant when young is used in preparing chutneys and sauces. Coriander seeds possess immense medicinal values. Oleoresin extracted from coriander seeds is used in flavouring beverages, pickles and sweets. The crop is grown almost all the states of the country but Madhya Pradesh, Rajasthan, Gujarat, Assam, West Bengal, Uttar Pradesh and Andhra Pradesh are the major coriander growing states. Madhya Pradesh produces quality coriander and enjoys major share in area and production in the country. Madhya Pradesh is the leading state in area and production of seed coriander with 274475.47 ha and 373347.99 MT production respectively (Anonymous, 2020).

Rapid germination, emergence of seedlings establishment and uniform crop stand are essential for successful crop establishment. But the major constraints in successful crop production in Coriander are poor germination and inappropriate crop stand. This problem can be curtailed by adding seed priming in production practice (Chivasa *et al.*, 1998). Seed priming is a physiological method of controlled hydration followed by drying up to its original moisture content. The main aim behind seed priming is to enhance sufficient pre-germination metabolic process for rapid germination (Dawood, 2018). It is a simple, effective and low cost technique to ensure uniform emergence and high vigour of seeds which is leading to better crop establishment and yield. The quality of seed can also be enhanced by seed priming. Munawar *et al.* (2013) conducted a field experiment to study the effect of seed priming on germination and establishment of seedlings in carrot. Three micronutrients i.e. Zn, Mn and B in different concentration were used for priming. Significant differences were observed among treatments for emergence percentage and other seedling traits observed. Seed priming with boron solution inhibited the germination. Highest emergence percentage, rate of emergence, vigour index, hundred seedling weight were observed in case of seed priming with Zn (1.5%) solution. Mn (1.5%) and Mn (2%) solution showed highest mean shoot length and root length respectively. Jamshidian and Talat (2017) explained that seed priming in coriander with different solutions (water, Folic acid 75 mmol, Indole Acetic Acid 20ppm, humic acid 200mg/l, Ascorbic acid 30mg/l, P 100mmol, $K_2SO_4$100mmol, Zinc 100mmol, GA_3 40ppm) for 24 hours at 25°C have significant effect on the agronomic performance measurements including fresh weight of plant, plant height, distance of the first branch from ground, number of umbels, number of compound leaves, leaf surface area, total dry weight and seed weight.

Seed priming also proved to be beneficial in improving the seedling vigour, increasing shoot and root length, seedling fresh and dry weight, it is because due to priming leaching of growth inhibitors takes place and the activities of different enzymes like malate synthase, malate dehydrogenase and iso-citrate lyase enhanced (Lin and Sung, 2001).

MATERIAL AND METHODS

The experiment was conducted in Completely Randomized Design under laboratory conditions, at Department of Horticulture, College of Agriculture, Jabalpur, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh during *Rabi* season of 2020-2021. The experiment consists of seven treatments *viz.* seed priming with Copper @ 150 ppm, Copper @ 300 ppm, Copper @ 450 ppm, Manganese @ 150 ppm, Manganese @ 300 ppm, Manganese @ 450 ppm and control (Seed soaking in distilled water). The seeds were splitted into two halves before soaking them in different solutions of Copper and Manganese for 16 hr followed by surface washing with tap water and drying for 48 hr to their original moisture content. Seeds were sown in three portrays for evaluating germination and seed vigour parameter. Each protray was having 98 cells, therefore, there were 98 seeds per replication. The lab was visited on daily basis and data was recorded for germination and seedling vigour parameters. After complete germination, germination percentage was calculated. The numbers of germinated seeds were counted on daily basis and the data were complied successfully and germination percentage was calculated by following formula.

$$\text{Germination percentage (G\%)} = \frac{\text{Total no. of germinated seeds of a treatment}}{\text{Total no. of seeds sown in treatment}} \times 100$$

The Mean Germination Time (MGT) was calculated based on following equation of Ellis and Roberts (1981).

$$Me \quad Germination\,Time \;\; (MGT) = \frac{\Sigma nd}{N}$$

where, $\Sigma n = n1 + n2 + n3 + n4 + n5 + \ldots\ldots\ldots\ldots\ldots.. + nt$

n = number of seeds which were germinated on each day, d = number of days from the beginning of germination test. N = total number of seeds germinated at the termination of the experiment.

The root length and shoot length of randomly selected 10 seedlings of each treatment were recorded at 15 days after sowing.

The Vigour index of seedlings was computed by adopting the method suggested by Abdul Baki and Anderson (1973).

$$\text{Vigour Index I} = \text{Germination (\%)} \times \text{Seedling length (cm)}$$

$$\text{Vigour Index II} = \text{Germination (\%)} \times \text{Seedling dry weight (g)}$$

RESULT AND DISCUSSION

Seed priming with different concentration of micronutrients Cu and Mn, presented in Table 1 depicted and illustrated in Fig. 1 significant variation in germination parameters of coriander seeds under laboratory conditions. The data indicated that the seeds primed with Mn @ 450 ppm (SP_6) recorded maximum germination percentage (96.18 %) followed by Cu @ 450 ppm (SP_3) with 95.81 % and Cu @ 300 ppm (SP_5) with 93.78 % germination percentage (GI) over unprimed seeds (SP_7). Seeds primed with Mn @ 450 ppm recorded the significant improvement in all the germination parameters as well as seedling vigour. Similar results have been reported by Babaeva *et al*. (1999) on priming of *Echinacea purpurea* (L.). They revealed that seed primed with 0.1% $MnSO_4$ solution enhanced germination by 36% and also improved stand establishment. The high germination percentage (96.18 %) and synchronized germination of primed seeds was due to reduction in the lag time of germination (Brocklehurst and Dearman 2008) and activation of enzymes (Lee and Kim 2000). Primed seeds quickly imbibe water and restore seed metabolism thereby increasing the rate of germination (Jisha *et al*., 2013).

With respect to the data of mean germination time (MGT) of coriander presented in Table 2 and Fig. 2, significant variation was recorded among different priming treatments. Among treatments Mn @ 450 ppm (SP_6) primed seeds exhibited least mean germination time (MGT) *i.e*., 6.99 followed by Cu @ 450 ppm (SP_3) with 7.51 and Mn @ 300 ppm (SP_5) with 7.94 MGT. It was maximum (8.56 days) in control (SP_7). Enhanced germination parameters may be due to the various biochemical, physiological and molecular change that start during seed priming which includes build up of germination enhancing metabolites (Hussain *et al*., 2015), metabolic repair during imbibition (Farooq *et al*., 2006), reducing damage to protein, RNA-DNA (Farooq *et al*., 2009), synthesis of protein, nucleic acids and repairing of membranes (McDonald, 2000).

The result of seedling shoot and root length presented in Table 2 and illustrated in Fig. 3 revealed that the different priming concentration of Cu and Mn have significantly increased the length of shoot. The maximum shoot length 2.96 cm was observed when the seeds were treated with Mn @ 450 ppm (SP_6) followed by SP_5 (Mn @ 300 ppm) with 2.79 cm. The shoot length was the minimum (2.33 cm) in SP_7 (control). Significantly maximum root length 9.21cm was measured in the seedling of SP_6 (Mn @ 450 ppm) followed by SP_5 (Mn@ 300ppm) with 8.20 cm root length. The minimum root length 5.81 cm was observed in unprimed seeds. Munawar *et al.* (2013) also concluded that seed treated with Mn 1.5 % and Mn 2% showed highest shoot and root length respectively.

The data of Vigour index I and Vigour index II was computed and represented in Table 2 and illustrated in Fig. 4 and 5. The data revealed that there was a positive influence of micronutrients and their specific concentration on the vigour index. The highest value 1172.72 and 5.36 of vigour index I and vigour index II respectively was observed from treatment SP_6 (Seed priming with Mn @ 450 ppm) followed by SP_3 (Cu @ 450 ppm). The lowest vigour index- I (714.67) and vigour index-II (3.17) was recorded in control over control. Munawar *et al*. (2013) also revealed that seed priming with Mn improves the vigour index in carrot. Farooq *et al.* (2012) reported that seed priming with Mn improves seedling establishment.

Table 1: Analysis of variance for studied traits.

Source of variation	df	Mean sum of squares					
Replication		Germination (%)	Mean germination Time (days)	Shoot length(cm)	Root length (cm)	Vigour index I (cm)	Vigour index II (g)
Treatment	6	0.084	0.850	0.145	3.482	66,312.047	2.340
Error	14	0.002	0.020	0.018	0.017	858.258	0.033

Table 2: Effect of seed priming with micronutrients on mean performance of germination parameters and seed vigour parameters.

Seed priming	Germination (%)	Mean Germination Time (days)	Shoot length (cm)	Root length (cm)	Vigour index-I (cm)	Vigour index-II (g)
SP1 Cu 150 ppm	88.08 (9.49)*	8.79	2.48	6.90	835.58	3.64
SP2 Cu 300 ppm	91.96 (9.64)	8.00	2.74	7.82	971.62	4.65
SP3 Cu 450 ppm	95.81 (9.83)	7.51	2.65	8.14	1034.42	5.36
SP4 Mn 150 ppm	92.34 (9.66)	8.14	2.45	7.58	926.81	4.48
SP5 Mn 300 ppm	93.78 (9.73)	7.94	2.79	8.20	1031.33	4.90
SP6 Mn 450 ppm	96.18 (9.85)	6.99	2.96	9.21	1172.72	5.64
SP7 Control	87.59 (9.41)	8.56	2.33	5.81	714.67	3.17
S.Em±	0.02	0.08	0.07	0.07	16.91	0.10
C.D. 5% level	0.07	0.25	0.23	0.22	51.80	0.32

*Value in the paranthesis are square root transformed values.

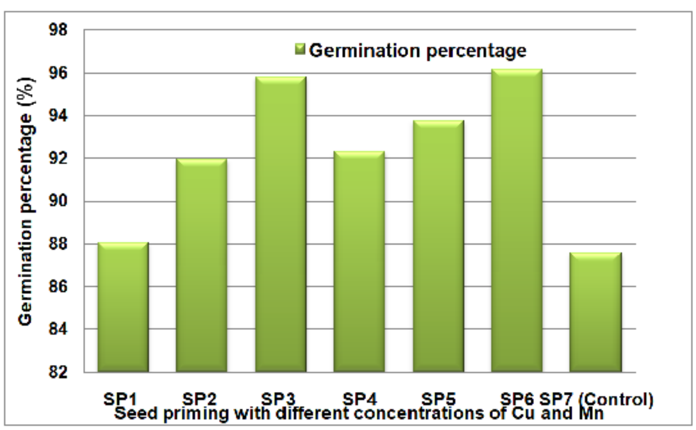

Fig. 1. Effect of seed priming on germination percentage.

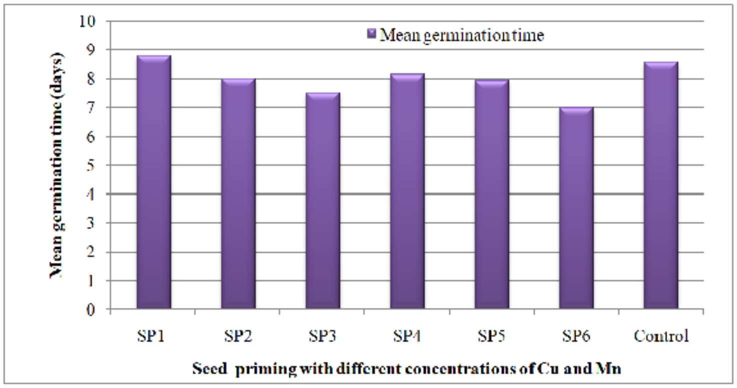

Fig. 2. Effect of seed priming on mean germination time.

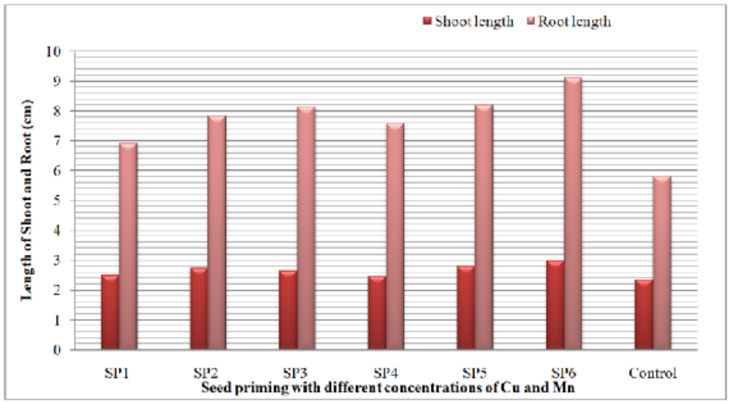

Fig. 3. Effect of seed priming on shoot and root length.

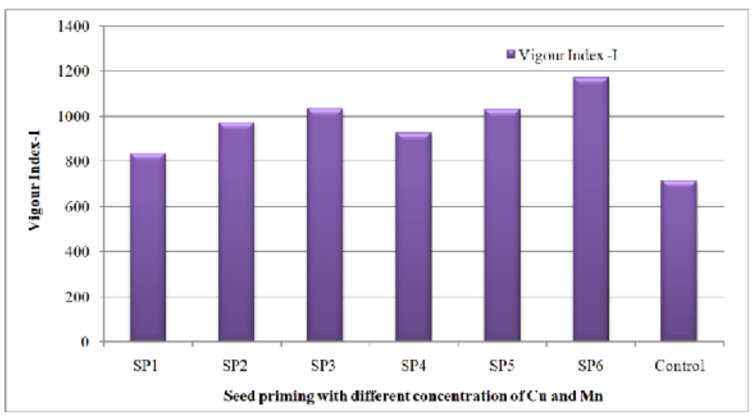

Fig. 4. Effect of seed priming on vigour index-I.

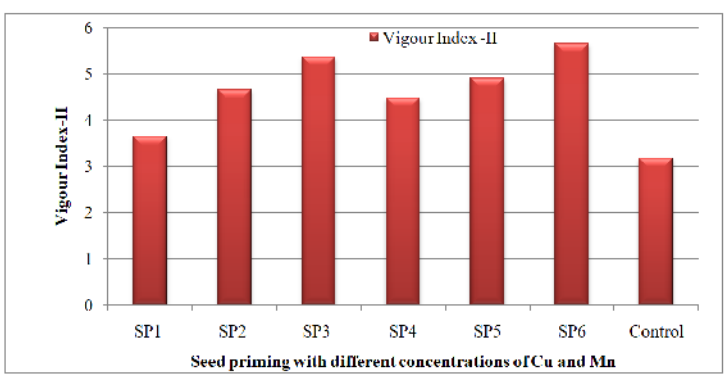

Fig. 5. Effect of seed priming on vigour index-II.

CONCLUSION

As regards to germination and seedling vigour parameters, the best results were recorded when seed of coriander var Jawahar Dhaniya-1 were primed with Manganese at 450 ppm closely followed by Copper at 450 ppm. The micronutrients as well as their appropriate concentrations play an important role in enhancing the germination and further growth of crop. Seed priming can be considered as the best method to enhance the seed performance. For further research, seed priming with different micronutrients and different priming techniques can also be included. Seed priming has scope in future as it is one of simplest way of dealing with poor germination of seeds.

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Conflict of Interest. The authors have not declared any conflict of interest**.**

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