



## **Effect of variable mode of pollination on plant growth, yield attribute and yield enhancement on Coriander (*Coriandrum sativum* L.)**

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### **ABSTRACT**

A filed experiment was conducted at the institute's farm, NRC on Seed Spices (ICAR), Tabiji, Ajmer (Rajasthan) during Rabi season of 2014-15. The soil of research farm is sandy loam, poor in fertility and water holding capacity, having pH 8 to 8.3, EC 0.07 to 0.12 dS/m and 0.15 to 0.23% organic carbon, available N 178.5, P<sub>2</sub>O<sub>5</sub> 12, K<sub>2</sub>O 85, Ca 214.7, Mg 258 and S 27 kg/ha. The treatments including: T<sub>1</sub>-without insect pollination (caged), T<sub>2</sub>- open pollination, T<sub>3</sub>-Bee pollination with *Apis mellifera* -Caged, T<sub>4</sub>-Sugar solution (10%), T<sub>5</sub>-Jaggery solution (10%) and T<sub>6</sub>-Organic control (Organic salt 5ml/lit.). The higher plant height (147.43 cm), no. of primary branches (17.25), no. of umbels/plant (50.33), no. of umbellates/umbel (10.45), no. of seed/umbellates (19.16) and test weight (8.75g) of coriander variety Acr-1 were recorded in bee population with *A. mellifera* under the plots covered with insect proof nylon nets. The highest seed yield 2176.2 kg/ha of coriander was obtained in plots caged with *A. mellifera* colony for bee pollination, whereas lowest yield of 905.3 kg/ha was recorded in without insect pollination -WIP plots with no input of flower visitors. It was also indicated that the 140.3% yield increased in bee pollination over the yield of without insect pollination -WIP (plots caged without insects). The yield of other treatments was in between and statistically at par with each other.

**Key words:** *A. mellifera*, Coriander, Pollination, Yield

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### **INTRODUCTION**

Coriander (*Coriandrum sativum* L.) is an annual herbaceous plant, belongs to the family Apiaceae (Umbelliferae). It is also popularly known as 'Dhania' (Evans *et al.*, 2002). Coriander plants are erect, branched having 60-100 cm height usually but it can go even up to 150 cm in case of coriander variety ACr-1 with tap root, stem are erect hollow, leaves dimorphic alternate. India alone produced 314 thousand metric tons of seeds from an area of 447 thousand hectare along with average productivity of 0.7 MT/ha during the year 2013-14 [1]. In the country, coriander is mostly growing in Rajasthan, Gujarat, Andhra Pradesh, Madhya Pradesh, Maharashtra, Uttar Pradesh and Bihar. Rajasthan is the leading coriander producing state with its share of about 60% in the total area and production of the country. In Rajasthan, coriander occupies a prime place amongst all seed species, which are cultivating in the districts of Baran, Kota, Jhalawar, Bundi, Sikar, Tonk, and Nagaur.

Coriander green leaves contain 87.9% moisture, 3.3% protein, 0.6% fat, 6.5% carbohydrates and 1.7% mineral matter. The mature dry seeds are tan to brownish-yellow and have 6.3-8.0% moisture, 1.3% protein, 0.3-1.7% volatile oil, 19.6% non-volatile oil, 31.5% ether extract, 24.0% carbohydrates, 5.3% mineral matter and vitamin A 175 IU per 100 g. A pleasant aromatic odour is present in the stem, leaves and fruits of coriander, and it is due to presence of  $\alpha$ -linalool or coriander oil [10, 7]. Seeds are the primary ingredient of curry and Dhania dal. The seeds of coriander are also useful in relieving flatulence, indigestion, vomiting, intestinal disorders and treatment of various ailments like bleeding piles, mucous, diarrhea, rheumatism, and in eye infection [8, 11].

Among the various insect pollinators from different orders and families, honeybees perform the most important role in pollination of seed spices. Honeybees are to be considered as major pollinators of coriander crops in semi-arid region of Rajasthan play a major role in enhance the yield significantly.

## **MATERIAL AND METHODS**

A filed experiment was conducted at the institute's farm, NRC on Seed Spices (ICAR), Tabiji, Ajmer (Rajasthan) during *Rabi* season of 2014-15. The site is situated in mid part of Rajasthan. The soil of research farm is sandy loam, poor in fertility and water holding capacity, having pH 8 to 8.3, EC 0.07 to 0.12 dS/m and 0.15 to 0.23% organic carbon, available N 178.5, P<sub>2</sub>O<sub>5</sub> 12, K<sub>2</sub>O 85, Ca 214.7, Mg 258 and S 27 kg ha<sup>-1</sup>. Weather, the non- monetary input influence the growth, yield and quality of crops as well as biotic phase of soil during the growing season, hence it is important to present climatic variables in this context. The experiment was laid out in factorial randomized block design with four replications and six treatments. The treatments including: T1- without insect pollination (caged), T2- open pollination, T3- Bee pollination with *Apis mellifera* –Caged, T4- Sugar solution (10%), T5- Jaggery solution (10%) and T6- Organic control (Organic salt 5ml/lit.). The seeds of coriander variety ACr-1 were sown on 12 November, 2014 in well prepared field keeping a depth of 1.5cm in rows spaced at 30cm. The seeds were used @ 12 kg /ha. A uniform dose of FYM 10-20 t/ha, 40kg N/ha, 30 kg P<sub>2</sub>O<sub>5</sub>/ha and 20 kg K<sub>2</sub>O/ha as basal dose and remaining 20 Kg of N in two equal split dose at 30 and 60 days after sowing as a top dressing. These fertilizers were given through urea, single super phosphate and muriatic of potash, respectively. After harvesting the plant it kept for sun drying then threshed it.

## **RESULT AND DISCUSSION**

### **Effect of variable mode of pollination on plant growth**

#### **Plant height**

The maximum average plant height (147.43 cm) was recorded in bee pollination, wherein plants caged with insect proof nylon net for bee pollination with *A. mellifera* followed by without bee pollination-WIP (146.5 cm), in which plants caged with insect proof nylon net and no insects were allowed for pollination over the flowering period, although both the treatments were statistically at par but significantly more plant's height was recorded than rest of the treatments. The next higher average plant height (131.08 cm) was recorded in plots treated with organic salt (organic control) followed by open pollination (130.92 cm), jaggery solution (126.50 cm) and sugar solution (126.33 cm) treated plots. The plant heights under these four treatments were statistically at par with each other, hence there were no differences observed due to treatments. The literatures on the effect different mode of pollination on plant height are not available so far, hence, the results could not be discussed and compared.

#### **No. of primary branches**

The highest average no. of primary branches (17.25) was recorded in bee pollination, wherein plants caged with insect proof nylon net for bee pollination with *A. mellifera* followed by without bee pollination-WIP (15.76), in which plants caged with insect proof nylon net and no insects were allowed for pollination over the flowering period.

The average no primary branches in open pollination, sugar solution 10%, jaggery solution 10% and organic control were ranged from 12.00 to 11.62 nos. and among these, no significant differences were recorded between treatments. The literatures on the effect different mode of pollination on no. of primary branches/plant are not available so far; hence, the results could not be discussed and compared.

#### **No. of umbels/plant**

The no. of umbels/plant in coriander variety ACr-1 was varied in different treatments. The highest average no. of umbels/plant (50.33) was recorded in bee pollination, wherein plants caged with insect proof nylon net for bee pollination with *A. mellifera* followed by without bee pollination-WIP (47.92), in which plants caged with insect proof nylon net and no insects were allowed for pollination over the flowering period, although both the treatments were statistically at par but significantly more no. of umbels/plant was recorded than rest of the treatments. The average no of umbels/plant in open pollination, jaggery solution 10%, sugar solution 10%, and organic control were 43.86, 43.15, 42.68 and 42.00, respectively and among these, no significant differences were recorded between treatments. The literatures on the effect different mode of pollination on no. of umbels/plant are not available so far, hence, the results could not be discussed and compared.

#### **No. of umbellates/umbel**

The highest average no. of umbellates/ umbel (10.45) was recorded in bee pollination, wherein plants caged with insect proof nylon net for bee pollination with *A. mellifera* found significantly superior over rest of the treatments. The treatment of without bee pollination-WIP was recorded second next effective treatment had 8.12 umbellates/umbel, in which plants caged with insect proof nylon net and no insects

were allowed for pollination over the flowering period. The average no of umbellates/umbel in open pollination, jaggery solution 10%, sugar solution 10%, and organic control were 7.05, 6.72, 6.41 and 6.40, respectively and among these, no significant differences were recorded between treatments. The literatures on the effect different mode of pollination on no. of umbellates/umbel are not available so far, hence, the results could not be discussed and compared.

#### Effect of different mode of pollination on yield attributes and yield

##### No. of seeds/umbellate

The maximum average no. of seeds/ umbellate (19.16) was recorded in bee pollination, which was significantly higher than without bee pollination-WIP (10.06 seeds/umbellate). The next higher average no. of seeds/umbellate (18.46) was recorded in plots treated with Jaggery solution followed by open pollination (15.2 seeds/umbellate), sugar solution (16.08 seeds/ umbellate) and organic salt for organic control (14.78 seeds/ umbellate). Chandrashekhar and Sattigi [2] reported positive impact of jaggery solution (10%) and sugar solution (10%) in increasing no. of seeds/pod in radish in UAS, Dharwad get support the present findings. Prasad *et al.* [9] also reported more number of seeds crop sprayed with jaggery solution (10%) followed by sugar solution (10%) in *Brassica* sp.

##### Test weight

The highest average test weight (8.57g) was recorded in the treatment of bee pollination, wherein plants caged with insect proof nylon net for bee pollination with *A. mellifera* and which was significantly higher than the treatment of without insect pollination-WIP, wherein test weight was 7.92g. The test weight of coriander variety ACr-1 in other treatments *i.e.* open pollination, jaggery solution 10%, organic control and sugar solution 10% were 8.45, 8.43, 8.29 had 8.25g, respectively. Chandrashekhar and Sattigi [2] also reported the positive impact of jaggery solution (10%) and sugar solution (10%) in increasing test weight in radish to get support the present findings.

##### Grain yield

The highest yield (2176.2 kg/ha) was obtained from the plots caged with *A. mellifera* colony for bee pollination and which was significantly superior over rest of the treatments. Whereas, the lowest yield of 905.3 kg/ha was recorded in without insect pollination-WIP plots with no input of flower visitors.

The next highest yield of 2025 kg/ha was achieved from open plots treated with jaggery solution followed by 1982.5 kg/ha from plots treated with sugar solution, 1965 kg/ha from plots exposed to natural pollination, which was considered as open pollination, and 1936.5 kg/ha from the plots treated with organic salt. The yields obtained from these four treatments (mode of pollination) were being statistically at par with each other. Choudhary and Singh [3] also recorded the similar results in coriander get support to the present findings. Dhakal [4] reported that bee pollination improves the yield and quality of crops, such as fruits, vegetable seeds, spices, oilseeds and forage crops.

The yield increased in bee pollination plot caged with insect proof nylon net and applied one four framed *A. mellifera* colony 140.3%, 123.7% in Jaggery solution, 118.9% sugar solution and 117.05% yield of without insect pollination, 10.7% yield increased in bee pollination (caged with *A. mellifera*) and 3.1% yield increased in Jaggery solution treated plots. Choudhary and Singh [3] reported 122.2% higher yield in bee pollination (Caged with *A. mellifera*) as compared with without insect pollination-WIP. Kumar and Jaiswal [6] recorded higher seed yield (96.55%) and germination percentage (79.75%) of coriander due to insect pollination. Chandrashekhar and Sattigi [2] also reported the positive impact of jaggery solution (10%) and sugar solution (10%) in increasing the yield of radish to get support the present findings.

**Table 1. Effect of variable mode of pollination on plant growth and yield attribute**

Treatment	Plant height (cm)	No. of primary branches	No. of umbels/plant	No. of umbellate/umbel	No. of seeds/umbellate	Test weight (g)
WIP	146.5	15.96	47.92	8.12	10.06	7.92
OP	130.92	12.00	43.86	7.05	15.2	8.45
BP (Caged)	147.43	17.25	50.33	10.45	19.16	8.57
Sugar Solution (10%)	126.33	11.62	42.00	6.40	16.08	8.25
Jaggery solution (10%)	126.50	11.75	43.15	6.41	18.46	8.43
Organic control	131.08	11.83	42.68	6.72	14.78	8.29
Overall mean	135.13	13.40	44.98	7.53	15.62	8.32
CD (p=0.05)	5.60	3.61	3.88	1.55	2.57	0.32

**Table 2. Effect of variable mode of pollination on yield enhancement**

Treatment	Seed yield (kg/ha)	Per cent change over					
		WIP	OP	BP	Sugar solution (10%)	Jaggery solution (10%)	Organic salt (5ml/lit)
WIP (caged)	905.3*	-	-53.9	-58.4	-54.3	-55.3	-53.2
OP	1965	117.05	-	-7.9	-0.8	-2.9	1.4
BP (Caged)	2176.2	140.38	10.7	-	9.7	7.5	12.3
Sugar Solution (10%)	1982.5	118.99	0.9	-2.1	-	-2.1	2.3
Jaggery solution (10%)	2025.0	123.68	3.1	-6.9	2.1	-	4.5
Organic control	1936.5	113.90	-1.5	-11.0	-2.3	-4.3	-
CD (p=0.05)	117.12						

\*Mean of four replication, WIP- Without insect pollination, OP- open pollination, BP- Bee pollination

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