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Effect of different orgopriming and foliar spraying treatments in coriander (*Coriandrum sativum* L.) for seed yield and its quality parameters

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Abstract— *Coriander is a vital spice crop in India, but its prolonged germination often delays crop establishment. As the world's leading producer, India must adopt innovative agronomic strategies to enhance early growth and overall productivity. To address this, two experiments-one in the laboratory and one in the field were conducted during the Rabi season of 2023–24 at the Seed Testing Laboratory and Sagdividi Farm, Department of Seed Science and Technology, Junagadh Agricultural University, Junagadh. The study aimed to evaluate the effects of orgopriming and foliar spray treatments on seed quality, growth and yield of the coriander variety Gujarat Coriander-3 (GC-3). Six seed priming treatments were tested under both lab and field conditions, while the field experiment also included foliar spraying treatments as a second factor. Among priming treatments, tender coconut water significantly enhanced germination (81.25%), root length (6.08 cm), shoot length (8.31 cm), seedling length (14.39 cm), seedling fresh (397.70 mg) and dry weight (32.18 mg) and seedling vigour indices (1168.97 and 2614.51). In field performance, it also improved field emergence (82.33%), plant height (76.39 cm), number of umbels per plant (20.88), umbellets per umbel (8.17), seeds per umbellet (10.68), seeds per umbel (61.44), 1000-seed weight (12.56 g), and seed yield per plant (12.48 g) and led to earlier flowering (50.50 days). Among foliar sprays, Jivamrut (10%) significantly increased all growth and yield parameters compared to the control. The highest plant height (80.97 cm), with a 40.48% increase over control, was recorded with the interaction of Bijamrut (10%) priming and Jivamrut (10%) foliar spray. Thus, seed priming with tender coconut water and foliar spraying with Jivamrut (10%) can substantially improve the seed quality and yield of coriander.*

Keywords – ***Coriander, germination, Jivamrut, orgopriming, yield***

I. INTRODUCTION

India, often referred to as the land of spices, is globally renowned for its diverse use of plant-derived condiments that enhance the sensory qualities of food. Among these, coriander (*Coriandrum sativum* L.), commonly known as "Dhania," is a widely used spice, appreciated for its characteristic aroma, flavour and versatility in both fresh and dried forms. Additionally, coriander holds medicinal significance in Ayurvedic practices due to its digestive and therapeutic properties [1]. Belonging to the family *Apiaceae* (*Umbelliferae*), coriander is a diploid species (2n = 2x = 22) and its aromatic quality is primarily attributed to the essential oil compound *linalool*

[2]. India is the leading producer, consumer and exporter of coriander, accounting for approximately 80% of global production [3].

Despite its economic and culinary importance, coriander cultivation faces challenges related to poor seed germination and uneven field emergence, often caused by low seed vigour. Seed priming has emerged as an effective method to improve germination performance and seedling establishment. Among various approaches, *orgopriming*—the treatment of seeds with organic solutions—has shown potential in enhancing seed metabolic activity and early growth [4]. In addition to seed treatments, nutrient application through foliar sprays offers a cost-effective method to meet crop nutrient demands during critical stages of development [5]. Organic foliar inputs, rich in plant hormones, micronutrients, and beneficial microbes, improve soil health and crop productivity while minimizing environmental risks associated with chemical fertilizers [6].

Given the limitations of chemical-based inputs, there is an increasing emphasis on adopting sustainable and eco-friendly agricultural practices [7]. The emerging era of natural and organic farming promotes soil health, enhances nutrient cycling and reduces environmental pollution, ensuring long-term agricultural sustainability [8]. The reason behind selecting organic compounds as priming agents is that they leverage natural bioactive compounds - such as growth hormones, vitamins and amino acids found in substances like tender coconut water - to enhance seed germination and seedling vigour in an eco-friendly manner while avoiding the potential environmental hazards, chemical residues and dependency on synthetic inputs associated with chemical priming agents. The orgoprimers [9] and foliar treatments were selected due to their higher nutrient composition, presence of various vitamins, phytohormones, necessary micro-organisms and disease-resistance properties. In this context, the present investigation was undertaken to evaluate the impact of organic seed priming and foliar treatments on the growth, seed quality, and yield attributes of coriander under field conditions.

II. MATERIALS AND METHODS

Two different experiments were carried out during *Rabi* 2023-24 at the Seed Testing Laboratory, DSST, JAU, Junagadh for laboratory experiment and *Sagdividi* Farm, DSST, JAU, Junagadh for field experiment. Genetically pure seeds of variety Gujarat Coriander-3 (GC-3) were obtained from Research Scientist (G & O), Vegetable Research Station, Junagadh Agricultural University, Junagadh.

Six different priming agents along with control were used for orgopriming *viz*., P_0: Control (untreated dry seeds), P_1: *Panchagavya* - 6 %, P_2: *Bijamrut* - 10 %, P_3: *Jivamrut* - 10 %, P_4: Cow urine - 3 %, P_5: *Trichoderma harzianum* - 4 %, P_6: Tender coconut water. Different foliar spraying treatments (F_0: No spray, F_1: Cow urine - 50 %, F_2: *Jivamrut* - 10 %, F_3: Buttermilk) were also evaluated as the second factor. The experiment was conducted with three replications at 30 × 15 cm spacing. Seeds were soaked in different priming solutions for eight hours at room temperature. Afterwards, the seeds were removed from the solutions and dried in the shade at room temperature until they returned to their original moisture content. Foliar spraying was done twice, each at 35 and 55 days after sowing.

The laboratory germination test was conducted as per ISTA [10] procedure by adopting top of the paper method. 100 seeds in four replications were taken at random from the seed lot of each treatment, placed uniformly on germination paper and kept in the control environment, where the temperature was maintained at 25 ± 0.50°C. The final counts were made on the 21st day of the germination test for normal seedlings and germination was expressed in percentage. Ten normal seedlings were selected randomly from the germination paper (T.P) on final day of counting germination and root and shoot length were measured from the tip of primary root to the tip of shoot. The mean root and shoot length were expressed in centimeters. Seedling length was measured by adding root and shoot length in centimeters. To record seedling fresh weight ten seedlings were counted, cut free from their cotyledon and weighted while still moist. Their weights were recorded in milligram. These seedlings were kept in a hot air oven for 24 hours at a temperature of 100°C as described by Gupta [11]. The weight of the dried seedlings was recorded and expressed in milligram. Seedling vigour index-I and II were computed using following formula suggested by Abdul-Baki and Anderson [12] and mean values were expressed in the whole number.

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

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

The laboratory data were analyzed statistically adopting the procedure described by Panse and Sukhatme [13].

The following parameters were recorded for the field study: field emergence (%), days to 50 per cent flowering, plant height (cm), number of umbels per plant, number of umbellets per umbel, number of seeds per umbellet, number of seeds per umbel, 1000 seed weight (g) and seed yield per plant (g). From each treatment of each

replication, five selected plants were tagged for recording observations. Mean of five plants for each character was worked out and used for statistical analysis. Observations were recorded at maturity stage of plant growth on all the quantitative characters. The experimental data was analysed statistically by adopting randomized block design as described by Panse and Sukhatme [13] for field emergence and randomized block design (Factorial) as described by Cochran and Cox [14] for the rest of the characters and ANOVA was used to assess treatment effects.

III. RESULTS AND DISCUSSION

There is significant difference observed among priming treatments for all laboratory observations under study. The results of laboratory observations are depicted in Figure 1 and Table 1 and 2. Seeds primed with tender coconut water (P_6) recorded significantly higher germination (81.25%, a 21.72 % increase), root length (6.08 cm, a 41.72 % increase), shoot length (8.31 cm, a 30.66 % increase), seedling length (14.39 cm, a 35.12 % increase), seedling fresh weight (397.70 mg, a 21.90 % increase) and seedling dry weight (32.18 mg, a 30.49 % increase), seedling vigour index-I (1168.97, a 64.54 % increase) and seedling vigour index-II (2614.51, a 59.05 % increase). *Bijamrut* showed at par effect (20.60 %, 39.39 %, 27.99 %, 32.68 %, 20.41 %, 28.43 %, 60.06 % and 55.04 % increase, respectively) compared to control. Control seeds showed the lowest result for all the above-mentioned characters.

The significantly superior above-mentioned traits were recorded in seeds primed with tender coconut water might be due to its content of enzymes, phytohormones and growth promoting substances especially cytokinin that promotes cell wall degradation. This can help soften hard seed coats, allowing the radicle (root) and plumule (shoot) to emerge more easily during germination. These hormones promote cell division and cell elongation, leading to increased seedling size and weight. Similar results were obtained by different researchers for different crops [15, 16, 17, 18, 19, 9].

The results of different field parameters are given in Table 3-11. Irrespective of foliar spraying, there was a significant difference among priming treatments for all the characters studied. Seeds primed with tender coconut water (P_6) recorded significantly higher field emergence (82.33 %, a 25.37 % increase), plant height (76.39 cm, a 19.62 % increase), number of umbels per plant (20.88, a 23.99 % increase), number of umbellets per umbel (8.17, a 21.04 % increase), number of seeds per umbellet (10.68, a 25.06 % increase), number of seeds per umbel (61.44, a 19.58 % increase), 1000 seed weight (12.56 g, a 12.04 % increase) and seed yield per plant (12.48 g, a 15.13 % increase), while also reducing the number of days to 50 % flowering (50.50) by 12.38 % compared to the control. *Bijamrut* showed at par effect (19.28 %, 17.08 %, 19.54 %, 19.26 %, 21.66 %, 16.00 %, 9.19 % and 11.72 % increase respectively) compared to control. Control seeds showed the lowest result for all the above-mentioned characters.

The notable improvement in plant growth and yield traits observed in seeds treated with tender coconut water (P_6) and *Bijamrut* (P_2) could be attributed to the presence of plant growth regulators such as auxins, cytokinins and gibberellins. These hormones are known to enhance stem elongation [15], thereby promoting quicker germination and vigorous early seedling development. Coconut water activates key metabolic processes, including starch breakdown, which boosts energy availability and supports rapid radicle emergence and robust seedling establishment [20]. Moreover, the natural sugars and electrolytes it contains help regulate osmotic balance during the hydration phase, minimizing the risk of imbibitional injury and encouraging uniform sprouting [21]. Its rich composition of vitamins and phenolic compounds also imparts antioxidant properties, which protect seed tissues from oxidative damage during the germination process [22].

In addition, tender coconut water provides vital nutrients like potassium, magnesium, and calcium, which enhance enzyme functions and energy metabolism, thereby supporting improved seedling establishment [20]. This contributes to notable advancements in plant growth, development and yield components, particularly influencing flowering and fruit or pod formation. The use of tender coconut water and *Bijamrut* as seed priming agents has been shown to improve growth and yield traits in crops such as okra and cowpea, respectively [19, 23]. Regardless of the type of orgopriming treatment, the number of days to 50% flowering showed no significant variation across different foliar spray treatments. However, foliar application of 10% *Jivamrut* (F_2) significantly boosted plant height, number of umbels per plant, umbellets per umbel, seeds per umbellet, seeds per umbel, 1000-seed weight and seed yield per plant, showing increases of 72.36 cm (+5.80%), 19.79 (+8.98%), 7.83 (+8.75%), 10.41 (+19.38%), 59.35 (+12.02%), 12.41 g (+8.57%) and 12.20 g (+9.42%) respectively, when compared to the control. This was followed by the performance of 50% cow urine (F_1). The lowest values for these parameters were recorded in the untreated control group (F_0), with plant height of 68.39 cm, umbels per plant at 18.16, umbellets per umbel at 7.20, seeds per umbellet at 8.72, seeds per umbel at 52.98, 1000-seed weight at 11.43 g and seed yield per plant at 11.15 g.

When used as a foliar spray, *Jivamrut* boosts plant growth and yield by enhancing nutrient availability, stimulating microbial activity, and supporting various metabolic processes in plants. It supplies key nutrients like nitrogen, phosphorus and potassium, which are efficiently absorbed through the foliage, thereby aiding chlorophyll formation and improving photosynthetic efficiency [24]. The presence of beneficial microorganisms in *Jivamrut* helps in nutrient solubilization and offers protection against plant diseases [25]. Furthermore, it contains natural growth regulators such as auxins and gibberellins that encourage vegetative growth and flowering [26]. Its organic constituents also contribute to increased stress resistance and higher seed yield [27]. Foliar application of *Jivamrut* has shown to enhance all related growth and yield parameters in maize [28], with similar positive effects observed in cowpea [29]. In rice, the use of 10 % *Jivamrut* foliar spray also led to improvements in plant development and yield performance [30].

The combined effect of seed priming and foliar spray treatments was found to be non-significant for most traits, including days to 50% flowering, number of umbels per plant, umbellets per umbel, seeds per umbellet, seeds per umbel, 1000-seed weight and seed yield per plant. However, plant height exhibited a significant response to the interaction of these treatments. The tallest plants (80.97 cm) were observed in the P_2F_2 treatment combination, where seeds were primed with 10% *Bijamrut* and sprayed with 10% *Jivamrut*, while the shortest plants (57.64 cm) were recorded in the untreated control group (P_0F_0). This reflects a 40.48% increase in plant height in P_2F_2 compared to the control.

IV. FIGURES AND TABLES

Figure 1: Germination of coriander seed in tender coconut water (P_6) and control (P_1)

Table 1: Effect of seed priming on germination (%), shoot length (cm), root length (cm) and seedling length (cm)

Treatment	Germination (%)	Shoot length (cm)	Root length (cm)	Seedling length (cm)
P_0	66.75	4.29	6.36	10.65
P_1	77.75	5.67	7.58	13.25
P_2	80.50	5.98	8.14	14.13
P_3	74.25	5.10	7.15	12.25
P_4	76.75	5.45	7.69	13.14
P_5	70.50	4.82	6.72	11.53
P_6	81.25	6.08	8.31	14.39
S. Em. ±	0.99	0.11	0.16	0.20
C. D. at 5%	2.90	0.33	0.48	0.60
C. V. %	2.62	4.21	4.41	3.20

Table 2: Effect of seed priming on Seedling fresh weight (mg), seedling dry weight (mg), seedling vigour index I and seedling vigour index II

Treatment	Seedling fresh weight (mg)	Seedling dry weight (mg)	Seedling vigour index I	Seedling vigour index II
P_0	326.25	24.66	710.46	1643.88
P_1	378.70	29.41	1030.58	2286.09
P_2	392.83	31.67	1137.19	2548.66
P_3	364.50	27.35	909.07	2029.01
P_4	379.28	29.49	1008.63	2261.76
P_5	350.45	26.75	813.08	1886.14
P_6	397.70	32.18	1168.97	2614.51
S. Em. ±	4.80	0.70	20.21	46.69
C. D. at 5%	14.11	2.05	59.44	137.35
C. V. %	2.59	4.84	4.17	4.28

Table 3: Effect of orgopriming on field emergence (%) of coriander

Treatments	Field emergence (%)
P_0	65.67
P_1	73.67
P_2	78.33
P_3	72.67
P_4	74.00
P_5	68.33
P_6	82.33
S. Em. ±	4.64
C. D. at 5%	13.64
C. V. %	4.13

Table 4: Effect of orgopriming, foliar spraying and their interaction on days to 50 per cent flowering of coriander

Characters	Days to 50 per cent flowering				
Factor	**F_0**	**F_1**	**F_2**	**F_3**	**Mean (P)**
P_0	59.00	56.67	54.67	56.67	56.75
P_1	53.00	52.33	52.67	57.33	53.83
P_2	52.33	52.00	51.00	52.00	51.83
P_3	56.33	56.00	56.33	54.00	55.67
P_4	55.00	55.67	55.33	54.00	55.00
P_5	56.33	56.33	55.33	55.67	55.92
P_6	50.33	50.33	49.33	52.00	50.50

Mean (F)	54.62	54.19	53.52	54.52	54.11
	S. Em. ±	**C. D. at 5%**	**S.D.**	**C.V. %**	
P	0.83	2.34	3.35	5.29	
F	0.62	NS	**S.E.**		
P × F	1.65	NS	0.37		

Table 5: Effect of orgopriming, foliar spraying and their interaction on plant height (cm) of coriander

Characters	**Plant height (cm)**				
Factor	**F_0**	**F_1**	**F_2**	**F_3**	**Mean (P)**
P_0	57.64	66.62	65.31	65.87	63.86
P_1	67.94	67.50	76.94	68.59	70.24
P_2	75.76	76.08	80.97	66.27	74.77
P_3	68.11	69.33	65.54	69.93	68.23
P_4	68.57	68.25	75.33	67.45	69.90
P_5	68.40	67.93	65.41	69.12	67.71
P_6	72.34	78.48	77.05	77.67	76.39
Mean (F)	68.39	70.60	72.36	69.27	70.45
	S. Em. ±	**C. D.e at 5%**	**S.D.**	**C.V. %**	
P	1.37	3.88	6.44	6.73	
F	1.03	2.93	**S.E.**		
P × F	2.74	7.76	0.70		

Table 6: Effect of orgopriming, foliar spraying and their interaction on number of umbels per plant of coriander

Characters	**Number of umbels per plant**				
Factor	**F_0**	**F_1**	**F_2**	**F_3**	**Mean (P)**
P_0	16.07	16.87	17.80	16.63	16.84
P_1	18.60	19.10	20.17	18.90	19.19
P_2	19.53	19.93	21.00	20.03	20.13
P_3	17.67	18.20	19.27	17.93	18.27
P_4	18.03	18.70	19.53	18.50	18.69
P_5	17.17	17.77	18.93	17.70	17.89
P_6	20.07	21.00	21.80	20.67	20.88
Mean (F)	18.16	18.80	19.79	18.62	18.91
	S. Em. ±	**C. D. at 5%**	**S.D.**	**C.V. %**	
P	0.45	1.28	1.90	8.28	
F	0.34	0.97	**S.E.**		
P × F	0.90	NS	0.21		

Table 7: Effect of orgopriming, foliar spraying and their interaction on number of umbellates per umbel of coriander

Characters	Number of umbellates per umbel				
Factor	**F_0**	**F_1**	**F_2**	**F_3**	**Mean (P)**
P_0	6.60	6.63	7.00	6.77	6.75
P_1	7.27	7.67	8.03	7.53	7.63
P_2	7.80	8.07	8.43	7.90	8.05
P_3	6.87	7.23	7.60	7.07	7.19
P_4	7.23	7.60	7.97	7.50	7.58
P_5	6.73	6.90	7.20	6.83	6.92
P_6	7.87	8.13	8.57	8.10	8.17
Mean (F)	7.20	7.46	7.83	7.39	7.50
	S. Em. ±	**C. D. at 5%**	**S.D.**	**C.V. %**	
P	0.16	0.47	0.73	7.60	
F	0.12	0.35	**S.E.**		
P × F	0.33	NS	0.08		

Table 8: Effect of orgopriming, foliar spraying and their interaction on number of seeds per umbellate of coriander

Characters	Number of seeds per umbellate				
Factor	**F_0**	**F_1**	**F_2**	**F_3**	**Mean (P)**
P_0	7.83	8.70	9.23	8.40	8.54
P_1	8.93	10.00	11.07	9.73	9.93
P_2	9.50	10.53	11.23	10.30	10.39
P_3	8.43	9.43	10.23	9.30	9.35
P_4	8.67	9.77	10.37	9.43	9.56
P_5	7.87	8.83	9.30	8.63	8.66
P_6	9.80	11.00	11.47	10.47	10.68
Mean (F)	8.72	9.75	10.41	9.47	9.63
	S. Em. ±	**C. D. at 5%**	**S.D.**	**C.V. %**	
P	0.23	0.65	1.18	8.27	
F	0.17	0.49	**S.E.**		
P × F	0.46	NS	0.13		

Table 9: Effect of orgopriming, foliar spraying and their interaction on number of seeds per umbel of coriander

Characters	Number of seeds per umbel				
Factor	**F_0**	**F_1**	**F_2**	**F_3**	**Mean (P)**
P_0	48.07	52.27	55.23	49.93	51.38
P_1	54.27	58.37	60.50	55.97	57.28
P_2	56.77	60.47	62.40	58.77	59.60
P_3	51.47	55.23	57.13	55.73	54.89

P_4	53.07	56.93	58.97	54.97	55.98
P_5	49.13	53.77	55.80	51.20	52.48
P_6	58.07	62.27	65.40	60.03	61.44
Mean (F)	52.98	57.04	59.35	55.23	56.46
	S. Em. ±	**C. D. at 5%**	**S.D.**	**C.V. %**	
P	1.39	3.94	5.74	8.52	
F	1.05	2.98	**S.E.**		
P × F	2.78	NS	0.63		

Table 10: Effect of orgopriming, foliar spraying and their interaction on 1000 seed weight (g) of coriander

Characters	**1000 seed weight (g)**				
Factor	**F_0**	**F_1**	**F_2**	**F_3**	**Mean (P)**
P_0	10.89	11.38	11.57	11.01	11.21
P_1	11.59	12.05	12.62	11.82	12.02
P_2	11.86	12.35	12.78	11.97	12.24
P_3	11.06	11.68	12.19	11.36	11.57
P_4	11.57	12.05	12.56	11.72	11.97
P_5	10.95	11.58	12.07	11.19	11.45
P_6	12.07	12.68	13.10	12.39	12.56
Mean (F)	11.43	11.97	12.41	11.64	11.93
	S. Em. ±	**C. D. at 5%**	**S.D.**	**C.V. %**	
P	0.15	0.43	0.73	4.43	
F	0.12	0.33	**S.E.**		
P × F	0.31	NS	0.08		

Table 11: Effect of orgopriming, foliar spraying and their interaction on seed yield per plant (g) of coriander

Characters	**Seed yield per plant (g)**				
Factor	**F_0**	**F_1**	**F_2**	**F_3**	**Mean (P)**
P_0	10.43	11.08	11.27	10.58	10.84
P_1	11.32	11.87	12.35	11.54	11.77
P_2	11.69	12.16	12.74	11.86	12.11
P_3	10.74	11.39	11.91	11.07	11.28
P_4	11.27	11.78	12.29	11.45	11.70
P_5	10.65	11.28	11.78	10.92	11.16
P_6	11.96	12.68	13.07	12.23	12.48
Mean (F)	11.15	11.75	12.20	11.38	11.70
	S. Em. ±	**C. D. at 5%**	**S.D.**	**C.V. %**	
P	0.23	0.66	0.94	6.89	
F	0.18	0.50	**S.E.**		
P × F	0.47	NS	0.10		

V. CONCLUSION

The findings revealed that seed priming with tender coconut water significantly improved germination and all associated seed quality parameters. Additionally, tender coconut water priming and 10% *Jivamrut* foliar spraying notably increased field emergence, plant height and various yield-related traits. The interaction between priming and foliar spray treatments was statistically non-significant for most traits, except for plant height, which showed a marked difference. This suggests that priming and foliar applications acted independently in influencing most parameters. These organic inputs offer a low-cost and eco-friendly alternative to synthetic chemicals, making them practical and accessible for farmers. Given that both tender coconut water and *Jivamrut* are inexpensive and locally available, their use can lower cultivation costs while boosting productivity. Based on the results, it can be recommended that coriander seeds treated with tender coconut water and sprayed with 10% *Jivamrut* separately can lead to improved seed yield and related traits. Future research should investigate their long-term effects on soil health, microbial dynamics, and overall crop productivity, along with their integration into organic farming systems and validation under diverse agro-climatic conditions.

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