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Effect of Cow-Based Liquid Formulation on Growth and Yield of Coriander (*Coriandrum sativum* L.)

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ABSTRACT

The present field experiment was conducted at College of Horticulture, R.V.S.K.V.V. Mandsaur (M.P.) during the year 2024-2025 using Factorial Randomized Block Design in three replications. The experiment was carried out with the main factor as beejamrut and two sub-factors of panchagavya and jeevamrut. The main factor, beejamrut, comprised of three treatment levels as seed treatment (MP_1 @ 25%, MP_2 @ 50% and MP_3 @ 75%). Sub-factors, panchagavya and jeevamrut, comprised of two level each (SP_1 @ 5% panchagavya, SP_2 @ 10% panchagavya and SP_3 @ 5% jeevamrut, SP_4 @ 10% jeevamrut). The study concluded that cow-based liquid formulations positively influence the growth and yield of coriander. Treatment MP_3 (Beejamrit @ 75% as seed treatment) and SP_2 (panchagavya @ 10% as foliar spray) achieved all the phonological parameters, i.e. days to 50% germination, days to 50% flowering and days to maturity in significantly minimum days. Similarly, Treatment MP_3 (Beejamrit @ 75% as seed treatment) and subplot SP_2 (panchagavya @ 10% as foliar spray) expressed significantly higher morphological characters, viz., plant height, number of branches, fresh weight, and dry weight. The same treatments were recorded to have significantly higher yield and yield-attributing characters with respect to the maximum number of umbels, number of umbellate per umbel, number of seeds per umbel, seed yield, biological yield, harvest index, and test weight. The interaction treatment (B_3-beejamrit @75% + P_2-Panchagavya @10%) proved to be the most effective combination for maximizing the growth, productivity and economic return of coriander.

Keywords Cow-based liquid formulation, Beejamrut, Panchagavya, Jeevamrut, Coriander.

INTRODUCTION

Coriander (*Coriandrum sativum* L.) is one of the major seed spice crops of India. It is nature's gift to humankind, adding flavor to our food while also providing preservative and medicinal value. India is one of the largest producers as well as consumers of coriander in the world. In India, coriander is mainly cultivated in Rajasthan and Gujarat, with a sizeable amount of acreage in Madhya Pradesh, Tamil Nadu, and Bihar. In India, coriander is grown on approximately 628.61 thousand hectares, yielding an annual production of around 822.18 thousand tonnes.

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Specifically, in Madhya Pradesh, the total area spans 229.32 thousand hectares, with a production of 396.29 thousand tonnes (D.A.S.D. 2020-21). The average productivity of coriander seed in India is around 1.33 t/ha (Lal *et al.* 2024), which is relatively low compared to its potential. Owing to this, the country has been able to meet only 58 percent of the total global demand. Improper nutrient management is a major reason for low yield and poor seed quality. The organic or natural farming approach could be a rational way to increase the yield and profit of the crop. In recent years, the use of fermented cow-based organic formulations has gained increasing popularity in Indian agriculture, largely through the efforts of small groups of farmers and is recommended for crop improvement in natural organic agriculture (Gawai and Gudadhe 2023). Cow-based products are rich sources of beneficial microflora that support and stimulate plant growth, leading to improved vegetative growth and higher quality yields through the secretion of growth hormones. The application of bio-formulations offers several remarkable advantages, including its sustainable nature, plant probiotic properties, and long-term viability, positioning it as a promising technology for the future organic agriculture (Belagumpi *et al.* 2024). In line with the recognized importance of these factors, the present investigation was conducted to study the effect of cow-based fermented organic formulation practices on the growth and yield of coriander.

MATERIALS AND METHODS

The field experiment was carried out at the P. G. Research Block under the Department of Plantation, Spices, Medicinal and Aromatic Crops, College of Horticulture, Mandsaur, under Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior (M.P.) during the *rabi* season of 2024-2025. The experiment was laid out using a Factorial Randomized Block Design in three replications (Fig. 1 and Fig. 2). The experiment was carried out with the main factor as beejamrut and two sub-factors of panchagavya and jeevamrut. The main factor, beejamrut, comprised of three treatment levels as seed treatment (MP_1 @ 25%, MP_2 @ 50%, and MP_3 @ 75%). Sub-factor, panchagavya and jeevamrut, comprised of two level each (SP_1 @ 5% panchagavya, SP_2 @ 10% panchagavya and SP_3 @ 5% jeevamrut, SP_4 @ 10% jeevamrut respectively). In addition, an absolute control treatment was also included where neither seed treatment nor foliar spray was applied. Ajmer Coriander-1 (ACr-1) variety was used in this experiment. The seeds were treated with Beejamrit at different concentrations (25%, 50% and 75%) in main plots. The liquid bio manure was applied in the form of panchagavya and jeevamrut as foliar sprays in subplots with two different concentrations of 5% and 10% for both at 30, 60 and 90 days after sowing. Beejamrut was prepared using local agricultural ingredients, including cow dung, cow urine, lime, soil and water. Panchagavya was prepared using a mix of fresh cow dung, ghee, cow milk, cow curd, cow urine and cow dung (Indian breed). Jeevamrut was prepared using cow urine (Gomutra), jiggery, pulse flour and a handful of soil from the virgin soil of the farm. Observations were recorded on the different aspects, viz., growth and yield characteristics of coriander, on time.

RESULTS AND DISCUSSION

Effect on growth observation

a. Phenological parameters

The study on phenological parameters revealed that cow-based liquid formulations have a positive influence on the parameters. The experimental results showed (Table 1) that, in the main plots, the seed treatment of beejamrut @ 75% exhibited the earliest 50% germination and flowering, and took the minimum days to mature. In contrast, beejamrut @ 25% was late in all these traits. Among the subplots, treatment panchagavya @ 10% expressed the earliest 50% germination, and took the minimum days to mature. No significant difference was observed in the days taken to 50% flowering. Treatment Jeevamrit @ 10% was significantly at par with panchagavya @ 10% in days taken to 50% germination and maturity. In the interactions, all the phenological observations showed non-significant variation. However, the earliest 50% germination, the earliest 50% flowering, and minimum days to maturity were noted with MP_3 (beejamrut @ 75%) × P_2 (panchagavya @ 10%) treatments, while the absolute control treatment took more days. The beneficial impact on plant phenology

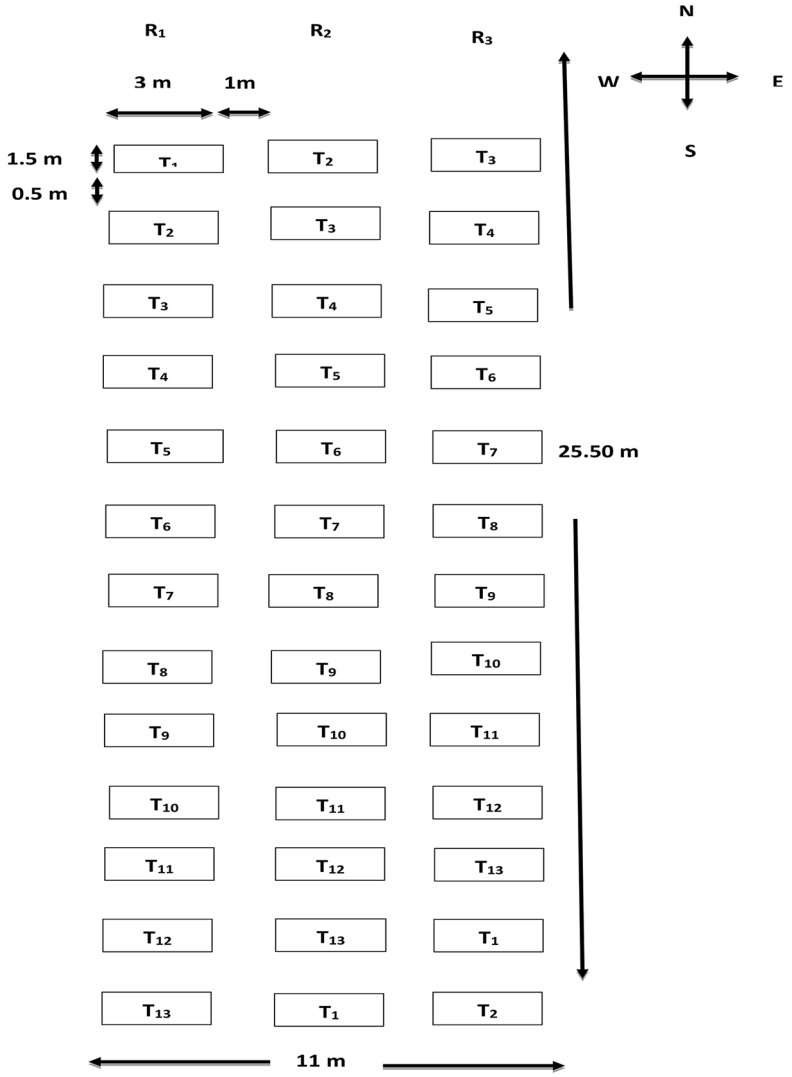

Fig. 1. Layout of experimental field.

might be due to seed treatment with Beejamrut, which improved the beneficial host plant-association with soil microorganisms, i.e. free-living nitrogen fixers and phosphorus-solubilizing bacteria. Beejamrut is a good source of IAA and many plant growth hormones, which fulfil seed requirements, resulting in timely physiological processes being completed within the plant system, as reported earlier by Mukherjee *et al.* (2022). The results are in harmony with Jackson 1974. The earliness in plant phenology was observed due to the foliar application of Panchagavya at a higher dose because it is a natural source of essential macro and micro plant nutrients, as suggested by Kumar *et al.* (2020). The Panchagavya is also responsible for encouraging plant growth. The analogous conclusions have also been reported by Panchal *et al.* (2017). Seed treatment with a higher dose of Beejamrut, followed by foliar application of Panchagavya, expressed its superiority over other treatment interactions because these are the good source of essential nutrients, beneficial microbes, and useful enzymes, which are playing a positive role for the vitality of the seed, soil



Fig. 2. View of the experimental field.

fertility, health and strength of plants as per the earlier finding reported by Patil *et al.* (2012).

b. Morphological parameters

The study on morphological parameters at harvest (Table 1) revealed that cow-based liquid formulations have a significant influence on these parameters. The experimental findings showed that, in the main plots, seed treatment of beejamrut @ 75% had the tallest plant height, maximum number of branches, the highest fresh and dry weight per plant. Seed treatment of beejamrut @ 25% was the lowest in all the same traits. Among the sub-plot treatments, panchagavya @ 10% expressed the tallest plant height, maximum number of branches, the highest fresh and dry weight per plant. Treatment Jeevamrit @10% was significantly at par with panchagavya @ 10% in the number of branches per plant and dry weight per plant parameters. In the interactions, all morphological observations showed significant variation, except for the number of branches per plant at harvest. The

Table 1. Effect of doses and stages of foliar application of cow-based liquid formulation on phonological and morphological parameters.

Treatments		Days to % Germination	Days to 50% Flowering	Days to Maturity	Plant height (cm)	No. of branches/ plant	Fresh weight (g)	Dry weight (g)
Main factors: Beejamrit								
MP_1	Beejamrit @ 25%	11.17	73.50	143.67	122.09	10.03	131.46	43.86
MP_2	Beejamrit @ 50%	10.50	72.67	141.67	127.15	12.18	147.59	49.19
MP_3	Beejamrit @75%	9.33	70.83	140.50	129.63	13.33	180.89	60.19
SEm ±		**0.19**	**0.25**	**0.20**	**0.80**	**0.18**	**0.86**	**0.71**
CD at 5%		**0.57**	**0.73**	**0.59**	**2.35**	**0.52**	**2.50**	**2.08**
Sub factors: Panchagavya and Jeevamrit								
SP_1	Panchagavya @5%	10.67	72.89	142.44	125.15	11.39	145.48	48.50
SP_2	Panchagavya @10%	9.89	71.56	141.33	129.88	12.37	161.67	53.74
SP_3	Jeevamrit @5%	10.67	72.78	142.33	123.49	11.51	148.67	49.52
SP_4	Jeevamrit @10%	10.11	72.11	141.67	126.64	12.11	157.44	52.56
SEm ±		**0.22**	**0.29**	**0.23**	**0.93**	**0.20**	**0.99**	**0.82**
CD at 5%		**0.66**	**NS**	**0.68**	**2.71**	**0.60**	**2.88**	**2.41**
Interaction: Main plots × Sub plots								
T_1	$MP_1 \times SP_1$	11.33	74.00	144.33	122.20	9.73	131.00	43.66
T_2	$MP_1 \times SP_2$	10.67	72.67	142.67	127.73	10.80	136.00	45.23
T_3	$MP_1 \times SP_3$	11.67	74.67	144.67	115.17	9.07	125.83	41.89
T_4	$MP_1 \times SP_4$	11.00	72.67	143.00	123.27	10.50	133.00	44.67
T_5	$MP_2 \times SP_1$	10.67	73.00	142.00	125.26	11.40	142.53	47.51
T_6	$MP_2 \times SP_2$	10.33	72.00	141.33	130.76	12.70	154.67	51.57
T_7	$MP_2 \times SP_3$	10.67	72.67	141.67	126.00	12.20	146.17	48.67
T_8	$MP_2 \times SP_4$	10.33	73.00	141.67	126.57	12.40	147.00	49.00
T_9	$MP_3 \times SP_1$	10.00	71.67	141.00	128.00	13.03	162.90	54.33
T_{10}	$MP_3 \times SP_2$	8.67	70.00	140.00	131.16	13.60	194.33	64.43
T_{11}	$MP_3 \times SP_3$	9.67	71.00	140.67	129.31	13.27	174.00	58.00
T_{12}	$MP_3 \times SP_4$	9.00	70.67	140.33	130.07	13.43	192.33	64.00
SEm ±		**0.63**	**1.01**	**1.01**	**3.47**	**1.04**	**13.53**	**4.59**
CD at 5%		**NS**	**NS**	**NS**	**10.13**	**NS**	**39.50**	**13.40**
T_{13}	Control	12.00	75.67	145.00	112.72	8.60	120.67	40.22
SEm ±		**0.41**	**0.52**	**0.42**	**1.67**	**0.37**	**1.78**	**1.49**
CD at 5%		**1.18**	**1.53**	**1.22**	**4.88**	**1.08**	**5.20**	**4.34**

tallest plant height, the highest fresh and dry weight per plant were noted with MP_3 (beejamrut @ 75%) × SP_2 (panchagavya @ 10%) treatments, while the absolute control treatment expressed the lowest values. The seed treatment with Beejamrut, followed by foliar application of Panchagavya, found the best combination for morphological parameters, as these lead to an increase in the valuable soil microorganisms and have a significant and positive impact on the enzymatic activity in the rhizosphere of the plant. Hence, they promote plant growth and support maintaining a safe environment (Shwetha *et al.* 2009). Alike findings are also confirmed by earlier findings reported by Sutar *et al*. (2019).

c. Yield and yield attributes

Seed treatment and foliar spray of cow-based liquid formulation had significantly enhanced the yield and yield attributes of the coriander except test weight (Table 2). The statistical results observed that, among the main plots, MP3-beejamrut @ 75% as seed treatment had the highest number of umbels, number of umbellate per umbel, seeds per umbel, biological

Table 2. Effect of doses and stages of foliar application of cow-based liquid formulation on yield parameters.

	Treatments	No. of umbels (plant^{-1})	No. of umbellate (umbel^{-1})	No. of seeds (umbel^{-1})	Seed yield (q ha^{1})	Biological yield (q ha^{-1})	Harvest index (%)	Test weight (g)
				Main factors: Beejamrit				
MP_1	Beejamrit @ 25%	29.52	5.87	34.47	29.52	73.65	40.31	8.69
MP_2	Beejamrit @ 50%	31.58	6.23	37.27	31.58	77.23	41.01	9.02
MP_3	Beejamrit @75%	33.31	6.48	39.44	33.35	81.19	42.11	9.28
	SEm ±	**0.18**	**0.04**	**0.16**	**0.18**	1.71	1.88	0.14
	CD at 5%	**0.52**	**0.13**	**0.46**	**0.52**	**4.98**	**5.48**	**NS**
				Sub factors: Panchagavya and Jeevamrit				
SP_1	Panchagavya @ 5%	30.93	6.13	35.26	30.90	76.48	40.77	8.98
SP_2	Panchagavya @ 10%	32.30	6.31	38.03	32.30	79.15	41.38	9.13
SP_3	Jeevamrit @ 5%	30.78	6.10	36.36	30.80	75.63	41.05	8.86
SP_4	Jeevamrit @ 10%	31.87	6.24	37.51	31.88	78.16	41.38	9.02
	SEm ±	**0.20**	**0.05**	**0.18**	**0.20**	**1.97**	**2.17**	**0.16**
	CD at 5%	**0.60**	**0.15**	**0.53**	**0.60**	**NS**	**6.33**	**NS**
				Interaction: Main plots × Sub plots				
T_1	$MP_1 \times SP_1$	29.00	5.84	34.28	29.00	73.32	39.99	8.73
T_2	$MP_1 \times SP_2$	30.87	6.03	35.43	30.87	77.21	40.22	8.93
T_3	$MP_1 \times SP_3$	28.00	5.66	33.17	28.00	68.85	40.26	8.37
T_4	$MP_1 \times SP_4$	30.20	5.96	35.01	30.20	75.22	40.77	8.73
T_5	$MP_2 \times SP_1$	31.33	6.16	35.79	31.33	76.80	40.41	9.00
T_6	$MP_2 \times SP_2$	31.87	6.31	38.57	31.87	78.47	41.09	9.07
T_7	$MP_2 \times SP_3$	31.33	6.21	37.09	31.33	76.71	41.26	9.00
T_8	$MP_2 \times SP_4$	31.80	6.24	37.63	31.80	76.92	41.27	9.00
T_9	$MP_3 \times SP_1$	32.47	6.39	38.70	32.47	79.33	41.91	9.20
T_{10}	$MP_3 \times SP_2$	34.17	6.60	40.08	34.17	81.77	42.83	9.40
T_{11}	$MP_3 \times SP_3$	33.00	6.43	39.13	33.00	81.33	41.63	9.20
T_{12}	$MP_3 \times SP_4$	33.60	6.51	39.84	33.60	82.33	42.09	9.33
	SEm ±	**1.39**	**0.27**	**1.86**	**1.39**	**3.94**	**3.43**	**0.58**
	CD at 5%	**4.07**	**NS**	**5.42**	**4.07**	**NS**	**10.01**	**NS**
T_{13}	Control	26.33	4.89	30.06	26.33	65.87	39.67	8.20
	SEm ±	**0.37**	**0.09**	**0.33**	**0.37**	**3.55**	**3.91**	**0.28**
	CD at 5%	**1.08**	**0.27**	**0.96**	**1.08**	**10.37**	**11.41**	**0.83**

yield, seed yield, and harvest index. Seed treatment of beejamrut @ 25% expressed the lowest values in all these parameters. Among the sub-plot treatments, panchagavya @ 10% expressed the highest number of umbels, number of umbellate, seeds per umbel, seed yield and harvest index . Treatment Jeevamrit @10% was significantly at par with panchagavya @ 10% with respect to all yield and yield attributes. There is no significant difference was observed in case of biological yield and test weight parameters. In the interactions, all the yield attributes showed significant variation except in the case of the number of umbellate per umbel, test weight and biological yield. The highest number of umbels, seeds per umbel, seed yield, and harvest index were recorded with MP_3 (beejamrut @ 75%) × SP_2 (panchagavya @ 10%) treatments, while the absolute control treatment expressed the lowest values. The seed treatment with Beejamrut increased germination and nutrient uptake, enhanced stress tolerance, and provided plant protection against various diseases, resulting in increased yield and yield attributes. The reasons for the improvement in yield and its characteristics with the foliar application of panchagavya over control, might be is a vibrant and

Table 3. Effect of doses and stages of foliar application of cow based liquid formulation on economics.

Treatments	Seed yield (q ha^{-1})	Economics of the treatments Cost of cultivation (Rs. ha^{-1})	Gross return (Rs. ha^{-1})	Net return (Rs. ha^{-1})	B : C Ratio
T_1 : $MP_1 \times SP_1$	29.29	46610	234283	187672.89	4.03
T_2 : $MP_1 \times SP_2$	30.87	47340	246954	199614.50	4.22
T_3 : $MP_1 \times SP_3$	27.43	46105	219467	173361.67	3.76
T_4 : $MP_1 \times SP_4$	30.33	46330	242667	196336.67	4.24
T_5 : $MP_2 \times SP_1$	30.98	47360	247831	200470.69	4.23
T_6 : $MP_2 \times SP_2$	32.05	48090	256365	208275.43	4.33
T_7 : $MP_2 \times SP_3$	31.5	46855	252000	205145.00	4.38
T_8 : $MP_2 \times SP_4$	31.77	47080	254133	207053.33	4.40
T_9 : $MP_3 \times SP_1$	32.74	48110	261949	213838.50	4.44
T_{10} : $MP_3 \times SP_2$	34.6	48840	276800	227960.00	4.67
T_{11} : $MP_3 \times SP_3$	33.8	47800	270400	222800.00	4.66
T_{12} : $MP_3 \times SP_4$	34.43	48730	275467	227636.67	4.67
T_{13}: Control	25.27	42630	202133	159503.33	3.74

Price of coriander seeds was 8000 q^{-1} as per local market.

natural source of several macro and other micronutrients, which are essentially required for the overall growth and development of crops. There are several reasons for improvement in yield and their attributes with the combination application of Beejamrut and panchagavya over control, and this may be due to Beejamrut, which is a cow-based organic formulation used as seed treatment to improve seed germination, increase nutrient uptake, help in stress tolerance, as well as plant protection against seed and soil-borne diseases. These findings are in conformity with Devakumar *et al*. (2014).

d. Economics

The statistical differences were exhibited among the treatments for the economic analysis depicted in Table 3. The investigation revealed that the highest cultivation cost was recorded in T_{10} - MP_3 - Beejamrut @ 75% with SP_2 - Panchagavya @ 10%, whereas the lowest cost was noted in T_{13} - control. The same treatment T_{10} - MP_3 - Beejamrut @75% with SP_2 - Panchagavya @10% produced the maximum gross return. The minimum gross return was found in the T_{13} - control. It was observed that T_{10} - MP_3 - Beejamrut @75% with SP_2 - Panchagavya @10% had the highest net return. The lowest net return was in T_{13} - control. Treatment T_{10} - MP_3 - Beejamrut @75% with SP_2 - Panchagavya @10%, accumulated the highest B:C Ratio (4.76). The minimum B:C ratio (3.74) was assessed in the T_{13}-control. Use of liquid organic formulation together increased the production of seed yield along with soil fertility, which led to enhanced returns. Implementing balanced fertilization is a key method to increase the productivity and economic profitability of coriander. Similar kind of results were observed previously also by Koner and Laha (2020).

CONCLUSION

On the basis of one year research finding, it could be concluded that the various treatment combinations significantly influenced the growth and yield of coriander. The growth and yield potential of coriander can be increased by the application of (Beejamrit @ 75% + Panchagavya @10%). This combination proved to be the most effective combination for maximising the growth, productivity and economic return of coriander.

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