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Organic cultivation of coriander during summer

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Abstract
The present study was carried out to investigate the influence of organic inputs on growth and yield of coriander during summer. In the experiment fermented liquid organic formulations were used *viz.*, beejamrutha, panchgavya and jeevamrutha as seed treatment and soil application. According to the results of the experiment, among the seed treatments, T_1(4% beejamrutha) was found to be superior with respect to all the seed parameters. In case of soil application A_3 (6% panchagavya + jeevamrutha @ 500 l/ha) recorded the highest plant height, leaf length, leaf area, leaf yield per plot and per hectare. T_1A_3 (4% beejamrutha + 6% panchagavya + jeevamrutha @ 500 l/ha) was considered as the best treatment combination as it produced maximum growth and high yield compared to T_4A_2 (no seed treatment + jeevamrutha @ 500 l/ha) which recorded the lowest growth and minimum yield of coriander among all the different treatment combinations during summer.

Keywords: Coriander, organic inputs, summer, seed treatment, soil application, beejamrutha, panchagavya, jeevamrutha

Introduction
Organic agriculture relies on ecosystem management rather than external agricultural inputs. It is a system that begins to eliminate the use of synthetic inputs such as chemical fertilizers and pesticides. In organic cultivation, the synthetic chemicals are replaced with site specific management practices that maintain and increase long term soil fertility and quality of the environment (Subbarao *et al.* 2007) [1].
The organic liquid formulations, such as beejamrutha, panchagavya and jeevamrutha are gaining much attention among the organic products as they stimulate the growth, yield, and quality of crops by increasing significant microbial counts and plant growth-promoting compounds (Somasundaram 2003) [2] and (Vasanthkumar 2006) [3]. Which are prepared by on farm products. They are efficient, eco-friendly, cost effective and economically viable apart from meeting the crop nutrient requirements (Krishna *et al.* 2022) [4]. Hence, awareness on organic farming among the farming community got increased which led to use of many organic formulations in crop production.
Judicious plant nutrition and efficient plant protection in organic farming enhances yield and quality in most of the crops. Organic system produced significant improvement in quality of soil mainly bulk density, maximum water holding capacity, infiltration rate, organic carbon, available nitrogen, phosphorus and potassium which intern increase the yield of the crop for longer duration. (Babalad *et al.* 2009) [5]. Excess usage of inorganic fertilizers has detrimental effects on crop yield, leading to reduced fruit production, delayed fruit setting, and ripening, as well as excessive vegetative growth (Abdou *et al.* 2017) [6].
The present farming scenario is largely dependent on the use of chemical fertilizers, pesticides and growth regulators for enhancing crop productivity. It is a well documented fact that increased dependence on agro-chemicals including fertilizers has led to several ill effects on soil and the environment (Sridhar *et al.* 2014) [7]. The organic (biological/ecological) approach is one of the alternatives to conventional production system currently being advocated (Subbarao *et al.* 2007) [1].

In India the agricultural lands continue to shrink and there is a greater threat to global environment and soil resources in the form of erosion of biodiversity and climate change marching towards desertification and environmental pollution. Hence, there is now a great concern to maintain soil health and protect environment by popularizing eco-friendly and cost-effective organics.

Leafy vegetables are popular around the world and especially in India. Their cultivation is a profitable business for farmers. They are quick growing crops that are harvested within four to six weeks. Coriander, *Coriandrum sativum* (2n-22) is an annual herb in the family Apiaceae. It is an important leafy vegetable used for flavouring curries and soups (Shivashankara *et al*. 2003) [10]. Its leaves are rich in vitamins A, C, K and minerals. India being largest country in spice production, annually India produces 4.96 lakh tonnes of coriander from 5.16 lakh ha area. (Lal and Singh, 2016) [11]. Though many improved varieties are available in coriander as a seed-spice, very little work has been done in improvement of leafy coriander.

Consumption of leafy vegetables grown by using organic inputs improves human health. Even though leafy vegetables are cultivated throughout the year their yield and quality are reduced during summer months due to high temperatures. Many farmers are not willing to cultivate leafy vegetables during summer. This might lead to increased prices of leafy vegetables during summer. Organic vegetables fetch a premium price of 10%-50% over conventional products (Sridhar *et al.* 2014) [7]. Hence in the light of the above, the current study is taken up to determine the effect of organic inputs on growth and yield of coriander during summer.

Materials and Methods

The present experiment was carried out during summer season of 2024 at Dr. YSRHU-Horticultural research station, Pandirimamidi, Alluri Seetharamraju District, Andhra Pradesh.

The experiment was laid out in Factorial Randomized Block Design (FRBD) with16 treatment combinations those replicated twice consists of two factors, first factor was seed treatment (ST) which comprised of four levels of organic inputs, those include 4% beejamrutha (T_1), 3% panchgavya (T_2), 20% jeevamrutha (T_3) and without seed treatment (T_4) and the second factor was soil application (SA) with four levels of organic inputs which consists of 6% panchgavya (A_1), jeevamrutha @500 l/ha (A_2), 6% panchgavya + jeevamrutha @500 l/ha (A_3) and 100% RDF (A_4). The quantity of organic inputs was fixed after the analysis for nitrogen content at soil science laboratory in Krishi Vignan Kendra, Undi.

Beejamrutha, panchgavya and jeevamrutha were prepared as per the standard procedure given by Palekar (2016) [8] and Natarajan (2002) [9]. Seeds of coriander were treated with different organic inputs for 12 hours and were air dried to original weight and then seeds were sown in their respective plots. The experimental plot was well prepared, cultural practices include thinning, weeding, irrigation were followed for the healthy growth of the crop. Soil application of organic inputs was done at 15 days interval according to the treatments during crop growth.

The observations recorded for this study include, growth parameters like days taken for 50% germination, seed vigour index, seedling height, root length, survival percentage, plant height, leaf length, leaf area and yield parameters like number of leaves per plant, leaf yield per plot and leaf yield per hectare. The data regarding these parameters are collected and interpreted and the results are discussed below.

Results and Discussion

The data on growth and yield parameters of coriander are presented in Table 1, 2, 3. The results reported that the seed treatment and soil application with organic inputs significantly influenced the growth and yield parameters of coriander. From the results it was noted that there was a positive response on growth and yield of coriander when treated with different combinations of organic inputs.

The effect of seed treatment with organic inputs was significant among all the seed parameters. Seeds treated with 4% beejamrutha (T_1) recorded less (7.53) number of days taken for 50% germination, maximum seed vigour index (2.62), highest seedling height (14.90 cm), highest root length (6.89 cm) and maximum survival percentage (73.42%), followed by seed treatment with 3% panchagavya (T_2) and the seeds without treatment (T_4) resulted in maximum no. of days (9.50) to reach 50% germination, minimum seed vigour index (1.27), lowest seedling height (12.02 cm), root length (5.78 cm) and survival percentage (46.79%).

Growth and yield of the coriander was significantly influenced by seed treatment and soil application of organic inputs. Among the all the seed treatments, the highest plant height (24.04 cm), leaf length (3.20 cm), leaf area (10.60 cm^2), no. of leaves per plant (20.28), leaf yield per plot (0.40 kg) and leaf yield per hectare (6.62 t) were recorded with T_1 (4% beejamrutha) and followed by T_2 (3% panchagavya). In case of soil application, the highest plant height (23.34 cm), leaf length (3.10 cm), leaf area (10.15 cm^2), no. of leaves per plant (19.98), leaf yield per plot (0.47 kg) and leaf yield per hectare (6.62 t) were recorded with A_3 (6% panchagavya + jeevamrutha @500 l/ha) and followed by A_1 (6% panchagavya).

The interaction effect was also found be significant, among all the treatment combinations, T_1A_3 (4% beejamrutha + 6% panchagavya + jeevamrutha @500 l/ha) recorded the highest plant height (26.97 cm), leaf length (3.32cm), maximum leaf area (11.16 cm^2), no. of leaves per plant (22.52), leaf yield per plot (0.57 kg) and leaf yield per hectare (7.03 t) which was followed by T_2A_3 (3% panchagavya + 6% panchagavya + jeevamrutha @500 l/ha) and the treatment combination with T_4A_2 (no seed treatment + jeevamrutha @500 l/ha) considered as the least performed treatment compared to all other combinations with minimum growth and yield.

From the above results on seed treatment, beejamrutha, hastened the germination by decreasing the number of days taken to 50% germination, increase in seed vigour index, seedling height, root length and survival percentage, this may be due to the presence of beneficial bacteria which might have produced high amounts of plant growth promoting hormones (IAA and GA) making beejamrutha as an efficient plant growth stimulant. (Christophe *et al.*, 2019) [12]. The findings from the present study are in conformity with Sravani *et al.* (2023) [13] in cluster bean and Suman *et al.* (2018) in coriander and Vyankatrao (2019) [14] in legume crops. Gathala *et al.* (2007) the reason for significant increase in plant growth might be due to application of panchagvaya that is believed to contain growth regulators i.e., IAA and GA3 which enhance the cell division, cell multiplication and cell elongation which in turn might have resulted in higher vegetative growth of the coriander. The outcomes reflect the findings of Prakash *et al.* (2022) [15] in onion, Reddy *et al.* (2022) [16] in cow pea, Mounika *et al.* (2017) [17] in coriander, and Samatha *et al.* (2022) [18] in cow pea. The utilization of panchagavya and jeevamrutha had possibly played a role in enhancing the vegetative growth of plants. This enhancement could have led to an increase in photosynthate production, effective partitioning of nutrients, and improved translocation. These factors collectively might have contributed to the augmentation of yield attributes and overall crop yield (Kumawat *et al.*, 2022) [19].

Table 1: Effect of organic inputs on seed treatment in coriander

Treatment	Days taken for 50% germination	Seed vigour index	Seedling height (cm)	Root length (cm)	Survival percentage (%)
T_1	7.53	2.62	14.90	6.89	73.42 (58.96)
T_2	8.23	1.95	13.49	6.48	66.84 (54.83)
T_3	8.20	1.51	12.53	6.08	54.45 (47.53)
T_4	9.50	1.27	12.02	5.78	46.79 (43.14)
S.Em ±	0.17	0.27	0.43	0.19	1.56
CD at 5%	0.51	0.09	0.15	0.06	0.53

Factor 1: Seed treatment

T_1: 4% beejamrutha

T_2: 3% panchagavya

T_3: 20% jeevamrutha

T_4: no seed treatment

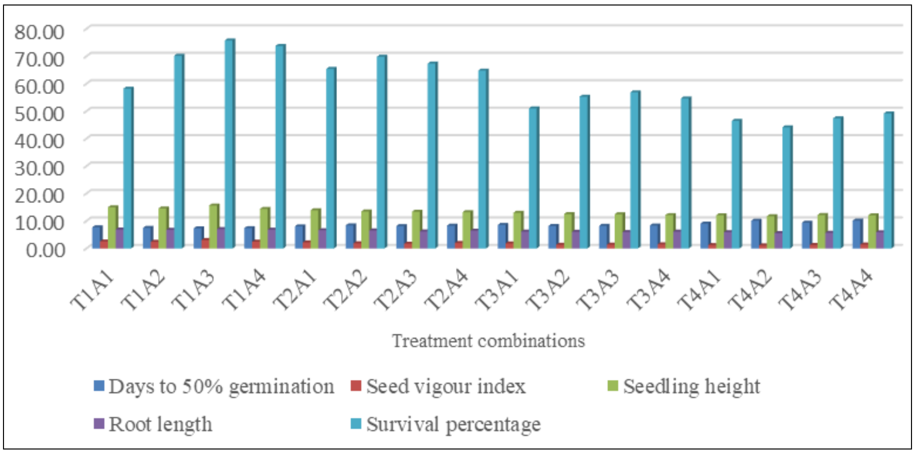

Fig 1: Effect of organic inputs on seed treatment in coriander

Table 2: Effect of organic inputs on plant height (cm), leaf length (cm) and leaf area (cm^2).

Organic inputs		Plant height (cm)					Leaf length (cm)					Leaf area (cm^2)				
		AT 45 DAS					AT 45 DAS					AT 45 DAS				
		SA				Means for ST	SA				Means for ST	SA				Means for ST
		A_1	A_2	A_3	A_4		A_1	A_2	A_3	A_4		A_1	A_2	A_3	A_4	
ST	T_1	24.45	23.12	26.97	21.6	24.04	3.22	3.08	3.32	3.16	3.20	10.99	10.83	11.16	9.43	10.6
	T_2	23.47	18.16	24.62	20.29	21.64	2.76	2.81	3.26	2.9	2.93	10.46	8.42	11.08	9.33	9.82
	T_3	18.64	18.35	20.81	20.78	19.65	2.83	2.77	2.97	2.65	2.80	8.18	6.97	10.8	10.98	9.23
	T_4	19.13	16.66	20.96	19.96	19.18	2.5	2.23	2.85	2.4	2.49	7.31	6.67	7.56	7.84	7.34
Means for SA		21.42	19.07	23.34	20.66		2.83	2.72	3.1	2.78		9.23	8.22	10.15	9.39	
Factors		**S.Em ±**		**CD at 5%**			**S.Em ±**		**CD at 5%**			**S.Em ±**			**CD at 5%**	
ST		0.09		0.26			0.03		0.09			0.32			0.98	
SA		0.09		0.26			0.03		0.09			0.32			0.98	
STxSA		0.17		0.51			0.06		0.18			0.65			0.98	

Table 3: Effect of organic inputs on number of leaves per plant, leaf yield per plot (kg) and leaf yield per ha (t)

Organic inputs		Number of leaves per plant					Leaf yield per plot (kg)					Leaf yield per ha (t)				
		At harvest					At harvest					At harvest				
		SA				Means for ST	SA				Means for ST	SA				Means for ST
		A_1	A_2	A_3	A_4		A_1	A_2	A_3	A_4		A_1	A_2	A_3	A_4	
ST	T_1	20.14	18.98	22.52	19.47	20.28	0.38	0.27	0.57	0.37	0.40	6.56	6.53	7.03	6.35	6.62
	T_2	17.11	16.54	21.21	16.98	17.96	0.38	0.25	0.45	0.23	0.32	6.46	5.35	6.85	6.04	6.18
	T_3	18.62	16.89	18.75	16.24	17.63	0.35	0.20	0.44	0.24	0.31	5.98	5.85	6.56	5.93	6.08
	T_4	19.80	14.32	17.45	15.95	16.88	0.3	0.19	0.42	0.23	0.28	6.01	5.08	6.03	6.01	5.78
Means for SA		18.92	16.68	19.98	17.16		0.35	0.23	0.47	0.26		6.25	5.7	6.62	6.08	
Factors		**S.Em ±**			**CD at 5%**		**S.Em ±**			**CD at 5%**		**S.Em ±**			**CD at 5%**	
ST		0.08			0.23		0.01			0.02		0.01			0.02	
SA		0.08			0.23		0.01			0.02		0.01			0.02	
STxSA		0.15			0.47		0.02			0.05		0.01			0.04	

Factor 1: Seed treatment

T_1: 4% beejamrutha

T_2: 3% panchagavya

T_3: 20% jeevamrutha

T_4: no seed treatment

Factor 2: Soil application

A_1: 6% panchgavya

A_2: jeevamrutha @500l/ha

A_3: 6% panchgavya + jeevamrutha @500l/ha

A_4: Recommended dose of fertilizer

Conclusion

From the results discussed above it was concluded that organic liquid formulations have remarkable potential to increase beneficial microbes in the soil which enhance nutrient uptake of plants by converting the complex nutrients into simpler form, they also stimulate plant growth by releasing important PGRs (IAA &GA) which in turn produces high yield. Preparation of these organics is cost effective as they are the prepared from locally available on farm products. They are the best eco-friendly alternatives to chemical fertilizers which mitigates the excessive usage of chemicals and their toxic effects on soil and human health. Hence, the usage of these organic liquid formulations should be encouraged by spreading awareness among the farming communities.

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