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Effect of various organic treatments on growth, yield attributes and yield of coriander under organic farming

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Abstract

An experiment was conducted on medium black calcareous clayey soil at Junagadh (Gujarat) in Rabi 2017-18 and 2018-19. Nine treatments comprising Control, FYM @ 5 t/ha, FYM @ 5 t/ha + *Azotobacter*, FYM @ 5 t/ha + *Azotobacter* + PSB, FYM @ 5 t/ha + *Azotobacter* + PSB + KSB, FYM @ 5 t/ha + *Azotobacter* + PSB + KSB + SOB, FYM @ 5 t/ha + *Azotobacter* + PSB + KSB + SOB + seaweed extract as foliar spray @ 3.5% at 30 and 60 DAS, FYM @ 5 t/ha + *Azotobacter* + PSB + KSB + SOB + seaweed extract as foliar spray @ 3.5% at 30 and 60 DAS + banana pseudostem sap as foliar spray @ 1% at 30 and 60 DAS and FYM @ 5 t/ha + *Azotobacter* + PSB + KSB + SOB + seaweed extract as foliar spray @ 3.5% at 30 and 60 DAS + banana pseudostem sap as foliar spray @ 1% at 30 and 60 DAS + cow urine as foliar spray @ 5% at 30 and 60 DAS in randomized block design with three replications. The experimental results revealed that application of FYM @ 5 t/ha + *Azotobacter* + PSB + KSB + SOB + seaweed extract as foliar spray @ 3.5% at 30 and 60 DAS + banana pseudostem sap as foliar spray @ 1% at 30 and 60 DAS + cow urine as foliar spray @ 5% at 30 and 60 DAS were found superior in respect of the growth parameters and yield attributes along with higher seed yield (1379 and 1377 kg/ha), strover yields (1585 and 1581 kg/ha) and 1000- seed weight (14.39 gm).

Keywords: Coriander, FYM, biofertilizers, seaweed extract, banana sap, organic farming

Introduction

Coriander (*Coriandrum sativum* L.) is one of the important spice crop belonging to family umbeliferae. It is commonly known as "Dhania" or "Dhana" from very ancient times. Spices play pivotal role in human diet as well as they give an agreeable flavour and aroma to food, which add greatly to the pleasure of eating. It is probably the first spice used by man as common flavouring substance. The stem, leaves and fruit have a pleasant aromatic odour due to the linalool containing essential oil in the fruits. The leaves are used for flavouring the curries, sauces and soups. The dry fruit are extensively used in preparations of curry powder, pickling spice, sausages and seasoning. Medicinal uses of coriander seed decoction is used in sore throat, common cold and bilious complaints. Decoction may also be used in eye wash and in chronic conjunctivitis. Seeds are chewed to remove foul breath and use as a purgative and roasted seeds are useful in dyspepsia. The juice of fresh plant is applied to erythema. The leaves are carminative, antibilious, diuretics, tonic, stomachis and aphrodisiac. The paste of seeds is applied to relieve pain in cephalgia.

In India coriander occupied an area of 530.50 million hectares giving a total production of 482.00 metric tonnes during 2011-12, whereas in Gujarat, coriander is cultivated in an area of about 20,574 ha with a production of about 32,310 tonnes and a productivity of 1570.00 kg ha⁻¹ (Anonymous 2012) [2].

India is predominantly an agricultural country and green revolution has brought a significant change in Indian agriculture. The achievements were mainly due to use of high yielding varieties, fertilizer responsive crop cultivars and increased fertilizer use. There is a keen awareness worldwide in recent years on the excess use of chemical fertilizers and other chemicals leading to environmental pollution and pest outbreaks. Sustained production strategies often involve application of organic sources.

Organic farming is getting more popular these days, which accentuates shift from high volume production system to high value production system. For achieving this, management practices that conserve soil health, efficient nutrient supply systems that rely on organics instead of chemicals and integrated pest management play vital role.

Among these, efficient, cheap and reliable nutrient supply system will ensure sustainability of the organic farming system. Biofertilizers in combination with organic manures and biostimulants also found as effective component in organic farming for reliable and cheap supply of nutrients. These combinations were ecologically safe and improve soil fertility by improving the soil physical, chemical, and biological condition.

Materials and Methods

A field experiment titled "Effect of nutrient management through organic sources on yield and quality of coriander (*Coriandrum sativum* L.) and soil properties under organic farming" was carried out at Certified Organic Farming Plot of Instructional Farm, College of Agriculture, JAU, Junagadh during rabi season of the year 2017-18 and 2018-19. The soil of the experimental field was clayey in texture and alkaline in reaction (pH of 8 and 7.8 in 2017-18 and 2018-19, respectively and EC of 0.55 and 0.50 dS/m in 2017-18 and 2018-19, respectively). The soil was medium in organic carbon (0.55 and 0.61% in 2017-18 and 2018-19, respectively), low in available nitrogen (210 and 195 kg/ha in 2017-18 and 2018-19, respectively), low in available phosphorus (18.56 and 17.68 kg/ha in 2017-18 and 2018-19, respectively), medium in available potash (229 and 215 kg/ha in 2017-18 and 2018-19, respectively) and medium in available sulphur (10.15 and 11.56 ppm in 2017-18 and 2018-19, respectively).

Nine treatments comprising control (T₁), FYM @ 5 t/ha (T₂), FYM @ 5 t/ha + *Azotobacter* (T₃), FYM @ 5 t/ha + *Azotobacter* + PSB (T₄), FYM @ 5 t/ha + *Azotobacter* + PSB + KSB (T₅), FYM @ 5 t/ha + *Azotobacter* + PSB + KSB + SOB (T₆), FYM @ 5 t/ha + *Azotobacter* + PSB + KSB + SOB + seaweed extract as foliar spray @ 3.5% at 30 and 60 DAS (T₇), FYM @ 5 t/ha + *Azotobacter* + PSB + KSB + SOB + seaweed extract as foliar spray @ 3.5% at 30 and 60 DAS + banana pseudostem sap as foliar spray @ 1% at 30 and 60 DAS (T₈) and FYM @ 5 t/ha + *Azotobacter* + PSB + KSB + SOB + seaweed extract as foliar spray @ 3.5% at 30 and 60 DAS + banana pseudostem sap as foliar spray @ 1% at 30 and 60 DAS + cow urine as foliar spray @ 5% at 30 and 60 DAS (T₉) in randomized block design with three replications. All the recommended cultural operations were followed throughout the experimentation. Irrigation to 5 cm depth applied during cropping period. Five random plants were selected from each plot excluding the border row for taking observation on growth, yield attributes and yield parameters. The data were subjected to statistical analysis by adopting appropriate analysis of variance as described by Cochran and Cox (1967) [4].

Results and discussion

Effect on growth attributes

Growth parameters viz., plant height and number of branches per plant at harvest (Table 1) were significantly influenced by different treatments.

Table 1: Effect of different treatments on growth and yield attributes of coriander (Pooled over two years)

Treatments	Plant height at harvest (cm)	No. of branches per plant	No. of umbels per plant	No. of umbellate per umbel	No. of seeds per umbellate	1000 seed weight (g)
T ₁ : Control (Absolute)	39.16	4.02	6.14	3.87	4.44	9.78
T ₂ : FYM @ 5 t/ha	43.81	4.3	6.74	4.57	4.85	10.23
T ₃ : FYM @ 5 t/ha + <i>Azotobacter</i>	46.72	4.59	6.91	5.04	5.12	10.94
T ₄ : FYM @ 5 t/ha + <i>Azotobacter</i> + PSB	44.69	4.72	7.24	5.18	5.19	12.04
T ₅ : FYM @ 5 t/ha + <i>Azotobacter</i> + PSB + KSB	48.38	4.79	7.4	5.35	5.39	11.37
T ₆ : FYM @ 5 t/ha + <i>Azotobacter</i> + PSB + KSB + SOB	48.77	5	7.91	5.47	5.56	12.47
T ₇ : FYM @ 5 t/ha + <i>Azotobacter</i> + PSB + KSB + SOB + Seaweed extract	48.74	5.29	7.95	5.57	5.76	13.06
T ₈ : FYM @ 5 t/ha + <i>Azotobacter</i> + PSB + KSB + SOB + Seaweed extract + Banana pseudostem sap	50.95	5.12	8.02	5.52	5.93	13.77
T ₉ : FYM @ 5 t/ha + <i>Azotobacter</i> + PSB + KSB + SOB + Seaweed extract + Banana pseudostem sap + cow urine	54.3	5.52	8.35	5.64	6	14.39
S. Em ±	1.9	0.2	0.28	0.17	0.2	0.47
C.D. at 5%	5.47	0.59	0.82	0.49	0.58	1.36
C.V.%	9.8	10.4	9.4	8.2	9.2	9.6

Significantly the highest plant height (54.30 cm) and number of branches per plant (5.52) were registered with the application of FYM @ 5 t/ha + *Azotobacter* + PSB + KSB + SOB + seaweed extract as foliar spray @ 3.5% at 30 and 60 DAS + banana pseudostem sap as foliar spray @ 1% at 30 and 60 DAS + cow urine as foliar spray @ 5% at 30 and 60 DAS in pooled results, which was at par with FYM @ 5 t/ha + *Azotobacter* + PSB + KSB + SOB + seaweed extract as foliar spray @ 3.5% at 30 and 60 DAS + banana pseudostem sap as foliar spray @ 1% at 30 and 60 DAS in plant height and FYM @ 5 t/ha + *Azotobacter* + PSB + KSB + SOB, FYM @ 5 t/ha + *Azotobacter* + PSB + KSB + SOB + seaweed extract as foliar spray @ 3.5% at 30 and 60 DAS, FYM @ 5 t/ha + *Azotobacter* + PSB + KSB + SOB + seaweed extract as foliar spray @ 3.5% at 30 and 60 DAS +

banana pseudostem sap as foliar spray @ 1% at 30 and 60 DAS in number of branches per plant.

Among the different treatments, the highest plant height and number of branches per plant were observed with the treatment of FYM @ 5 t/ha + *Azotobacter* + PSB + KSB + SOB + seaweed extract as foliar spray @ 3.5% at 30 and 60 DAS + banana pseudostem sap as foliar spray @ 1% at 30 and 60 DAS + cow urine as foliar spray @ 5% at 30 and 60 DAS. Organic manures (FYM) and bio-fertilizers (*Azotobacter*, PSB, KSB, SOB) have many advantages in increasing root growth and soil micro flora by providing congenial rhizosphere. It might have induced cell division, expansion of cell wall, meristematic activity photosynthetic efficiency and regulation of translocation of sugar (Meena, 2001 [7] in fenugreek and Prabu *et al.*, 2002 [8] in coriander).

The increase in plant height might be due to application of nutrients through foliar spray of banana pseudostem sap and seaweed extract enhanced the growth rate of plant since it contains the favourable macro and micro nutrients. Similar findings have been reported by Salukhe *et al.* (2013) [10] and Rao *et al.* (2015) [9].

Effect on yield attributes

The significant effect of different treatments was reflected on yield attributes (Table 1). The treatment FYM @ 5 t/ha + Azotobacter + PSB + KSB + SOB + seaweed extract as foliar spray @ 3.5% at 30 and 60 DAS + banana pseudostem sap as foliar spray @ 1% at 30 and 60 DAS + cow urine as foliar spray @ 5% at 30 and 60 DAS excelled yield attributes viz., number of umbels per plant (8.35), number of umbellate per plant (5.64), number of seeds per umbellate (6.00) and 1000-seed weight (14.39) in pooled result, followed by FYM @ 5 t/ha + Azotobacter + PSB + KSB + SOB + seaweed extract as foliar spray @ 3.5% at 30 and 60 DAS and FYM @ 5 t/ha + Azotobacter + PSB + KSB + SOB + seaweed extract as foliar spray @ 3.5% at 30 and 60 DAS + banana pseudostem sap as foliar spray @ 1% at 30 and 60 DAS. However, significantly the lowest values of these yield attributes were recorded under the control.

In case of organic cultivation, the treatment FYM @ 5 t/ha + Azotobacter + PSB + KSB + SOB + seaweed extract as foliar spray @ 3.5% at 30 and 60 DAS + banana pseudostem sap as foliar spray @ 1% at 30 and 60 DAS + cow urine as foliar

spray @ 5% at 30 and 60 DAS found superior than other treatments. FYM might have improved the physical and biochemical properties of the soil and increased the activities of beneficial microorganisms which resulted in to production of growth promoting substances and improved nutrient availability for longer period and thus, beneficial effects on yield attribute parameters Choudhary *et al.* (2008) [3]. Inoculation of various bio fertilizers (*Azotobacter*, PSB, KSB and SOB) might be due to increase in nutrient availability through solubilization of insoluble inorganic fertilizers, decomposition of organic compounds, production of plant growth promoting substances which favors the growth and development of crop and in possess anti-pathogenic activity aided in soils and ultimately beneficial effect on yield attributes Adel *et al.* (2012) [11]. Banana pseudostem sap and seaweed extracts and cow urine contains good amount of essential macro and micronutrients and natural growth hormones, which are essential for improving yield attributes parameters of coriander. Similar findings were also reported by Kumar *et al.* (2002) [5] in coriander, Kumawat and Yadav (2009) [6] in fenugreek, Singhal *et al.* 2015 [12] in cowpea and Shashikumar and Shashidhar (2016) [11] in onion.

Effect on crop yield

A close perusal of data on seed yield and stover yield revealed that different treatments significantly influenced the seed and stover yields (Table 2) of coriander in 2018, 2019 and pooled results.

Table 2: Effect of different treatments on seed yield, stover yield of coriander

Treatments	Seed yield (kg/ha)			Stover yield (kg/ha)		
	2018	2019	Pooled	2018	2019	Pooled
T ₁ : Control (Absolute)	1039	1030	1035	1284	1269	1276
T ₂ : FYM @ 5 t/ha	1170	1173	1171	1323	1312	1317
T ₃ : FYM @ 5 t/ha + <i>Azotobacter</i>	1188	1192	1190	1372	1366	1369
T ₄ : FYM @ 5 t/ha + <i>Azotobacter</i> + PSB	1216	1223	1220	1418	1417	1417
T ₅ : FYM @ 5 t/ha + <i>Azotobacter</i> + PSB + KSB	1249	1254	1252	1441	1442	1442
T ₆ : FYM @ 5 t/ha + <i>Azotobacter</i> + PSB + KSB + SOB	1242	1272	1257	1457	1460	1458
T ₇ : FYM @ 5 t/ha + <i>Azotobacter</i> + PSB + KSB + SOB + Seaweed extract	1294	1323	1308	1483	1489	1486
T ₈ : FYM @ 5 t/ha + <i>Azotobacter</i> + PSB + KSB + SOB + Seaweed extract + Banana pseudostem sap	1346	1344	1345	1502	1510	1506
T ₉ : FYM @ 5 t/ha + <i>Azotobacter</i> + PSB + KSB + SOB + Seaweed extract + Banana pseudostem sap + cow urine	1379	1377	1378	1585	1581	1583
S. Em ±	59	56	41	54	59	40
C.D. at 5%	177	168	117	161	176	115
C.V.%	8.3	7.8	8	6.5	7.01	6.8

Significantly the highest seed yield (1379, 1377, and 1378 kg/ha during 2018, 2019 and pooled results, respectively) was noted with an application of FYM @ 5 t/ha + *Azotobacter* + PSB + KSB + SOB + seaweed extract as foliar spray @ 3.5% at 30 and 60 DAS + banana pseudostem sap as foliar spray @ 1% at 30 and 60 DAS + cow urine as foliar spray @ 5% at 30 and 60 DAS, followed by treatments T₄, T₅, T₆, T₇, T₈ during 2018 and 2019 and T₇, T₈ in pooled result. Similarly, higher stover yield of coriander was recorded under FYM @ 5 t/ha + *Azotobacter* + PSB + KSB + SOB + seaweed extract as foliar spray @ 3.5% at 30 and 60 DAS + banana pseudostem sap as foliar spray @ 1% at 30 and 60 DAS + cow urine as foliar spray @ 5% at 30 and 60 DAS (1585, 1581, and 1583 kg/ha during 2018, 2019 and pooled results, respectively), followed by T₅, T₆, T₇, T₈ during 2018 and 2019 and T₇, T₈ in pooled result.

FYM might have improved the biochemical properties of the soil and increased the activities of beneficial microorganisms which resulted in to production of growth promoting substances and improved nutrient availability for longer period and thus, beneficial effects on growth and yield

parameters of coriander. Inoculation of various bio fertilizers (*Azotobacter*, PSB, KSB and SOB) might be due to increase in nutrient availability through solubilization of insoluble inorganic fertilizers, decomposition of organic compounds, production of plant growth promoting substances which favors the growth and development of crop and in possess anti-pathogenic activity aided in soils and ultimately resulted higher coriander yield. The overall improvement of crop growth reflected into better source-sink relationship, which in turn enhanced the seed and stover yields. The present findings are in close agreement with the results obtained by Vasmate *et al.* (2008) [13], Adel *et al.* (2012) [11].

Conclusion

On the basis of the results obtained from the present two-year field experimentation, it seems quite logical to conclude that higher growth attributes, yield attributes and yield of coriander (Gujarat coriander- 2) under organic farming can be secured by application of FYM @ 5 t/ha + *Azotobacter* + PSB + KSB + SOB + seaweed extract as foliar spray @ 3.5% at 30 and 60 DAS + banana pseudostem sap as foliar spray @ 1%

at 30 and 60 DAS + cow urine as foliar spray @ 5% at 30 and 60 DAS on clayey soil of South Saurashtra Agro-climatic Zone.

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