Journal of Spices and Aromatic Crops
Vol. 20 (1) : 30–33 (2011)

Indian Society for Spices

Effect of vermicompost and chemical fertilizers on growth, yield and quality of coriander (*Coriandrum sativum* L.) in a semi-arid tropical climate

Munnu Singh

Central Institute of Medicinal and Aromatic Plants
(Council of Scientific and Industrial Research)
Research Centre, Allalasandra, GKVK Post, Bangalore–560 065, India
E-mail: munnu.singh@cimap.res.in

Received 13 December 2010; Revised 16 February 2011; Accepted 18 February 2011

Abstract

Field experiments were conducted at Bangalore (semi-arid tropical climate) to study the influence of vermicompost and chemical fertilizers (NPK and sulphur) on growth, seed and oil yield and oil quality of coriander (*Coriandrum sativum*). The results of the study showed that application of vermicompost (7.5 t ha^{-1}) + 25% recommended NPK (25 : 12.5 : 12.5 kg ha^{-1}) produced maximum biomass (28.2 q ha^{-1}), seed (10.82 q ha^{-1}) and oil yield (6.53 kg ha^{-1}) of coriander which was at par with other treatments except full organic manure and control which indicated that 75% NPK requirement can be supplemented through vermicompost without loss of yield. The oil content and quality were not influenced by the treatments tested.

Keywords: coriander, *Coriandrum sativum*, essential oil, fertilizer, quality, yield.

The Central Institute of Medicinal and Aromatic Plants, Lucknow has introduced several Bulgarian selections of coriander (*Coriandrum sativum* L.) and evolved a superior variety, CIMPO S-33 which contains more essential oil (about 1.0%) than the local varieties available in India (0.2%-0.3%) (Dimri *et al.* 1976). Earlier work on coriander has shown that application of N (Singh *et al.* 1979; Rao *et al.* 1983) and N, P and K (Vagujfalvi 1964) increased seed and oil yield of coriander. Integrated supply of nutrients to plants through combination of organic and inorganic sources is becoming increasingly important to protect the environment and quality of soil. Research on the influence of vermicompost and combined application of vermicompost and inorganic fertilizers on yield and quality of coriander oil is meagre. Keeping this in view, the present experiment was conducted to study the effect of vermicompost in combination with fertilizers on growth, yield and oil quality of coriander.

The field experiment was conducted during the winter season (October–March) for 2 years (2004-05 to 2005-06) at Central Institute of Medicinal and Aromatic Plants, Research Centre, Bangalore, on red sandy loam soil of low to medium fertility. Vermicompost contained 1% N, 0.3% P and 0.7% K which was prepared from distilled waste material of Java citronella. The treatments consisted of

six combinations of vermicompost and fertilizer (NPK) : T_1 : Control (no fertilizer or manure), T_2 : Vermicompost (10 t ha^{-1}), T_3 : Vermicompost (7.5 t ha^{-1}) + 25% Recommended NPK (25 : 12.5 : 12.5 kg ha^{-1}), T_4 : Vermicompost (5.0 t ha^{-1}) + 50% Recommended NPK (50 : 25 : 25 kg ha^{-1}), T_5 : 100% Recommended NPK (100 : 50 : 50 kg ha^{-1}) and T_6 : Sulphur (40 kg ha^{-1}) + 100% Recommended NPK (100 : 50 : 50 kg ha^{-1}) (Table 1). The experiment was laid out in a randomized block design with four replications. Coriander seeds were sown on 29th and 31st October during 2004 and 2005, respectively. N, P and K were applied as urea, diammonium phosphate (DAP) and muriate of potash, respectively. Vermicompost and fertilizer P and K were applied as per treatments before planting and incorporated into soil. Nitrogen was top dressed in three equal splits during November, December and January. Coriander cv. S-33 was used at a seed rate of 7 kg ha^{-1} and a intra row spacing of 45 cm. The gross plot area per treatment was 3.6 x 3.6 m^2 and the net plot area was 2.7 x 3.0 m^2. Two weeks after sowing, the crop was thinned to obtain 30 cm inter plant spacing. The crop was harvested on 20th March and 28th March during 2005 and 2006, respectively. Five plants were selected for plant growth observation (height and spread), seed and essential oil yields and linalool content. Essential oil content in seed was estimated by Clevenger's apparatus (Langenau 1948) and essential oil yield was calculated by multiplying seed yield by oil content of seeds. Linalool, the main constituent of coriander oil was determined by gas chromatography (Masada 1976).

Table 1. Treatment combinations and applied nutrient levels under different treatments in coriander

Treatment	Fertilizer (kg ha^{-1})				Organic manure	Total applied nutrient (kg ha^{-1})			
	N	P	K	S	(t ha^{-1})	N	P	K	S
T_1 : Control	—	—	—	—	—	—	—	—	—
T_2 : Vermicompost (10 t ha^{-1})	—	—	—	—	10.0	100	30	70	—
T_3 : Vermicompost (7.5 t ha^{-1}) + 25 : 12.5 : 12.5 NPK kg ha^{-1}	25	12.5	12.5	—	7.5	100	35	65	—
T_4 : Vermicompost (5 t ha^{-1}) + 50 : 25 : 25 NPK kg ha^{-1}	50 40	25.0 60.0	25.0 —	—	5.0	100			
T_5 : 100 : 50 : 50 NPK kg ha^{-1}	100	50.0	50.0	—	—	100	50	50	—
T_6 : Sulphur (40 kg ha^{-1}) + 100 : 50 : 50 NPK kg ha^{-1}	100	50.0	50.0	40	—	100	50	50	40

Plant growth

Application of N P K or vermicompost alone or their combinations increased plant height and plant canopy in coriander over no vermicompost or no fertilizer (Table 2). Plant height increased by 16.7%, 25.6%, 16.6%, 15.7% and 10.9% over control (T_1), in T_2 (vermicompost 10 t ha^{-1}), T_3 (vermicompost 7.5 g ha^{-1} + 25% NPK), T_4 (vermicompost 5 t ha^{-1} + 50% NPK), T_5 100% NPK and T_6 (sulphur 40 kg ha^{-1} + 100% NPK), respectively. Combined application of vermicompost 7.5 t ha^{-1} + 25% NPK resulted in significantly higher plant height than vermicompost applied alone. Application of NPK alone resulted in significantly higher plant height compared with control (no fertilizer or vermicompost). Plant canopy was significantly higher with combined application of vermicompost and NPK fertilizer compared with control. The increase in plant height and plant canopy might be

Table 2. Effect of vermicompost and inorganic fertilizers on growth, yield, oil content and quality of coriander (pooled data of 2 years)

Treatment	Plant growth		Biomass yield (q ha^{-1})	Seed yield	Oil content (q ha^{-1})	Oil yield (kg ha^{-1}) (%)	Linalool % in oil
	Plant height (cm)	Plant spread (cm^2)					
T_1	58.5	794.7	16.1	4.79	0.60	2.87	81.5
T_2	68.3	1065.2	22.3	8.22	0.55	4.98	82.9
T_3	73.5	1305.7	28.2	10.82	0.60	6.53	81.7
T_4	68.2	1250.1	27.5	10.40	0.57	6.05	82.0
T_5	67.7	1135.2	24.0	9.01	0.58	5.61	82.0
T_6	64.9	1043.5	23.5	9.25	0.58	5.53	82.6
C D (P=0.05)	3.99	203.6	3.5	1.85	NS	1.34	NS

T_1 : Control (no fertilizer); T_2 : Vermicompost (10 t ha^{-1}); T_3 : Vermicompost (7.5 t ha^{-1}) + 25 : 12.5 : 12.5 NPK kg ha^{-1}; T_4 : Vermicompost (5 t ha^{-1}) + 50 : 25 : 25 NPK kg ha^{-1}; T_5 : 100 : 50 : 50 NPK kg ha^{-1}; T_6 : Sulphur (40 kg ha^{-1}) + 100 : 50 : 50 NPK kg ha^{-1}

due to beneficial effect of vermicompost in improving the soil environment which in turn encourages proliferous root growth resulting in better absorption of moisture, nutrients and thus producing higher biomass. The significant differences in herbage and seed yield may be attributed to the higher levels of nutrients besides growth stimulating substances (enzymes, antibiotics and growth hormones) available in vermicompost (Vadiraj *et al.* 1998).

Biomass, seed yield and oil yield

Application of NPK or vermicompost alone or their combination increased the biomass and seed and oil yield in coriander over control (no vermicompost or no fertilizer). Biomass yield increased by 38.5%, 75.2%, 70.8%, 49.1% and 46% over control (T_1), in T_2 (vermicompost 10 t ha^{-1}), T_3 (vermicompost 7.5 t ha^{-1} + 25% NPK), T_4 (vermicompost 5 t ha^{-1} + 50% NPK), T_5 (100% NPK) and T_6 (sulphur 40 kg ha^{-1} + 100% NPK), respectively. However, combined application of vermicompost with half dose of recommended fertilizer NPK recorded significantly higher biomass yield than the organic source applied alone. A similar trend was observed with seed and oil yields. The highest seed and oil yields were recorded in T_3 (vermicompost 7.5 t ha^{-1} + 25% NPK) compared with T_2 (full organic manure) and T_1 (control) (no fertilizer or vermicompost). Among the six treatments tested, the highest increase in seed yield was in T_3 followed by T_4 compared with other treatments. The combined effect of inorganic source and vermicompost played a very important role due to their synergistic effect. Application of vermicompost increased the supply of easily assimilated major as well as micronutrients to plants besides mobilizing unavailable nutrients into available form. Choudhary & Jat (2004) also reported similar findings in coriander.

Content and quality

Oil content and linalool content in oil were not influenced by vermicompost and inorganic fertilizers (Table 2). Similar results were also reported by Rao *et al.* (1983) in coriander.

The results of the study showed that application of vermicompost 7.5 t ha^{-1} + 25% recommended NPK (25 : 12.5 : 12.5 kg ha^{-1}) produced maximum biomass, seed and oil yield of coriander which was at par with other treatments except full organic manure and control which indicate that 75% NPK requirement can be supplemented through vermicompost without loss of yield. Content and oil quality were not influenced by organic and inorganic fertilizers.

Acknowledgement

The author is grateful to the Director, Central Institute of Medicinal and Aromatic Plants, Lucknow and Scientist-in-Charge of the Centre for facilities and encouragement and to Mr. S Ramesh, Ex-Technical Officer, for analysis of samples.

References

Choudhary G R & Jat N L 2004 Response of coriander (*Coriandrum sativum*) to inorganic nitrogen, farm yard manure and biofertilizer. Indian J. Agric. Sci. 78: 761-763.

Dimri B P, Khan M N A & Narayana M R 1976 Some promising selections of Bulgarian coriander (*Coriandrum sativum* L.) for seed and essential oil with a note on cultivation and distillation of oil. Indian Perfumer 20: 13-21.

Langenau E E 1948 The examination and analysis of essential oils, synthetics and isolates. In: Guenther E (Ed.) The Essential Oils, Vol. 1 (pp. 317-319). D. Van Nostrand Co., Inc., Princeton, New Jersey.

Masada Y 1976 Analysis of Essential Oil by Gas Chromatography and Mass Spectrometry. John Wiley Co., New York.

Panse V G & Sukhatme P V 1978 Statistical Methods of Agricultural Workers (2nd Edn.), Indian Council of Agricultural Research, New Delhi.

Rao E V S P, Singh M, Narayana M R & Ganesha Rao R S 1983 Fertilizer studies in coriander (*Coriandrum sativum* L.). J. Agric. Sci. Cambridge 100: 251-252.

Singh B, Dhillon G S, Singh S & Kler D S 1979 Effect of some agronomic factors on growth and yield of coriander. J. Res. Punjab Agric. Univ. 16: 389-393.

Vadiraj B A, Siddagangaiah & Pottay S N 1998 Response of coriander (*Coriandrum sativum* L.) cultivars to graded levels of vermicompost. J. Spices Arom. Crops 7: 141-143.

Vagujfalvi D 1964 Mineral fertilization experiment on coriander. Herba Hungarica 3: 41-50.