Effect of Sources and Levels of Organic Manures on Growth and Yield of Black Cumin

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Abstract: ***A field experiment entitled "studies on sources and levels of organic manures on growth, yield and quality of black cumin" was conducted at RIOF, UAS, GKVK, Bengaluru during rabi 2017. The experiment was laid out in RCBD with 12 treatments replicated thrice and the cultivar used was Ajmer Kalonji-1. Results revealed that application of 125 per cent N equivalent through vermicompost recorded significantly higher seed yield (723 kg ha^{-1}). This was attributed mainly by enhanced growth parameters like plant height (55.33 cm), primary branches per plant (8.07), dry matter accumulation per plant (12.93 g) at harvest and leaf area per plant (351.08 cm^2) at 60 DAS. Yield attributes like number of pods per plant (28.67), size of pods (3.00 cm^2) and seeds per pod (87.33).***

1. Introduction

The black cumin (*Nigella sativa* L.) seeds are economically important and they contain 36 to 38 per cent fixed oil and 0.5-1.0 per cent volatile oil. The most important active compounds are thymoquinone (30–48 %), thymohydroquinone, dithymoquinone, p-cymene (7–15 %), carvacrol (6-12 %), 4-terpineol (2-7 %), t-anethol (1-4 %), sesquiterpene longifolene (1-8 %) α-pinene and thymol etc. Black cumin seeds also contain some other compounds in trace amounts. Seeds contain two different types of alkaloids; *i.e.* isoquinoline alkaloids *e.g.* nigellicimine and nigellicimine N-oxide, and pyrazol alkaloids or indazole ring bearing alkaloids which include nigellidine and nigellicine. Moreover, *N. sativa* seeds also contain alpha-hederin, a water soluble pentacyclic triterpene and saponin, a potential anticancer agent (Al-jassir, 1992).

Organic farming gives major emphasis on recovery and maintenance of soil fertility and sustainable yield. Organic farming helps to improve the physical, chemical and biological properties of soil and maintains the ecological balance as well as productivity of life supporting system for the future generations. Organic farming is gaining momentum all over the world as it addresses self-reliance in food, rural development and conservation of natural ecosystem and sustained biodiversity (Pathak and Ram, 2006). Due to increasing health consciousness in recent years, organic products have gained niche position in global food market ($ 100 billion) particularly in developed countries. Organic farming has become a truly exiting and dynamic sector of the food industry.

Organic farming primarily dependent on site specific natural resources and those developed locally – farm yard manure, green manures, crop residues, farm wastes *etc*., rather than external inputs (fertilizer, herbicide, pesticide, antibiotic, hormone *etc*). Apart from using conventional farm based products there is an increasing demand for improvised materials like vermicompost, compost, bio digester liquid organic manure, jeevamrutha, panchagavya, fish amino acids, fermented plant extract, etc. which not only enrich the soil with indigenous micro organisms but also decrease the incidence of diseases in many crops.

2. Materials and Methods

A field experiment was carried out during *rabi*2017 at RIOF experiment block, Gandhi Krishi Vignana Kendra, Bengaluru. Bengaluru. Soil of the experimental site was red sandy loam classified as *Alfisols*. Organic carbon, available nitrogen, phosphorus and potassium content of the soil were medium. The experiment was laid out in randomized complete block design (RCBD). The experiment was laid out with 12 treatments consisting of different levels and combination of organic manures.

2.1 Application of manures

Well decomposed farm yard manure @ 7.5 t ha^{-1} was applied to all the treatments considering 0.4 per cent of N in FYM. The farm yard manure was incorporated into the soil by using hand fork. Compost, vermicompost and biodigester manures were analyzed for their nutritive value. Compost and vermicompost was applied as a basal dose and the biodigester liquid organic manure applied in split dose according to treatments details.

The seeds of black cumin cultivar Ajmer kalonji -1 were sown at spacing of 30 cm wide rows at 1 cm depth with a seed rate of 5 kg ha^{-1}. The furrows were covered properly and the plots were irrigated lightly after sowing. . Excess seedlings were thinned out manually 21 days after sowing and two healthy seedlings were retained per hill. A second thinning was done on 28th day after sowing, to retain only one seedling per hill with intra row spacing of 15 cm. The plots were irrigated lightly after sowing and thereafter at an interval of 5-6 days during the entire cropping period depending on the soil moisture conditions. Good drainage was provided to prevent water logging. Observations on growth and yield parameters were recorded adopting standard procedure at 30, 60, 90 days after sowing and at harvest. Experimental data collected was subjected to statistical analysis by adopting Fisher's method of Analysis of Variance (ANOVA) as outlined by Gomez and Gomez (1984). Critical Difference (CD) values were calculated whenever the 'F' test was found significant at 5 per cent level.

3. Results and Discussion

Application of different organic manures at different levels and their combination have significant effect in growth and yield, in which application of 125 per cent N equivalent through vermicompost has recorded significantly higher plant height (55.33 cm), primary branches per plant (8.07), dry matter accumulation per plant (12.93 g) at harvest and leaf area per plant (351.08 cm^2) at 60 DAS. However it was on par with application of 50 per cent N equivalent through vermicompsot + 25 per cent N equivalent through compost + 25 per cent N equivalent through biodigester liquid organic manure (52.92 cm, 7.88, 12.05 g and 331.00 cm^2 respectively) fallowed by application of 100 per cent N equivalent through vermicompost (51.92 cm, 7.53, 11.93 g and 327.67 cm^2 respectively)). Compared to application of 75 per cent N equivalent through compost (26.46 cm, 5.83 6.83 g and 238.33 cm^2 respectively)). Table 1

Higher plant growth parameter mainly due to proper supply of macro- and micro-nutrients through vermicompost (Cavender *et al*, 2003; Arancon *et al*., 2006 and Kumawat *et al*., 2006), this also resulted in increased vegetative growth parameters. Application of vermicompost also influenced the physiological processes, facilitated early leaf initiation, and resulted in a net increase in number of leaves. The increase in number of leaves, resulted in increased leaf area may have facilitated the capture of more solar energy for metabolic use, more CO_2 fixation and produced greater photosynthates. Has a positive effect on biomass production and subsequently enhanced plant height and primary branches. (Singh *et al*., 2009). These results are in conformity with (Darzi *et al*., 2007) in fennel, (Saeid Nejad and Rezvani Moghaddam, 2011) in cumin, (Darzi *et al*., 2012) in anise and (Nuthana, 2017) in black cumin

Table 1: Growth attributes of black cumin as influenced by sources and levels of organic manures

Treatments	Plant height (cm)	Primary Branches $plant^{-1}$	Dry weight (g $plant^{-1}$)	Leaf area (cm^2 $plant^{-1}$)
T_1	26.46	5.83	6.83	238.33
T_2	33.64	6.63	7.50	275.67
T_3	36.91	7.15	9.24	285.00
T_4	43.51	6.37	8.88	279.78
T_5	51.92	7.53	11.93	327.67
T_6	55.33	8.07	12.93	351.08
T_7	31.49	6.23	7.73	258.33
T_8	38.49	6.98	8.68	300.67
T_9	42.49	7.45	10.04	308.33
T_{10}	43.66	6.33	9.08	284.33
T_{11}	52.92	7.88	12.05	331.00
T_{12}	49.51	7.20	9.88	310.00
S.Em±	**2.44**	**0.22**	**0.376**	**9.38**
CD (P=0.05)	**5.14**	**0.63**	**1.097**	**27.38**

T_1: 75 % N equivalent through compost
T_2: 100 % N equivalent through compost
T_3: 125 % N equivalent through compost
T_4: 75 % N equivalent through vermicompost
T_5: 100 % N equivalent through vermicompost
T_6: 125 % N equivalent through vermicompost
T_7: 75 % N equivalent through bio digester liquid organic manure (50 % as a basal and 50 % at 30 DAS)
T_8: 100 % N equivalent through bio digester liquid organic manure (50 % as a basal and 50 % at 30 DAS)
T_9: 100 % N equivalent through bio digester liquid organic manure (50 % as a basal and 50 % at 30 DAS)
T_{10}: 50 % N equivalent through compost + 25 % N equivalent through vermicompost + 25 % N equivalent through bio digester liquid organic manure (30 DAS)
T_{11}: 50 % N equivalent through vermicompsot + 25 % N equivalent through compost + 25 % N equivalent through bio digester liquid organic manure (30 DAS)
T_{12}: 50 % N equivalent through bio digester liquid organic manure (30 DAS) + 25 % N equivalent through compost + 25 % N equivalent through vermicompost
T_{13}: Check (RDF: 40:20:20 kg N: P_2O_5: K_2O ha^{-1})

Application of different organic manures at different levels and their combination resulted in significant difference among the treatments, in which application of 125 per cent N equivalent through vermicompost has recorded significantly higher seed yield (723 kg ha^{-1}), pods per plant (28.67), seeds per plant (87.33) and pod size (3.00 cm^2). It was on par with application of 50 per cent N equivalent through vermicompsot + 25 per cent N equivalent through compost + 25 per cent N equivalent through biodigester liquid organic manure (656 kg ha^{-1}, 25.00, 85.00 and 2.86 cm^2 respectively) fallowed by application of 100 per cent N equivalent through vermicompost (635 kg ha^{-1}, 25.00, 83.33 and 2.81cm^2 respectively). As compared to application of 75 per cent N equivalent through compost (335 kg ha^{-1}, 17.00, 72.90 and 2.06 cm^2 respectively). Table 2

The important reason responsible for better production of yield attributes and yield could be due to the supply of nutrients in balanced amount and available form. The increased growth in terms of plant height, branches per plant and expansion of leaf lamina provided greater sites for photosynthesis and diversion of photosynthates towards sink (pods and seed). These results are in conformity with the findings of Darzi *et al*. (2012) in *Pimpinella anisum*

Significantly higher seed yield (723 kg ha^{-1}) was recorded with application of 125 per cent N equivalent through vermicompost and this was on par with application of 50 per cent N equivalent through vermicompsot + 25 per cent N equivalent through compost + 25 per cent N equivalent through biodigester liquid organic manure (656 kg ha^{-1}), this might be due to increased growth parameters number of pods per plant, number of seeds per pods and pod size due to enhanced rate of photosynthesis and the biomass production (Roy and Singh, 2006). The increased photosynthesis might be due to increased biological activities of soil and mineral element absorption such as; nitrogen and phosphorus (Jat and Ahlawat, 2006). The present results are in agreement with the report of Darzi *et al*. (2007) in *Foeniculum vulgare*, Moradi *et al*. (2010) in *Foeniculum vulgare* and Nuthana (2017) in black cumin.

4. Conclusion

Application of 125 per cent N equivalent through vermicompost resulted in better growth attributes and contributed for improved fertility status of soil. It was found on par with application of 50 per cent N equivalent through vermicompsot + 25 per cent N equivalent through compost + 25 per cent N equivalent through biodigester liquid organic manure (656 kg ha^{-1}) and also with application of 100 per cent N equivalent through vermicompost (635 kg ha^{1}). Hence, these organic manures, liquid formulations and there combination are efficient organic substitutes for obtaining higher crop yield besides improving the nutrient status of the soil.

Table 2: Yield attributes and grain yield as influenced by black cumin as influenced by sources and levels of organic manures

Treatments	Seed Yield (kg ha^{-1})	Pods $plant^{-1}$	Seeds pod^{-1}	Pod size (cm^{-2})
T_1	335	17.00	72.90	2.06
T_2	403	20.57	78.33	2.34
T_3	457	24.00	80.00	2.42
T_4	452	22.00	78.33	2.32
T_5	635	25.00	83.33	2.81
T_6	723	28.67	87.33	3.00
T_7	413	18.67	74.93	2.25
T_8	490	23.50	77.67	2.48
T_9	515	24.67	80.33	2.67
T_{10}	498	21.67	76.33	2.35
T_{11}	656	25.00	85.00	2.86
T_{12}	540	23.33	80.33	2.69
S.Em±	**32**	**1.333**	**2.107**	**0.063**
CD (P=0.05)	**92**	**3.336**	**6.317**	**0.184**

T_1: 75 % N equivalent through compost
T_2: 100 % N equivalent through compost
T_3: 125 % N equivalent through compost
T_4: 75 % N equivalent through vermicompost
T_5: 100 % N equivalent through vermicompost
T_6: 125 % N equivalent through vermicompost
T_7: 75 % N equivalent through bio digester liquid organic manure (50 % as a basal and 50 % at 30 DAS)
T_8: 100 % N equivalent through bio digester liquid organic manure (50 % as a basal and 50 % at 30 DAS)
T_9: 100 % N equivalent through bio digester liquid organic manure (50 % as a basal and 50 % at 30 DAS)
T_{10}: 50 % N equivalent through compost + 25 % N equivalent through vermicompost + 25 % N equivalent through bio digester liquid organic manure (30 DAS)
T_{11}: 50 % N equivalent through vermicompsot + 25 % N equivalent through compost + 25 % N equivalent through bio digester liquid organic manure (30 DAS)
T_{12}: 50 % N equivalent through bio digester liquid organic manure (30 DAS) + 25 % N equivalent through compost + 25 % N equivalent through vermicompost
T_{13}: Check (RDF: 40:20:20 kg N: P_2O_5: K_2O ha^{-1})

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