Int. J. Seed Spices 12(1), January 2022: 65-69 DOI : https://doi.org/10.56093/IJSS.v12i1.8

Reviewed By
Dr. C.K. Jangir
ICAR-National Research Centre on Seed Spices, Tabiji, Ajmer, Rajasthan, India.
Email: chetan.jangir@icar.gov.in

***Correspondence**
I.S. Naruka
drisnaruka@yahoo.com

Received: 15 March 2022
Revision: 31 January 2024
Accepted: 14 February 2024

Citation
Vaishnav, R., Naruka, I.S and Meena, K.C. 2022. Effect of organic manure and biofertilizers on growth and yield of Dill (*Anethum graveolens* L.). *Int J Seed Spices.*12 (1), 65-69

DOI
https://doi.org/10.56093/IJSS.v12i1.8

Affiliation
College of Horticulture, Mandsaur, Madhya Pradesh 458001, India

Effect of organic manure and biofertilizers on growth and yield of Dill (*Anethum graveolens* L.)

R. Vaishnav, I.S. Naruka* and K.C. Meena

Abstract

A field experiment was conducted during the *Rabi* season of 2020-21 to study the effect of organic manure and biofertilizers on growth and yield of dill (*Anethum graveolens* L.). The eight treatment combinations of FYM, vermicompost and biofertilizers were tested in randomized block design with three replications. Result indicated that organic manure and Biofertilizers significantly influenced growth and yield of dill. Significantly highest biological yield (42.67 q ha^{-1})and seed yield (1.57 q ha^{-1}) with harvest index (46.14%) were observed under treatment T7 [FYM (5 $tonha^{-1}$) + Vermicompost (2 ton ha^{-1}) + Azotobacter (3 kg ha^{-1}) + PSB (5 kg ha^{-1})] compared to control. Findings suggested that application of biological fertilizers significantly increased seeds performance, biological yield per plant, plant height, fresh weight, dry weight, number of umbels per plant, number of seeds per umbel.

Keywords: Dill, FYM, vermicompost, bio-fertilizers, yield and yield attributes

Introduction

Dill (*Anethum graveolens* L.), popularly known as sowa, is one of the oldest cultivated seed spices of India. It is a biennial or annual herb of the Apiaceae or Umbelliferae family. It grows up to 90-120cm tall and has slender branched stems, finely divided leaves, and small umbels of yellow flowers. Younger tender leaves are most important part for culinary use and seeds as spice. The leaves could be used as food, salads, sea foods, and soups. The seeds could be used in soups, bread and flavoring pickles. Dill seed have pleasant aroma with warming flavors is excellent for flavoring and seasoning. The seed used as an anti-spasmodic, anti-flatulent, carminative, anti-inflammatory, anti-rheumatic and diuretic in pharmacological industry and reduce the level of cholesterolemia (Lanky *et al.*, 1993). Dill leaves have excellent antioxidant activities (Singh *et al.*, 2005; Meena *et al.*, 2013).

Application of organic manure with biofertilizers such as vermicompost and nitrogen fixing bacteria has led to a reduce in the use of chemical fertilizers and has provided good quality products free of harmful agrochemicals. (Mahfouz and Sharaf, 2007; Moradi *et al.*, 2010). Organic Fertilizers by application has led to a decrease in the use of mineral fertilizers and has provided maximum quality products free of harmful

agrochemicals for safety of human and have useful effects on soil physical and chemical properties and provide plants with a good and save source of nutrients (Darzi, 2012). Use of organic and chemical fertilizers could affect soil physical properties by changing the organic carbon content of the soil and the chemical composition of the soil solution, which increases the plant's ability to increase the plant's access to high-consumption elements.

Farmyard manure improves the soil properties and finally crop yields (Bhatia and Shukla, 1982). Results generated from series of long-term fertilizer experiments on other cropping systems have revealed that continuous use of high analysis chemical fertilizers increased the crop yield in initial years and adversely affect the sustainability at the later stage (Virmani, 1994).

Vermicompost are the products of the degradation of organic matter through interactions between earthworms and microorganisms. Vermicompost are finely divided peat-like materials with high porosity, aeration, drainage, and water-holding capacity and usually contain most nutrients in the available forms such as nitrates, phosphates, exchangeable calcium and soluble potassium (Arancon *et al*., 2005). Several studies have reported that vermicompost can increase the growth and yield of some medicinal plants such as basil (Singh and Ramesh, 2002), coriander (Singh *et al*., 2009), fennel (Moradi *et al*., 2010), cumin (Saeid Nejad and Rezvani 2011).

Application of biofertilizers provides effective implementation of biological mechanism of plant nutrition and growth promotion. The biofertilizers improve the sustainability of the soil and make it more productive. Biofertilizer enhances the productivity of the soil either by fixing atmospheric nitrogen or stimulating plant growth through synthesis of growth promoting substances. Therefore, judicious and proper use of organic and inorganic source is very much essential not only for obtaining higher yield and quality produce but also to maintain soil health and sustainability for longer period (Elsen, 2000; Patil *et al*.,2016). Further the use of organic sources like biofertilizer, FYM and green manure has its own importance as it lowers the cost of production maintains soil health and is easily available to the small and marginal farmers. Hence, the present study was carried out to investigate the performance of organic manure and biofertilizers on growth, flowering and yield of Dill (*Anethum graveolens* L.)

Materials and Methods

Experiment site

The field experiment was conducted during Rabi season of 2020-21 at the research farm, RVSKVV, College of Horticulture, Mandsaur (Madhya Pradesh).

Treatment details

The experiment was conducted in randomized block design with three replications. There were 8 treatments in the experiment *viz*., T1- Absolute control, T2- FYM (10 ton ha^{-1}), T3- Vermicompost (2.5 ton ha^{-1}), T4- Azotobacter (3 kg ha^{-1}) + PSB (5 kg ha^{-1}), T5 - FYM (10 ton ha^{-1}) + Azotobacter (3 kg ha^{-1}) + PSB (5 kg ha^{-1}), T6 - Vermicompost (2.5 ton ha^{-1}) + Azotobacter (3 kg ha^{-1}) + PSB (5 kg ha^{-1}), T7 - FYM (5 ton ha^{-1}) + Vermicompost (2 ton ha^{-1}) + Azotobacter (3 kg ha^{-1}) + PSB (5 kg ha^{-1}), T8 - FYM (5 ton ha^{-1}) + Vermicompost (1.25 ton ha^{-1}) + Azotobacter (3 kg ha^{-1}) + PSB (5 kg ha^{-1}). The Dill cv. NRCSS-AD-1 was taken for the experiment. The experimental soil is medium black clay loamy soil having pH 7.7 EC 0.64 ds/m, available nitrogen 227 kg ha^{-1}, available phosphorus 15.5 kg ha^{-1} and available potassium 403 kg ha^{-1}. Soil samples (0-15 cm) were collected and analysed. Electrical conductivity of soil samples was determined by method suggested by Piper (1966) on conductivity meter in 1:2 (soil: solution ratio) and expressed in dSm^{-1} at 25 ^{o}C. The soil pH was determined by method suggested by Piper (1966) on Glass electrode pH meter in 1:2 (soil: solution ratio at 25 ^{o}C. Available nitrogen in soil sample was determined by the alkaline permanganate method of Subbiah and Asija (1956). The phosphorus content of soil was estimated following Olsen *et al*., (1954) extraction procedure with use of ascorbic acid method for developing the colour given by Watanabe and Olsen (1965). Availability of potassium in soil samples was determined by method suggested by Jackson (1967) by extracting soil with neutral (pH-7) and normal (1N) ammonium acetate with the help of —flame photometer. at 25 ^{o}C. Available nitrogen in soil sample was determined by the alkaline permanganate method of Subbiah and Asija (1956).

Field observation

Finally, the crop was harvested and produce were dried, threshed, cleaned and weighed. Observations were recorded from five random healthy plants of each treatment on growth, yield and its attributes.

Statistical analysis

The observations on vegetative growth, flowering and yield characters were recorded and analysed statistically as suggested by Panse and Sukhatme (1995).

Results and Discussion

ield parameters

It is evident from the data (Table 1) that the Yield attributes of dill viz. seed yield (q ha^{-1}), biological yield (q ha^{-1}) and harvest index (%) were significantly enhanced with the application of different organic manures and biofertilizers. In the present study, it was observed that application of organic manures and biofertilizers were significantly influenced the seed yield (1.57 q ha^{-1}), biological yield (42.67 q ha^{-1}) and harvest index (46.14%) of dill with treatment T7 (FYM (5 ton ha^{-1}) + Vermicompost (2 ton ha^{-1}) + Azotobacter (3 kg ha^{-1}) + PSB (5 kg ha^{-1}) compared to remaining treatments. This is due to the application of vermicompost which increases the growth rate because of the water and mineral uptake such as; nitrogen and phosphorus, which leads to the biomass yield improvement and number of umbellets, umbels per plant increased. These findings are in agreement with the findings of (Arancon *et al*., 2005; Zaller, 2007). Seed yield, biological yield and harvest index also increased with integrated use of FYM and biofertilizers which might be attributed to improved soil physical conditions along with increased availability of nutrients during the crop growth period (Rout *et al*., 2001).

Table 1: Effect of organic manures and biofertilizers on seed yield, biological yield and harvest index of dill

Treatments	Seed Yield (qha^{-1})	Biological yield (qha^{-1})	Harvest index (%)
T_1 - Absolute control	0.09	30.28	37.97
T_2- FYM (10 ton ha^{-1})	1.09	39.19	34.93
T_3 - Vermicompost(2.5 ton ha^{-1})	1.21	39.77	38.19
T_4 - *Azotobacter* (3 kg ha^{-1}) + PSB (5 kg ha^{-1})	1.31	39.82	41.23
T_5 - FYM (10 ton ha^{-1}) + *Azotobacter* (3 kg ha^{-1})+ PSB (5 kg ha^{-1})	1.43	41.69	43.03
T_6 - Vermicompost (2.5 ton ha^{-1}) + *Azotobacter* (3 kg ha^{-1}) + PSB (5 kg ha^{-1})	1.35	40.17	42.76
T_7 - FYM (5 ton ha^{-1}) + Vermicompost (2 ton ha^{-1}) + *Azotobacter* (3 kg ha^{-1}) + PSB (5 kg ha^{-1})	1.57	42.67	46.14
T_8 - FYM (5 ton ha^{-1}) + Vermicompost (1.25 ton ha^{-1}) + *Azotobacter* (3 kg ha^{-1})+ PSB (5 kg ha^{-1})	1.54	41.78	46.09
S.Em(±)	**0.14**	**0.09**	**0.84**
CD (5%)	**0.44**	**0.30**	**2.54**

Table 2: Effect of organic manures and biofertilizers on plant height, fresh weight and dry weight of dill

Treatments	Plant height (cm)		Fresh weight (g)	Dry weight (g)
	80 days	120 days	(120 days)	(120 days)
T_1 - Absolute control	30.80	107.00	207.13	56.73
T_2- FYM (10 ton ha^{-1})	42.40	123.27	270.73	75.44
T_3 - Vermicompost(2.5 ton ha^{-1})	46.47	123.13	340.80	78.05
T_4 - *Azotobacter* (3 kg ha^{-1}) + PSB (5 kg ha^{-1})	48.17	128.47	352.73	81.33
T_5 - FYM (10 ton ha^{-1}) + *Azotobacter* (3 kg ha^{-1})+ PSB (5 kg ha^{-1})	52.32	132.40	402.60	82.53
T_6 - Vermicompost (2.5 ton ha^{-1}) + *Azotobacter* (3 kg ha^{-1}) + PSB (5 kg ha^{-1})	48.34	129.13	358.20	81.32
T_7 - FYM (5 ton ha^{-1}) + Vermicompost (2 ton ha^{-1}) + *Azotobacter* (3 kg ha^{-1}) + PSB (5 kg ha^{-1})	70.49	150.00	469.40	85.87
T_8 - FYM (5 ton ha^{-1}) + Vermicompost (1.25 ton ha^{-1}) + *Azotobacter* (3 kg ha^{-1})+ PSB (5 kg ha^{-1})	54.63	146.87	432.93	83.54
S.Em(±)	**1.05**	**3.32**	**13.00**	**1.68**
CD (5%)	**3.18**	**10.07**	**39.43**	**5.09**

Table 3: Effect of organic manures and biofertilizers on days to 50 % germination, days to 50 % flowering and days to maturity of dill

Treatments	Days to 50 % germination	Days to 50 % flowering	Days to Maturity
T_1 - Absolute control	10.60	93.27	163.87
T_2- FYM (10 ton ha^{-1})	9.00	85.47	162.67
T_3 - Vermicompost(2.5 ton ha^{-1})	9.20	85.33	161.07
T_4 - *Azotobacter* (3 kg ha^{-1}) + PSB (5 kg ha^{-1})	9.13	85.07	161.13
T_5 - FYM (10 ton ha^{-1}) + *Azotobacter* (3 kg ha^{-1})+ PSB (5 kg ha^{-1})	8.67	83.93	159.60
T_6 - Vermicompost (2.5 ton ha^{-1}) + *Azotobacter* (3 kg ha^{-1}) + PSB (5 kg ha^{-1})	9.13	84.87	161.00
T_7 - FYM (5 ton ha^{-1}) + Vermicompost (2 ton ha^{-1}) + *Azotobacter* (3 kg ha^{-1}) + PSB (5 kg ha^{-1})	7.80	82.67	154.40
T_8 FYM (5 ton ha^{-1}) + Vermicompost (1.25 ton ha^{-1}) + *Azotobacter* (3 kg ha^{-1})+ PSB (5 kg ha^{-1})	8.33	83.80	157.90
S.Em(±)	**0.20**	**0.91**	**0.76**
CD (5%)	**0.61**	**2.75**	**2.29**

Growth Parameters

Combined use of FYM, vermicompost and biofertilizers increased the Growth attributes of dill *viz*., plant height (cm), number of branches per plant, fresh weight of plant (g), dry weight of plant (g) phenological parameters *viz*., days to 50 % germination, days to 50 % flowering and days to maturity of dill (Table 2 and 3). These were significantly affected by different doses of organic manures and biofertilizers. The maximum plant height (70.49 cm and 150 cm at 80 and 120 days after sowing, respectively), fresh (**469.40 g)** and dry weight (85.87 g) were observed with treatment T7 (FYM (5 ton ha^{-1}) + Vermicompost (2 ton ha^{-1}) + Azotobacter (3 kg ha^{-1}) + PSB (5 kg ha^{-1}) compared to remaining treatments. This may be due to positive effect of Azotobacter and Pseudomonas which biologically fixed nitrogen and solubilization of soil phosphate, considerably affect plant growth regulators improve the plant performance. Azotobacter is able to produce antifungal compounds that fight plant diseases, as a result, improve the overall plant growth. Vermicompost also have high water-holding capacity and proper supply of macro and micro-nutrients has a positive effect on biomass production and subsequently enhanced plant height. According to the present analysis, biofertilizer increased plant height, fresh weight, dry weight by enhancing the nitrogen content and the rate of photosynthesis. The present result was derived from the improvement of nitrogen fixing bacteria' activities which are in agreement with the previous studies carried out on fennel, turmeric and hyssop. The above findings are in close conformity with the findings of Joshee *et al.* (2007), Mahfouz and Sharaf Eldin (2007) and Darzi *et al.* (2012) in dill, fennel, and hyssop, respectively.

Conclusion

The overall results obtained from the present investigation clearly revealed that among various combinations oforganic manures and bio-fertilizers, the treatments combination (T7) FYM (5 ton ha^{-1}) + Vermicompost (2 ton ha^{-1}) + *Azotobacter* (3 kg ha^{-1}) + PSB (5 kg ha^{-1}) responded well as substitute to sole fertilizer for seed yield, biological yield and harvest index,plant height, fresh weight and dry weight& reduced days in 50% germination, 50 % flowering and maturity. Production as well as nutrient to human health from dill under organiccondition can be studied. Complete organic production technology for dill is may be developed for betterproduction and human health.

Conflicts of Interest : The authors declare no conflicts of interest.

References

Arancon, N.Q., Edwards, C.A., Bierman, P., Metzger, J.D. and Lucht, C. 2005. Effects of vermicomposts produced from cattle manure, food waste and paper waste on the growth and yield of peppers in the field. *Pedobiologia* 49(4): 297-306.

Bhatia, K.S. and Shukla, K.K. 1982. Effect of continuous application of fertilizer and manure on some physical properties of eroded alluvial soils. *J*

Indian Soc Soil Sci., 30 (1):33-36.

Darzi. M.T., Haj, S. and Rejali, F. 2012. Effects of the application of vermicompost and phosphate solubilizing bacterium on the morphological traits and seed yield of anise (*Pimpinella anisum* L.). *J. Med. Plants Res.,* 6(2):215-219.

Elsen, T.V. 2000. Species diversity as a task for organic agriculture in Europe. *Agri Ecosystem Environ.,* 77:101–109.

Jackson, M.L. 1967. Soil Chemical Analysis. Asia Publishing House, Bombay, India.

Joshee, N.S.R., Mentreddy. and K, Yadav. 2007. 'Mycorhizal fungi and growth and development of micropropagated *Scutelleria integrifolia* plants'. *Ind Crops Prod.,* 25:169-177.

Krishna, A.C., Patil, R., Raghavendra, S.M. and Jakati, M.D. 2008. Effect of bio-fertilizers on seed germination and seedling quality of medicinal plants. *Karnataka J. Agric. Sci.,* 21(4): 588-590.

Lanky, P.S., Schilcher, H., Phillipson, J.D. and Loew, D. 1993. Plants that lower cholesterol. *Acta Hort.,* 14(332):131–136.

Mahfouz, S.A. Sharaf, E.M.A. 2007. Effect of mineral vs. biofertilizer on growth, yield, and essential oil content of fennel (*Foeniculum vulgare* Mill). *Int Agrophysic.* 21:361-366.

Meena, S.S., Mehta, R.S., Meena, R.D., Meena, N.K. and Singh, B. 2013. Effect of sowing time and crop geometry on growth and seed yield of dill (*Anethum sowa* L.). *Int J Seed Spices,* 3(2):81-84.

Moradi, R., Rezvani, M.P., Nasiri, M.M. and Lakzian, A. 2010. The effect of application of organic and biological fertilizers on yield, yield components and essential oil of *Foeniculum vulgare* (Fennel). *Spanish J. Agric. Res.*, 9(2):546-553.

Olsen, S.R., Cole, C.V. and Dean, L.A. 1954. Estimation of available phosphorous in soil by extraction with sodium carbonate. USDA Circular No. 939, Washington. pp.15.

Panse, V.G. and Sukhatme, P.V. 1995. Statistical Methods for Agricultural Workers. ICAR, New Delhi.

Patil, A.G., Mangesh, F., and Rajkumar, M. 2016. Integrated nutrient management in carrot (*Daucus carrota* L.) under north eastern transitional track of Karnataka. *Bioscan.*11: 271-73.

Piper, C.S. 1950. Soil and plant analysis. Inter science Publishers Inc. New York, USDA.

Piper, C.S. 1966. Soil and Plant analysis, Hans Publisher, Bombay.

Rout, D., Satapathy, M.R. and Mahapatra, B.K. 2001. Effect of biofertilizers on nitrogen economy in maize. *Madras Agril. J.,* 88:530-532.

Saeid Nejad, A. H. and Rezvani Moghaddam, P. 2011. Evaluation of compost, vermicompost and cattle manure application on yield,yield components and essential oil per cent in cumin (*Cuminum cyminum*). *J. Hortic. Sci.*, 24:142-48.

Singh, B., Singh, B., Masih, M. R. and Choudhari,R. L. 2009. Evaluation of P and S enriched organic manures and their effect on seed yield and quality of coriander (*Coriandrum sativum*). *Int J Agri. Sci.*, 5:18-20.

Singh, G., Maurya, S., Lampasona, M.P. and De Catalan, C. 2005. Chemical constituents, antimicrobial investigations, and antioxidative potentials of *A. Graveolens* L. Essential oil and acetone extract: Part 52. *J. Food Sci.,* 70:208–215.

Singh, M. and Ramesh, S. 2002. Response of sweet basil (*Ocimum basilicum*) to organic and inorganic fertilizer in semi-arid tropical conditions. *J. Med. Arom. Plant Sci.,* 24:947-50

Subbiah, B.V. and Asija, G.L. 1956. A rapid procedure for the estimation of available nitrogen in soils. *Curr. Sci.,* 25(7):259-260.

Virmani, S.M. 1994. UNCED agenda 21: The new challenges for soils research. *J. Indian Soc. Soil Sci,.* 42:516-524.

Watanabe, F.S. and Olsen, S.R. 1965. Test of ascorbic acid method for determining phosphorus in water and sodium bicarbonate extracts of soil. Proc. *Soil Sci. Soc. Am.*, 29: 677-78.

Zaller, J.G. 2007. Vermicompost as a substitute for peat in potting media: Effects on germination, biomass allocation, yields and fruit quality of three tomato varieties. *Sci. Hortic.*112:191-199.