Int.J.Curr.Microbiol.App.Sci (2018) Special Issue-7: 3632-3637

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Special Issue-7 pp. 3632-3637**
Journal homepage: http://www.ijcmas.com

Original Research Article

Effect of Different INM Practices on Productivity of Dill (*Anethum sowa* Roxb) and on Post-Harvest Soil Properties in Vertisol

Pradeep Singh*, I. S. Naruka, R. Gallani and O. P. Singh

College of Horticulture, Mandsaur, Madhya Pradesh 458001, India
**Corresponding author*

A B S T R A C T

A field experiment was conducted during the Rabi season of 2016-17 to study the effect of different integrated nutrient management practices on yield of dill (*Anethum sowa Roxb*) and on post-harvest soil properties. The eight treatment combinations of different fertilizers doses, vermicompost and biofertilizers were tested in randomized block design with three replications. Integrated nutrient management practices significantly influenced yield of dill and post-harvest soil nutrient status. Significantly higher straw and seed yield with harvest index were observed under treatment 100% NPK of recommended dose + 5 t/ha Vermicompost + PSB and Azotobacter @ 5Kg/ ha each. The same treatment exhibited significantly higher soil organic carbon, available nitrogen, available phosphorus and available potassium Although, there was non-significant difference were observed among the treatments for soil pH and EC.

Keywords

Dill, INM, Vermicompost, Biofertilizer and post-harvest nutrient status

Introduction

'Green Revolution' has shown path to the country for self-sufficiency in food grain production, but the indigenous knowledge and local wisdom was ignored in adopting scientific approach, particularly in applying fertilizers.

Most of the agro-ecological regions now showing reduction in organic carbon consequent upon adoption of intensive cropping and improper crop management practices (Srinivasarao *et al.,* 2006). As a result, soils are encountering diversity of constraints broadly on account of physical, chemical and biological health and ultimately leading to poor soil quality. This shows signs of reversing trend in production at several places, in spite of increased inputs (Srinivasarao, 2011).

Chemical fertilizers play an important role to meet nutrient requirement of the crop but their continuous indiscriminate and improper use on soil have deleterious effects on physical, chemical and biological properties of soil, which in turn reflects on yield. Therefore, there is an urgent need to formulate integrated nutrient management practices for increasing the productivity and quality of soil. Keeping in view, present investigation was undertaken to study the effect of integrated nutrient management practices on yield of Dill and on post-harvest soil properties. Dill (*Anethum sowa Roxb*) is one of an annual aromatic and medicinal plant belonging to the Apiaceae family (Heamalatha *et al.,* 2011). Dill seed and leaves are used as flavouring in sauces vinegars, pastries and soups. Dill seed has

medicinal value as a diuretic, stimulants and a carminative. The emulsion of dill oil in water is considered to be carminative, anti-flatulent, anti-colic pain, anti-vomiting and anti-hiccups for infant and children (Randhawa and Singh, 1988). The gripe water is prepared from its seed, which is used to improve digestion and control vomiting in infants and children. In India dill seed is cultivated in about 36 thousand hectare with production of about 35 thousand metric tonns (DASD, 2017). It is cultivated commercially in Rajasthan, Gujarat, Maharashtra, Andhra Pradesh and Madhya Pradesh states of India. To evaluate the influence of INM practices, the present study is planned with dill (*Anethum sowa Roxb*) on Vertisols of Central India.

Materials and Methods

The field experiment was conducted during Rabi season of 2016-17 at the research farm, RVSKVV, College of Horticulture, Mandsaur (Madhya Pradesh). 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}. The experiment was conducted in randomized block design with three replications. There were 8 treatments in the experiment viz., T_1- 100% NPK recommended dose (80:60:40 kg/ha), T_2- 100% NPK + 2.5t/ha Vermicompost + PSB and Azotobacter 5 kg/ha each, T_3- 100% NPK + 5t/ha Vermicompost + PSB and Azotobacter 5 kg/ha each, T_4- 75% NPK + 2.5t/ha Vermicompost + PSB and Azotobacter 5kg/ha each, T_5- 75% NPK + 5t/ha Vermicompost + PSB and Azotobacter 5 kg/ha each, T_6- 50% NPK + 2.5t/ha Vermicompost + PSB and Azotobacter 5 kg/ha each, T_7- 50% NPK + 5t/ha Vermicompost + PSB and Azotobacter 5 kg/ha each, T_8- 5t/ha Vermicompost + PSB and Azotobacter 5 kg/ha each. The Dill cv. NRCSS-AD-2 was taken for the experiment. 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 ºC. The soil pH was determined by method suggested by Piper (1966) on Glass electrode pH meter in 1:2 (soil: solution ratio)" at 25 ºC. 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".

Results and Discussion

Straw yield, seed yield and harvest index

Integrated use of 100 % NPK, vermicompost and biofertilizers increased the straw yield, seed yield and harvest index (%) of dill (Table 1). These were significantly affected by integrated nutrient management. The maximum straw yield, seed yield and harvest index were observed with treatment T_5 (100% NPK + 5 t/ha Vermicompost + PSB and Azotobacter 5 kg/ha each). This may be due to major nutrients actively involved in vital processes and the availability of these nutrients was enhanced by vermicompost and biofertilizers inoculations resulted in higher yield attributes. The higher yield attributes under this treatments could also be attributed to better growth and development of foliage

of dill which intercepted and efficiently utilized the incident in higher meristematic activities, thus enhancing the growth and finally attained the higher seed yield on account of better and balanced partitioning of photosynthates to the sink (roots and seeds) from source (foliage). Vermicompost also helps in releasing humus forming microbes, nitrogen fixers and some growth regulators which results in the production of more vegetative growth of the plants (Gallani *et al.,* 2016). Ultimately, these characters had beneficial effect on higher seed and straw yield. However, reverse was true in case of other treatments, therefore, they could not registered the higher values of yield attributes on account of restricted supply of photosynthates towards the seeds. These findings are in accordance with the findings of Hnamte *et al.,* (2013) in coriander and Singh and Singh (2016) in dill.

Post-harvest soil nutrient status

It is evident from the data (Table 2) that the pH and electrical conductivity was not altered significant by various treatments under the study. The values of pH and EC for different treatments were ranged from 7.67 to 7.87 and from 0.63 to 0.67 respectively. This could be due to high buffering capacity of the black soil, as reported by Gallani *et al.,* (2013). Significant higher organic carbon content was noted in treatment 100 % NPK + 5 t/ha Vermicompost + PSB 5 kg/ha + *Azotobacter* 5 kg/ha (T_3), closely followed by treatment 75 % NPK + 5 t/ha Vermicompost + PSB 5 kg/ha + *Azotobacter* 5 kg/ha (T_5) and lowest values regarding soil organic carbon was under treatment 100 % NPK recommended dose (80:60:40 kg/ha) (T_1).

This appeared feasible due to the direct and abundant addition of organic matter through organic sources. Kulmi and Tiwari (2006) reported similar increase in organic carbon content of soil due to continuous addition of organic manures.

The post-harvest analysis showed a drastic improvement in available status of major nutrients. The available nitrogen, phosphorus and potassium contents also revealed significant differences.

Table.1 Effect of integrated nutrient management on straw yield, seed yield and Harvest index of dill

S. No	Treatment	Straw yield (q ha^{-1})	Seed yield (q ha^{-1})	Harvest index (%)
T_1	100 % NPK recommended dose (80:60:40 kg/ha)	20.16	11.00	35.30
T_2	100 % NPK + 2.5 tonns Vermicompost/ha + PSB 5 kg/ha and *Azotobacter* 5 kg/ha	25.77	14.15	35.45
T_3	100 % NPK + 5 tonns Vermicompost/ha + PSB 5 kg/ha and *Azotobacter* 5 kg/ha	29.00	17.50	37.63
T_4	75 % NPK + 2.5 tonns Vermicompost/ha + PSB 5 kg/ha and *Azotobacter* 5 kg/ha	23.68	13.10	35.62
T_5	75 % NPK + 5 tonns Vermicompost/ha + PSB 5 kg/ha and *Azotobacter* 5kg/ha	24.91	13.84	35.72
T_6	50 % NPK + 2.5 tonns Vermicompost/ha + PSB 5 kg/ha and *Azotobacter* 5 kg/ha	19.43	10.55	35.20
T_7	50 % NPK + 5 tonns Vermicompost/ ha + PSB 5 kg/ha and *Azotobacter* 5 kg/ha	19.66	10.70	35.24
T_8	5 tonns Vermicompost/ha + PSB 5 kg/ha and *Azotobacter* 5 kg/ha	17.15	9.35	35.29
S.Em. ±		0.729	0.384	0.120
CD at 5%		2.212	1.166	0.365

Table.2 Effect of integrated nutrient management on post-harvest nutrient status of soil

S. No	Treatment	pH	EC (dS/m)	Organic carbon (%)	Available N (kg/ha)	Available P (kg/ha)	Available K (kg/ha)
	Initial status	7.7	0.64	0.42	227	15.56	403
	Post-harvest status						
T_1	100 % NPK recommended dose (80:60:40 kg/ha)	7.67	0.67	0.46	241.67	18.70	432.00
T_2	100 % NPK + 2.5 tonns Vermicompost/ha + PSB 5 kg/ha and *Azotobacter* 5 kg/ha	7.67	0.64	0.52	242.33	18.85	437.67
T_3	100 % NPK + 5 tonns Vermicompost/ha + PSB 5 kg/ha and *Azotobacter* 5 kg/ha	7.67	0.65	0.58	243.67	18.98	445.00
T_4	75 % NPK + 2.5 tonns Vermicompost/ha + PSB 5 kg/ha and *Azotobacter* 5 kg/ha	7.73	0.64	0.51	240.33	17.73	417.33
T_5	75 % NPK + 5 tonns Vermicompost/ha + PSB 5 kg/ha and *Azotobacte*r 5kg/ha	7.83	0.65	0.57	241.00	18.53	429.67
T_6	50 % NPK + 2.5 tonns Vermicompost/ha + PSB 5 kg/ha and *Azotobacter* 5 kg/ha	7.87	0.63	0.48	234.00	17.02	419.00
T_7	50 % NPK + 5 tonns Vermicompost/ ha + PSB 5 kg/ha and *Azotobacter* 5 kg/ha	7.87	0.67	0.56	238.33	17.24	414.00
T_8	5 tonns Vermicompost/ha + PSB 5 kg/ha and *Azotobacter* 5 kg/ha	7.83	0.67	0.53	231.00	16.70	408.00
S.Em. ±		0.164	0.012	0.017	1.088	0.224	5.065
CD at 5%		NS	NS	0.052	3.301	0.680	15.363

The content of these major nutrients were maximum in treatment 100 % NPK + 5 t/ha Vermicompost + PSB 5 kg/ha + *Azotobacter* 5 kg/ha (T_3), closely followed by treatment 100 % NPK + 2.5 t/ha Vermicompost + PSB 5 kg/ha + *Azotobacter* 5 kg/ha (T_2) and 100 % NPK recommended dose 80:60:40 kg/ha (T_1). The significantly lowest values regarding available nitrogen, phosphorus and potassium contents were registered under treatment 5 t/ha Vermicompost + PSB 5 kg/ha + *Azotobacter* 5 kg/ha (T_8). The addition of organics have synergetic effect on nutrient availability. The higher available nutrient content under treatment 100 % NPK + 5 t/ha Vermicompost + PSB 5 kg/ha + *Azotobacter* 5 kg/ha (T_3), may be due to the application of optimum quantity of enriched synthetic fertilizers with vermicompost and biofertilizers which supply adequate amount of readily available nutrients to the soil. Though treatment 100 % RDF 80:60:40 kg/ha (T_1) received the same quantity of nutrients from fertilizers as in 100 % NPK + 5 t/ha Vermicompost + PSB 5 kg/ha + *Azotobacte*r 5 kg/ha (T_3), but comparatively lower post-harvest nutrient status values were observed. This may be lack of addition of organic matter and there by depletion of native pool of available nutrients by plants which was mineralized by build-up of micro-flora and fauna. The results are in conformity with findings of Malviya *et al.*, (2017).

On the basis of one year research and the result reported above it could be concluded that the integrated nutrient management significantly influenced the yield of dill and post-harvest soil nutrient status. The straw yield, seed yield, harvest index of dill and soil nutrient status can be increased with the application of treatment 100 % NPK + 5 tonns Vermicompost/ha + PSB 5 kg/ha and *Azotobacter* 5 kg/ha. The present study indicated that practising INM promoted favourable soil environment for the growing crop by improving soil organic carbon and soil physico-chemical properties leading to better seed yield of dill than inorganic farming system with RDF only.

References

DASD, Directorate of Arecanut and spice development, Kalikut. (2017). Spices-area, production and productivity in India. www.dasd.gov.in

Gallani, R.; Sharma, S.K.; Sirothia, P. and Joshi, O.P. (2013). Effect of organic and inorganic farming systems on physico-chemical properties of vertisols under Soybean- Wheat cropping system. *Soybean Res*., 11(1): 22-29.

Gallani, R; Sharma, S.K., and Joshi, O.P. (2016). Effect of organic and inorganic farming conditions on biological properties of Vertisols under soybean - wheat cropping system. (2016) Soybean Research 14(1): 40-45.

Heamalatha, S.; Swarnalatha, S.; Divya, M.; Gandhi, L. R.; Ganga, D. A. and Gomathi, E. (2011). Pharmacognostical, Pharmacological, Investigation on Anethum Graveolens Linn: A Review Research *Journal of Pharmaceutical, Biological and Chemical Sciences.* 2(4): 564.

Hnamte, V.; Chatterjee, R. and Tania, C. (2013). Growth, flowering, fruit setting and maturity behaviour of coriander (*Coriandrum sativum* L.) With Organics including biofertilizers and inorganic. *The Biosean,* 8(3): 791-793.

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

Kulmi, G.S. and Tiwari, P.N. (2006). Integrated nutrient management in

ashwagandha (*Withania somnifera* Dunal.). *Res. on Crops*, 7(3): 895-899.

Malviya, Nikhil, Naruka, I. S., Gallani, R., Singh, O. P. and Patidar, D. K. (2017). Effect of Integrated Nutrient Management on Growth, Yield and Quality of Ashwagandha (Withania somnifera (L.) Dunal.). Environment & Ecology. 35 (4B): 3206—3210.

Olsen, S.R.; Cole, C.V.; Watanabe, F.S. and Dean, L.A. (1954). Estimation of available phosphorus in soils by extraction with sodium bicarbonate USDA Circular No. 959. Washington DC, USA.

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

Randhawa, G. S. and Singh, A. (1988). Effect of agronomic practices on growth yield and nutrient uptake of dill (*Anethum graveolens* L.). *Indian Perfumer*, 32(4): 327-333.

Singh, D.P.; Sanjay, K.; Sutanu, M. and Kumar, P.V. (2016). Studies on Integrated Nutrient Management on Growth, Yield and Quality of Carrot (*Daucus carota* L.). *International Journal of Agriculture Sciences*, 8(51): 2187-2188.

Srinivasarao Ch., Vittal K P R, Gajbhiye P N and Venkateswarlu B. (2006). Indian Journal on Dryland Agricultural Research and Development 21(5): 105-13.

Srinivasarao Ch. (2011). Nutrient management strategies in rainfed agriculture: constraints and opportunities. Indian Journal of Fertilizers 7(4):12-25.

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

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.