



P-ISSN: 2349-8528
E-ISSN: 2321-4902
IJCS 2017; 5(5): 397-399
© 2017 IJCS
Received: 10-07-2017
Accepted: 11-08-2017

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Effect of integrated nutrient management on growth, yield and quality of Fennel (*Foeniculum vulgare* Mill.)

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Abstract

An experiment was conducted during *rabi* season of 20015-16 at Horticultural experimental farm, College of Horticulture, Mandsaur to study the effect of integrated nutrient management on growth, yield and quality of Fennel (*Foeniculum vulgare* Mill). Integrated application of 50% recommended dose of nitrogen (RDN) through vermicompost (VC) + 50% RDN through fertilizers showed higher values of all the growth, yield and quality attributes, viz. plant height, branches/plant, fresh weight, dry weight, umbels/plant, umbellates/umbel, seeds/umbel, 1,000-seed weight, seed yield, stover yield, biological yield, harvest index, protein and nitrogen% in seed over the absolute 100% RDN through FYM, respectively, closely followed by 50% RDN through FYM + 50% RDN through fertilizers. Therefore, it is recommended to apply 50% RDN through VC + 50% RDN through fertilizers and reduced chemical fertilizers to 50%.

Keywords: Farmyard manure, Fennel, Vermicompost

Introduction

Fennel (*Foeniculum vulgare* Mill.) is one of popular seed spice in India mainly grown in *rabi* season, locally known as saunf belongs to the family Apiaceae (Umbelliferae). Fennel is native to Southern Europe and Mediterranean region. It is a perennial, but is grown as annual or biennial. It is cultivated throughout the temperate and subtropical regions of the world for its aromatic seeds which are used for culinary purpose.

Plants has dark green or bronze wispy leaves with the yellow flowers on compound umbels and is cross pollinated. It is tall, hardy and erect growing herb and grows from 90-150 cm. Among the aromatic plants, we consider the fennel, in which its seeds have several uses (culinary, pharmaceutical, etc). Fennel is also highly recommended for diabetes, bronchitis and chronic coughs, treatment of kidney stones, and is considered to have diuretic, stomachic and galactogogue properties.

In India, it is mainly cultivated in the states of Gujarat and Rajasthan and to some extent in Uttar Pradesh, Bihar, Madhya Pradesh, Punjab and Haryana. India is the largest producer of fennel with an area of about 100,000 ha and annual production of 143,000 tonnes having the productivity of 1,430 kg/ha.

Integrated nutrient management (INM) includes the combined use of organics (i.e. manures, composts, biofertilizers, green manures crop residues etc) and inorganic fertilizer to increase crop yields, improve crop quality and minimise nutrient loss to the environment. Organic sources of nutrients are key factors for improving soil fertility and sustaining yield and quality of the crop in the long run. Use of organic manures combined with chemical fertilizer ensures sustainable and quality production with minimum adverse effect on soil health and environment.

Vermicompost is an ecofriendly natural fertilizer prepared from biodegradable organic wastes, rich in micro and macronutrients. Vermicompost have high porosity, aeration, drainage, water holding capacity and microbial activity, which make it an excellent soil conditioner, it contains plant growth regulating materials, such as humic acids and plant growth regulators like auxins, gibberellins and cytokinins which are responsible for increased plant growth and yield of many crops.

The farm yard manure (FYM) seems to be directly responsible in increasing crop yields either by accelerating the respiratory process by increasing cell permeability by hormone growth

action or by combination of all these processes. It supplies nitrogen, phosphorus, potassium and sulphur in available forms to the plants through biological decomposition. Indirectly it improves physical properties of soil such as aggregation of soil, permeability and water holding capacity. It is prepared from the dung of farm animals and contains all the essential elements.

Materials and Methods

The experiment was undertaken to study the effect of integrated nutrient management on growth, yield and quality of Fennel (*Foeniculum vulgare* Mill) at the farm, College of Horticulture, Mandsaur, Madhya Pradesh using cultivar RF-101 during rabi season of 2015-16. Treatment consisted of T₁ - 100% RDN through fertilizer, T₂ - 100% RDN through FYM, T₃ - 100% RDN through VC, T₄ - 50% RDN through FYM + 50% RDN through fertilizer, T₅ - 50% RDN through VC + 50% through fertilizer, T₆ - 75% RDN through FYM + 25% through fertilizer, T₇ - 75% RDN through VC + 25% through fertilizer. The experiment was conducted in randomized block design having three replications and recommended practices were undertaken. The experimental soil was light black loamy in texture with 7.2 pH and 0.35 ds/m EC having low available of nitrogen (243.2 kg ha⁻¹), medium in available phosphorus (19.75 kg ha⁻¹) and high in potassium (448.0 kg ha⁻¹).

Result and Discussion

Growth and yield attributes

The data showed that integrated nutrient management

significantly affected different growth and yield attributes of fennel viz., plant height (cm), number of branches per plant, fresh weight, dry weight during all stages of growth of fennel viz., 35, 75, and 110 DAS. The maximum plant height (17.20, 89.67 and 147.67 cm), number of branches per plant (4.77, 7.03 and 8.83), fresh weight (47.80, 71.23 and 121.20) was recorded during all stage of growth with T₅ - 50% RDN through VC + 50% RDN through fertilizer.

Yield is the most important marketable produce of Fennel. Inorganic nutrients, organic nutrient and their combination variously affected of yield. Yield increased linearly with the number umbel/plant, number umbellate/umbel, number seeds/umbel, 1000 seed weight, seed yield/plant, seed yield q/ha¹, stover yield, biological yield, harvest index. Fennel recorded was significantly affected by integrated nutrient management. The maximum number umbel/plant (22.73), number umbellate/umbel (26.07), number seeds/umbel (355), 1000 seed weight (6.70 g) and seed yield/plant (14.03 g), seed yield q/ha¹ (18.70), stover yield (38.17 q), biological yield (56.87 q), harvest index(32.88%) were accumulated in T₅ - 50% RDN through VC + 50% RDN through fertilizer. These results confirm the findings of Baboo and Rana (1995) [1] and Tiwari and Banafar (1995) [4].

Quality Parameters

Total protein and nitrogen content (%) in fennel seed was significantly influenced by integrated nutrient management. T₅ - 50% RDN through VC + 50% RDN through fertilizer accumulated the maximum protein content in seed (9.50%) and nitrogen contents in seed (1.52%).

Growth parameters

Treatment	Plant height			No. of branches			Fresh weight (g)			Dry weight (g)		
	35 DAS	75 DAS	110 DAS	35 DAS	75 DAS	110 DAS	35 DAS	75 DAS	110 DAS	35 DAS	75 DAS	110 DAS
T1-100% RDN through fertilizer	13.00	74.33	129.00	3.17	4.50	6.33	37.43	67.47	116.43	14.10	23.33	39.27
T2-100% RDN through FYM	10.67	69.33	116.67	2.30	3.37	4.97	30.83	64.27	113.50	11.93	20.67	36.27
T3-100% RDN Through VC	12.33	71.33	122.67	2.87	3.97	5.80	35.70	65.80	115.50	13.53	22.49	38.40
T4- 50% RDN Through FYM + 50% RDN through fertilizer	15.20	87.00	142.33	4.20	6.13	8.00	44.90	70.00	119.13	17.53	26.37	42.20
T5- 50% RDN Through VC +50% RDN through fertilizer	17.20	89.67	147.67	4.77	7.03	8.83	47.80	71.23	121.20	18.70	27.57	43.93
T6- 75% RDN Through FYM + 25% through fertilizer	13.87	77.67	133.33	3.40	5.00	6.87	39.10	68.37	117.57	15.73	24.83	40.17
T7- 75% RDN Through VC + 25% through fertilizer	14.93	83.00	138.00	3.83	5.53	7.40	41.97	69.67	118.80	16.27	25.07	41.67
S.Em ±	0.220	0.931	1.398	0.078	0.161	0.135	0.673	0.209	0.200	0.132	0.112	0.293
CD at 5%	0.679	2.870	4.308	0.242	0.497	0.418	2.074	0.644	0.619	0.408	0.346	0.904

Yield Parameter

Treatment	Number of umbel/ plant	Number of umbellate / umbel	Number of seeds / umbel	1000 seed weight (g)	Seed yield / plant (g)	Seed yield (q ha ⁻¹)	Stover yield (q ha ⁻¹)	Biological yield	Harvest index
T1-100% RDN through fertilizer	17.83	18.53	343.33	5.87	9.00	10.67	26.53	37.20	28.67
T2-100% RDN through FYM	14.87	14.13	338.00	5.27	6.13	6.50	19.80	26.30	24.71
T3-100% RDN Through VC	16.07	16.50	341.00	5.67	8.00	8.50	22.00	30.50	27.88
T4- 50% RDN Through FYM + 50% RDN through fertilizer	21.63	24.73	352.00	6.50	12.83	16.27	36.33	52.60	30.93
T5- 50% RDN Through VC +50% RDN through fertilizer	22.73	26.07	355.00	6.70	14.03	18.70	38.17	56.87	32.88
T6- 75% RDN Through FYM + 25% through fertilizer	18.80	19.63	346.33	6.03	10.07	12.93	30.90	43.83	29.52
T7- 75% RDN Through VC + 25% through fertilizer	20.21	22.27	349.00	6.30	11.20	14.67	33.53	48.20	30.43
S.Em ±	0.295	0.398	0.896	0.066	0.319	0.499	0.612	0.390	1.165
CD at 5%	0.910	1.228	2.763	0.205	0.985	1.539	1.886	1.204	3.590

Quality Parameter

Treatment	Protein content in seed (%)	Nitrogen content in seed (%)
T ₁ -100% RDN through fertilizer	7.53	1.21
T ₂ -100% RDN through FYM	6.50	1.04
T ₃ -100% RDN Through VC	7.07	1.13
T ₄ - 50% RDN Through FYM + 50% RDN through fertilizer	9.00	1.44
T ₅ - 50% RDN Through VC +50% RDN through fertilizer	9.50	1.52
T ₆ - 75% RDN Through FYM + 25% through fertilizer	8.03	1.29
T ₇ - 75% RDN Through VC + 25% through fertilizer	8.53	1.37
S. Em±	0.135	0.021
CD at 5%	0.419	0.067

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