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Effect of different level of organic manures and inorganic fertilizers on growth, yield and quality of Spinach (*Spinacia oleracea*)

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Abstract

The present experiment was carried out during November, 2019 to January, 2020 in Research Field, Department of Horticulture, SHUATS, Prayagraj. The experiment was conducted in Randomized Block Design (RBD), with ten treatments replicated thrice with (FYM+Vermicompost+NPK) and variety on Hybrid palak. The treatments were T₁ (RDF (NPK- 60:60:60 kg/ha) FYM (10 ton/ ha), T₂ (NPK (45:45:45 kg/hac) + 2.5 ton FYM), T₃ (NPK (45:45:45 kg/hac) +1.5 ton VC), T₄ (NPK (45:45:45 kg/hac) + 1.5 ton FYM +0.75 VC), T₅ (NPK (30:30:30 kg/hac) +5 ton FYM), T₆ (NPK (30:30:30 kg/hac) +2.5 tonVC), T₇ (NPK (30:30:30 kg/hac) + 2.5 ton FYM +1.5 ton VC), T₈ (NPK (15:15:15 kg/hac) +7.5 ton FYM) T₉ (NPK (15:15:15 kg/hac) +3.5 ton VC) and T₁₀ (NPK (15:15:15 kg/hac) + 4 ton FYM +2.25 ton VC). From the present investigation it is concluded that the treatment T₅ (NPK (30:30:30) + 5 ton FYM) was best in growth, yield and quality parameters of Spinach, followed by treatment T₆ (NPK (30:30:30) + 2.5 ton VC) and minimum growth, yield and quality was recorded in treatment T₁ (NPK (60:60:60) + 10 ton FYM), in terms of economics treatment T₅ was best with benefit cost ratio 2.43.

Keywords: Organic manures, inorganic fertilizers, Spinach, growth, yield and quality

Introduction

Vegetables play important role in human diet by providing nutritious compounds like carbohydrates, proteins, fats, vitamins and minerals etc. which are essential constituents of balanced diet. In tropical countries, green leafy vegetables constitute an excellent component of diet.

The important leafy vegetables which are grown in India are Amaranthus, spinach, fenugreek, and coriander. Spinach (*Spinacia oleracea*), belongs to Chenopodiace family, is one of the most important vegetables. It is a leafy cool-season vegetable with global cultivation usually consumed after boiling either fresh or frozen leaves or raw consumed in salad. It is native of Southwest Asia. Green leafy vegetables such as spinach are rich sources of many nutrients and form a major category of vegetable groups that have been designated as 'nature anti-aging wonders' and medicinal value.

Organic agriculture is gaining movement in India due to the individual as well as group efforts to conserve environment and avoid contamination of the farm produce from the use of chemical fertilizers and pesticides. The experiment is to know the difference of growth and yield of spinach/ palak by using organic manures and inorganic fertilizers. To observe the benefits and time duration of crop by using organic manures and inorganic fertilizers. As organic manures are renewable, biodegradable, sustainable and environmentally friendly whereas inorganic fertilizers are inexpensive and get immediate results. Organic manures improve the structure of soil and increases the ability to water holding capacity and nutrients uptake.

Materials and methods

The present Experiment was conducted in Randomized Block Design (RBD), with ten treatments replicated thrice with (FYM+Vermicompost+NPK) and variety on Hybrid palak. The treatments were T₁ (RDF (NPK- 60:60:60 kg/ha) FYM (10 ton/ ha), T₂ (NPK (45:45:45 kg/hac) + 2.5 ton FYM), T₃ (NPK (45:45:45 kg/hac) +1.5 ton VC), T₄ (NPK (45:45:45 kg/hac) + 1.5 ton FYM +0.75 VC), T₅ (NPK (30:30:30 kg/hac) +5 ton FYM), T₆ (NPK (30:30:30 kg/hac) +2.5 tonVC), T₇ (NPK (30:30:30 kg/hac) + 2.5 ton FYM +1.5 ton VC), T₈ (NPK (15:15:15 kg/hac) +7.5 ton FYM) T₉ (NPK (15:15:15 kg/hac) +3.5 ton VC) and T₁₀ (NPK (15:15:15 kg/hac) + 4 ton FYM +2.25 ton VC), in Research field, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during November, 2019 to January, 2020.

Climatic condition in the experimental site

The area of Prayagraj district comes under subtropical belt in the south east of Uttar Pradesh, which experience extremely hot summer and fairly cold winter. The maximum temperature of the location reaches up to 46° C- 48° C and seldom falls as low as 4°C- 5°C. The relative humidity ranges between 20 to 94 %. The average rainfall in this area is around 1013.4 mm annually. However, occasional precipitation is also not uncommon during winter months.

Results and discussion

The present investigation entitled “Effect of different level of organic manures and inorganic fertilizers on growth, yield and quality of Spinach (*Spinacia oleracea*)” was carried out during November, 2019 to January, 2020 in Research Field, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.) India. The results of the present investigation, regarding the effect of different levels of organic and inorganic fertilizers on growth, yield and quality of Spinach, have been discussed and interpreted in the light of previous research work done in India and abroad.

The results of the experiment are summarized below.

A. Growth Parameters

The data on growth parameters are given in table 1.1 it is clear from the table that all the treatment differed significantly for all growth parameters. Significantly maximum Plant height (15.39, 19.92 and 23.48 cm) at 15, 30 and 45 DAS was noticed in T₅(NPK (30:30:30 kg/ha) + 5 t FYM) followed by T₆(NPK (30:30:30) + 2.5t VC) with (13.60, 17.65 and 21.31 cm) and minimum (8.48, 12.14 and 15.01 cm) was observed in treatment T₁(RDF (NPK- 60:60:60 kg/ha) + FYM (10 t/ha)). Similarly in terms of number of leaves/plant maximum significant number of leaves/plant (7.52, 15.63 and 17.73 leaves/plant) at 15, 30 and 45 DAS was noticed in T₅(NPK (30:30:30 kg/ha) + 5 t FYM) followed by T₆(NPK (30:30:30) + 2.5t VC) with (6.88, 14.36 and 16.48 leaves) and minimum (4.43, 9.12 and 11.20 leaves) was observed in treatment T₁(RDF (NPK- 60:60:60 kg/ha) + FYM (10 t/ha)). This is clearly indicated that integrated use of nutrient helpful in cell elongation of leaves use to development of cell and rapid cell division and cell elongation in meristematic region of plant due to production of plant growth substance and this may be due to abundant supply of plant nutrients and nitrogen which led in the growth of Spinach. This findings correlates with the findings of Roy *et al.* (2009) [12] and Vethamoni and Thampi (2018) [16] in Spinach.

In earliness parameter *i.e.* Days to maturity significantly, minimum days for maturity (32.27 days) was recorded in T₅(NPK (30:30:30 kg/ha) + 5 t FYM) followed by T₆(NPK (30:30:30) + 2.5t VC) with (34.65 days) and maximum (40.67 days) was observed in treatment T₁(RDF (NPK- 60:60:60 kg/ha) + FYM (10 t/ha)). The decreased in the number of days taken for edible maturity in best treatment of organic and inorganic fertilizers in spinach is due to combined effect of the organic manures and Chemical fertilizers. The Similar results were also obtained by Aguoru *et al.* (2014) [1] and Vethamoni and Thampi (2018) [16] in the spinach.

B. Yield Parameters

The data on yield parameters are given in table 1.2 it is clear from the table that all the treatment differed significantly for all yield parameters. Significantly maximum fresh weight of plants (91.16 g) was recorded in T₅(NPK (30:30:30 kg/ha) + 5 t FYM) followed by T₆(NPK (30:30:30) + 2.5t VC) with (80.94 g) and minimum (57.96 g) was observed in treatment T₁(RDF (NPK- 60:60:60 kg/ha) + FYM (10 t/ha)). Similarly in terms of yield/plot maximum significant yield (8.20 kg/plot) was observed in T₅ (NPK (30:30:30 kg/ha) + 5 t FYM) followed by T₆ (NPK (30:30:30) + 2.5t VC) with (7.28 kg) and minimum (5.21 kg) was recorded in T₁ (RDF (NPK- 60:60:60 kg/ha) + FYM (10 t/ha)). This might be due to abundant supply of nutrients in form of organic manures with combination of NPK in treatment T₅ enhanced photosynthesis, accumulation of carbohydrates and favorable effect on vegetative growth which increased the weight and size of plants. This finding correlates the findings of Roy *et al.* (2009) [12], Aguoru *et al.* (2014) [1] and Vethamoni and Thampi (2018) [16] in Spinach.

Similar trends was noticed in yield/ha maximum significant yield (194.79 q)/ha was recorded in T₅ (NPK (30:30:30 kg/ha) + 5 t FYM) followed by T₆ (NPK (30:30:30) + 2.5t VC) with (172.99 q) and minimum (123.88 q) was observed in treatment T₁ (RDF (NPK- 60:60:60 kg/ha) + FYM (10 t/ha)). This might be attributed to enhanced photosynthesis, accumulation of carbohydrates, and development of cell wall and cell differentiations as they boost up overall vegetative growth, biological activity of the plants and retention of more number of leaves which increased plant size besides increasing the yield. This finding correlates the findings of Roy *et al.* (2009) [12], Aguoru *et al.* (2014) [1] and Vethamoni and Thampi (2018) [16] in Spinach.

C. Quality Parameters

The data on quality parameters are given in table 1.2 it is clear from the table that all the treatment differed significantly for all quality parameters. Significantly maximum Shelf life (5.12 days) was recorded in T₅ (NPK (30:30:30 kg/ha) + 5 t FYM) followed by T₈ (NPK (15:15:15 kg/ha) + 7.5 t FYM) with (4.52 days) and minimum (2.15 days) was observed in treatment T₁ (RDF (NPK- 60:60:60 kg/ha) + FYM (10 t/ha)). This might be due to higher concentration of organic manures and NPK effect on leaves resulted in better accumulation of assimilates resulting in better quality parameters. This finding correlates the findings of Roy *et al.* (2009) [12] and Aguoru *et al.* (2014) [1] in Spinach.

D. Economics (Benefit: cost ratio)

The data on Economics (Benefit: cost ratio) are given in table 1.2 it is clear from the table that all the treatment differed significantly for all in gross, net return and benefit: cost ratio. In terms of maximum gross return Rs. 136353, net return Rs. 80178.00 and benefit: cost ratio 2.43, was recorded in T₅, followed by T₆ with Rs. 121093.00 gross return and T₄ with Rs. 62004 net return and benefit: cost ratio 2.05 and minimum gross return Rs. 86716.00. Net return Rs. 20886.00 and Benefit: cost ratio 1.32 was recorded in T₁.

Table 1.1: Effect of organic manures and inorganic fertilizers on Plant height, Number of leaves and Days to maturity of Spinach.

Treatment symbol	Treatment combinations	Plant height (cm)			Number of leaves/plant			Days required for Maturity
		15 DAS	30 DAS	45 DAS	15 DAS	30 DAS	45 DAS	
T ₁	RDF (NPK- 60:60:60 kg/ha) + FYM (10 t/ ha)	8.48	12.14	15.01	4.43	9.12	11.20	40.67
T ₂	NPK (45:45:45 kg/ha) + 2.5 t FYM	12.64	16.50	19.96	6.05	12.27	14.30	37.50
T ₃	NPK (45:45:45 kg/ha) +1.5 tVC	13.24	17.53	20.57	6.32	13.36	15.36	36.67
T ₄	NPK (45:45:45 kg/ha) + 1.5 t FYM +0.75 VC	12.76	16.59	19.37	6.18	12.12	14.30	35.31
T ₅	NPK (30:30:30 kg/ha) +5 t FYM	15.39	19.92	23.48	7.52	15.63	17.73	32.27
T ₆	NPK (30:30:30 kg/ha) +2.5 tVC	13.60	17.65	21.31	6.88	14.36	16.48	34.65
T ₇	NPK (30:30:30 kg/ha) + 2.5 t FYM +1.5 tVC	12.53	15.95	18.68	6.26	11.01	13.02	35.30
T ₈	NPK (15:15:15 kg/ha) +7.5 t FYM	11.52	14.61	17.46	5.73	12.18	14.09	35.12
T ₉	NPK (15:15:15 kg/ha) +3.5 tVC	9.56	13.61	16.50	5.43	10.22	12.26	38.02
T ₁₀	NPK (15:15:15 kg/ha) + 4 t FYM +2.25 tVC	11.45	14.79	17.89	5.31	10.49	12.42	38.11
F-Test		S	S	S	S	S	S	S
SE(d)		0.178	0.281	0.302	0.205	0.217	0.221	0.320
C.V.		1.795	2.161	1.947	4.181	2.202	1.920	1.079
C.D. at 5%		0.376	0.595	0.640	0.434	0.460	0.468	0.678

Table 1.2: Effect of organic manures and inorganic fertilizers on Fresh weight, yield/plot, yield/ha, Shelf life and Benefit: Cost ratio of Spinach

Treatment symbol	Treatment combinations	Fresh weight of plant (g)	Yield/plot (kg)	Yield/ha (q)	Shelf life (days)	Benefit : Cost Ratio
T ₁	RDF (NPK- 60:60:60 kg/ha) + FYM (10 t/ ha)	57.96	5.21	123.88	2.15	1.32
T ₂	NPK (45:45:45 kg/ha) + 2.5 t/ha	71.04	6.39	151.81	2.68	1.9
T ₃	NPK (45:45:45 kg/ha) +1.5 t/ha	78.62	7.07	167.99	3.01	1.93
T ₄	NPK (45:45:45 kg/ha) + 1.5 t/ha +0.75 t/ha	80.72	7.26	172.51	3.05	2.05
T ₅	NPK (30:30:30 kg/ha) +5 t/ha	91.16	8.20	194.79	5.12	2.43
T ₆	NPK (30:30:30 kg/ha) +2.5 t/ha	80.94	7.28	172.99	3.97	1.9
T ₇	NPK (30:30:30 kg/ha) + 2.5 t/ha +1.5 t/ha	74.72	6.72	159.69	3.38	1.83
T ₈	NPK (15:15:15 kg/ha) +7.5 t/ha	72.39	6.51	154.70	4.52	1.92
T ₉	NPK (15:15:15 kg/ha) +3.5 t/ha	65.86	5.92	140.73	2.68	1.48
T ₁₀	NPK (15:15:15 kg/ha) + 4 t FYM +2.25 t/ha	67.98	6.11	145.25	2.86	1.57
F-Test		S	S	S	S	
SE(d)		0.385	0.34	0.830	0.198	
C.V.		0.636	0.626	0.641	7.255	
C.D. at 5%		0.815	0.072	1.756	0.419	

Conclusion

From the present investigation it is concluded that the treatment T₅ (NPK (30:30:30) + 5 t/ha) was best in growth, yield and quality parameters of Spinach, followed by treatment T₆ (NPK (30:30:30) + 2.5t/ha) and minimum growth, yield and quality was recorded in treatment T₁ (NPK (60:60:60) + 10 t/ha), in terms of economics treatment T₅ was best with benefit cost ratio 2.43.

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