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Studies on the Effect of Integrated Nutrient Management Practices on Growth and Leaf yield of Palak (*Beta vulgaris* var. *bengalensis* Hort.)

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ABSTRACT

The results revealed that application of 100% recommended dose of fertiliser through inorganic (80:40:50 kg of NPK ha^{-1}) recorded higher values for plant height, number of leaves, leaf area, fresh weight, dry weight and fresh leaf yield per hector and it was on par with 75% RDF through inorganic fertilizers + 25% recommended dose of nitrogen through poultry manure of organic source and 75% RDF through inorganic fertilizers + 25% RD of nitrogen through vermicompost in the palak.

Key words : INM, Leaf yield, Palak growth.

Palak (*Beta vulgaris var. bengalensis* Hort.) belonging to the family Chenopodiaceae is the most popular leafy vegetables with good nutritive value. It is a commonly grown as leafy vegetable throughout the tropical and subtropical regions (Veeraragavathatham, 1998) for its tender succulent leaf and petiole, and is a cheap and rich source of Vitamin-A which helps in improving the eyesight. It is also a good source of Vitamin-C and mineral elements like iron, calcium, phosphorus and amino acids. In India, farm yard manure (FYM) remains the most popular organic manure applied to fields and it can potentially supply about 6.8 million tons of N, P and K per year (Sarkar and Rattan, 1995). Bio-fertilizers and organic manures together can make significant contribution in maintaining soil health and balancing soil fertility through supply of plant nutrients at an optimum level (Swaminathan, 1992). However, application of organic manures alone is not adequate to meet the nutrient demand of the recent high yielding varieties of crops because of their scarce availability, low nutrient content and slow nutrient releasing nature. Improved varieties require higher amount of nutrients to reap higher yields, but continuous usage of chemical fertilizers without any or little addition of organic manures may not sustain the soil fertility. The problem of nutrient depletion is being further aggravated with the decreasing availability and consequent low rates of application of organic manures. Therefore, combined use of chemical, organic manures and bio-fertilizers seems to be the only way out to replenish the soil nutrient reserve. In this context, Integrated Nutrient Management (INM) holds a great response in meeting the growing nutrient demands of intensive agriculture and maintaining crop productivity at fairly high level. The conjunctive use of organic and inorganic sources will improve soil health and help in maximizing production as it involves utilization of local resources and hence turned out to be rational, realistic, eco-friendly and economically viable way of supply of nutrients to the crops. Keeping this in view, the present investigation was under taken.

MATERIAL AND METHODS

The field experiment was laid out in a randomized block design (RBD) with three replications during *rabi*, 2010-2011 at College Farm of Horticulture College and Research Institute, Venkataramannagudem, West Godavari district, Andhra Pradesh on red sandy loam soil. The studies were carried out using palak cv Arka Anupama with 11 treatments viz.,75%RDF +25% RDN through VC(T_1), 75%RDF +25% RDN through FYM (T_2), 75%RDF +25% RDN through PM (T_3), 50% RDF +50% RDN through VC(T_4), 50% RDF + 50% RDN through FYM(T_5), 50% RDF + 50% RDN through PM (T_6), 25% RDF + 75% RDN through VC (T_7), 25%RDF + 75% RDN through FYM (T_8), 25% RDF + 75% RDN through PM(T_9), 100% RDF through

Table 1. Effect of integrated nutrient management practices on growth parameters at harvest in palak cv. Arka Anupama.

Treatments	Plant height (cm)	No.of leaves/ plant	Leaf area per plant (cm^2)
T_1- 75% RDF through inorganic fertilizers + 25% RD of nitrogen through VC	27.50	15.70	393.86
T_2- 75% RDF through inorganic fertilizers + 25% RD of nitrogen through FYM	26.41	14.86	389.18
T_3-75% RDF through inorganic fertilizers + 25% RD of nitrogen through PM	28.11	16.20	396.44
T_4- 50% RDF through inorganic fertilizers + 50% RD of nitrogen through VC	23.72	13.00	374.88
T_5- 50% RDF through inorganic fertilizers + 50% RD of nitrogen through FYM	22.92	12.36	369.66
T_6- 50% RDF through inorganic fertilizers + 50% RD of nitrogen through PM	24.16	13.40	376.33
T_7- 25% RDF through inorganic fertilizers + 75% RD of nitrogen through VC	21.18	10.10	359.34
T_8- 25% RDF through inorganic fertilizers + 75% RD of nitrogen through FYM	19.88	9.78	354.11
T_9- 25% RDF through inorganic fertilizers + 75% RD of nitrogen through PM	20.72	10.90	360.77
T_{10}-100% RD of nutrients through organic manures (33.3% VC + 33.3% FYM + 33.3% PM)	17.67	8.37	344.38
T_{11}- 100% RDF through inorganic fertilizers (80:40:50 kg of NPK ha^{-1})	29.63	16.86	401.88
Mean	23.72	12.86	374.63
SE m±	0.73	0.46	2.70
C.D at 5%	2.16	1.38	8.04

VC - Vermicompost; FYM – Farm Yard Manure; PM – Poultry Manure

organic(33%VC, 33% FYM and 33%PM)(T_{10}), and 100% through RDF(80:40:50 kg of NPK ha^{-1}). A common application of bio-fertilizers (*Azospirllum*@ 5 $kgha^{-1}$ and PSB@ 2 kg ha^{-1}),was given to all treatments. Total quantity of vermicompost, farm yard manure and poultry manure along with bio-fertilizers were applied to the soil as a basal dose as per the treatments. Dosages of different organic manures were arrived to meet the recommended dose of nitrogen as per the available nitrogen content in the respective organic manures. The inorganic source of nitrogen was applied in four equal splits in the form of urea as a basal dose ($1/4^{th}$ of the total nitrogen) and remaining thee splits were applied after each leaf cutting. The inorganic source of phosphorus and potassium were applied as a basal dose only in the form of single super phosphate and muriate of potash respectively. The seeds were sown at a spacing of 20 cm between rows and 10 cm within the row. The data were analyzed statistically applying the analysis of variance procedures for Randomized Block Design (Panse and Sukhatme, 1967).

RESULTS AND DISCUSSION

Significant differences in plant height, number of leaves per plant and leaf area per plant of palak due to different nutrient sources and their combinations were observed at harvest (Table-1).

Table 2. Effect of integrated nutrient management practices on fresh weight of leaf plant^{-1}(g plant^{-1}) dry weight (g plant^{-1}) and total leaf yield (t ha^{-1}) in palak cv Arka Anupama.

Treatments	Total fresh weight (g plant^{-1})	Total dry weight (g plant^{-1})	Fresh leaf yield (t ha^{-1})
T_1- 75% RDF through inorganic fertilizers + 25% RD of nitrogen through VC	137.46	10.44	42.91
T_2- 75% RDF through inorganic fertilizers + 25% RD of nitrogen through FYM	133.16	10.18	42.46
T_3-75% RDF through inorganic fertilizers + 25% RD of nitrogen through PM	139.55	10.60	43.55
T_4- 50% RDF through inorganic fertilizers + 50% RD of nitrogen through VC	124.96	9.34	39.47
T_5- 50% RDF through inorganic fertilizers + 50% RD of nitrogen through FYM	121.41	9.01	38.61
T_6- 50% RDF through inorganic fertilizers + 50% RD of nitrogen through PM	126.94	9.57	40.22
T_7- 25% RDF through inorganic fertilizers + 75% RD of nitrogen through VC	112.35	8.01	35.58
T_8- 25% RDF through inorganic fertilizers + 75% RD of nitrogen through FYM	110.13	7.73	34.70
T_9- 25% RDF through inorganic fertilizers + 75% RD of nitrogen through PM	114.01	8.33	36.20
T_{10}-100% RD of nutrients through organic manures (33.3% VC + 33.3% FYM + 33.3% PM)	104.04	7.03	32.03
T_{11}- 100% RDF through inorganic fertilizers (80:40:50 kg of NPK ha^{-1})	141.53	10.79	44.23
Mean	124.14	8.80	39.09
SE m±	0.96	0.20	0.49
C.D at 5%	5.56	0.59	1.47

VC - Vermicompost; FYM – Farm Yard Manure; PM – Poultry Manure

The results revealed that application of 100% RDF produced taller plants (29.63 cm) with maximum number of leaves per plant (16.86)and maximum leaf area per plant (401.88 cm^2), but was on par with 75% RDF through inorganic fertilizers + 25% recommended dose of nitrogen through poultry manure and 75% RDF through inorganic fertilizers + 25 % recommended dose of nitrogen through vermicompost (Table-1) The significant increase in plant height, and number of leaves in these treatments over the others was due to the presence of readily available form of nitrogen at higher quantities that might have resulted in increased plant height mainly by elongation of cells and cell division as it is a chief constituent of protoplasm and chlorophyll. The similar result with application of poultry manure was also observed in garlic (Raghava Rao, 2003). Ibeawuchi *et al.* 2006 also reported that application of poultry manure increased the number of leaves per plant in amaranthus. Availability of nitrogen in higher quantities was reported to accelerate the synthesis of carbohydrates, amino acids etc., from which the phytohormones such as auxins, gibberellins, cytokinins and ethylene get synthesized resulting in increased plant height as stated by Maynard and

David, (1987). Higher plant height and leaf area per plant might have resulted in successive increase of leaf dry weight. The possible reason for the acceleration of these growth parameters might be due to influence of nitrogen, the chief constituent of proteins, essential for the formation of protoplasm which might have lead to cell division and cell enlargement. Moreover, nitrogen is an important component of amino acids and coenzymes which are of considerable biological importance.

Total fresh and dry weight per plant and total fresh leaf yield were significantly influenced by the application different nutrient sources and their combination. The treatment with 100% RDF produced maximum total fresh and dry weight per plant (141.53 and 10.79g respectively) and fresh leaf yield (44.23 t/ha) but was on par with 75% RDF through inorganic fertilizers + 25% recommended dose of nitrogen through poultry manure (T_3)and 75% RDF through inorganic fertilizers + 25 % recommended dose of nitrogen through vermicompost (T_1)(Table-2). The maximum total fresh weight observed in plants was due to better growth of the plants as a result of increase in plant height number of leaves and leaf area per plant. These results are in combination with the findings of Ramakrishna(2005), and (Phadnis *et al.,* 2007) (Madhavi *et al*., 2009) in spinach. The increase in dry matter content could be attributed to increased plant height, number of leaves and higher leaf area per plant during the crop growth period. Which might have contributed by the increased photosynthetic activity with the more leaf surface area with better supply of nutrients as reported by Vachani and Patel, (1993a). The higher dry matter accumulation in the plant with the poultry manure combination over FYM combination also could be due to higher availability of nutrients as it contains higher concentration of nitrogen and other nutrients (Reddy and Reddy, 1998). Seshadri and Prabhakara Setty (2002) also reported the similar results that the poultry manure application resulted in significant highest yield in chilli, in lettuce were reported by (Paudel *et al.,* 2004), in amaranthus (Geethakumar *et al.,* 2005) and in palak (Phadnis *et al.,* 2007).

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