



STUDIES ON INTEGRATED NUTRIENT MANAGEMENT PRACTICES ON DRY MATTER PRODUCTION AND NUTRIENT UPTAKE OF PALAK (*Beta vulgaris* var. *bengalensis* Hort.)

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ABSTRACT

A study on Palak (*Beta vulgaris* var. *bengalensis* Hort.) was carried out during *rabi* season, 2010-2011 at college farm of Horticulture College and Research Institute, Venkataramannagudem, West Godavari district, Andhra Pradesh, to determine the Studies on the effect of integrated nutrient management practices on dry matter production and nutrient uptake". It revealed that the highest dry matter production (5395 kg ha⁻¹) and nutrient uptake of nitrogen, phosphorus and potassium (102.81, 18.06 and 98.667 kg ha⁻¹) was recorded with the application of 100% RDF through inorganic (80:40:50 kg of NPK ha⁻¹) and was on par with the dosage of 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.

KEY WORDS: Palak, Dry matter and Nutrient uptake

INTRODUCTION

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 leafy vegetable throughout the tropical and subtropical regions (Veeraragavathatham, 1998) for its tender succulent leaf and petiole and it 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 as 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. 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.

MATERIAL AND METHODS

The field experiment was laid out in a randomized block design 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 (T₁), 75% RDF + 25% RDN through FYM (T₂), 75% RDF + 25% RDN through PM (T₃), 50% RDF + 50% RDN

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through VC (T₄), 50% RDF + 50% RDN through FYM (T₅), 50% RDF + 50% RDN through PM (T₆), 25% RDF + 75% RDN through VC (T₇), 25% RDF + 75% RDN through FYM (T₈), 25% RDF + 75% RDN through PM (T₉), 100% RDF through organic (33%VC, 33% FYM and 33%PM) (T₁₀) and 100% through RDF (80:40:50 kg of NPK ha⁻¹). A common application of bio-fertilizers (*Azospirillum* @ 5 kg ha⁻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 (1/4th of the total nitrogen) and remaining three 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. To determine the dry matter production, the samples were dried in hot air oven at 60±2°C temperature till constant weights were obtained. The dry matter was worked out from the dried leaf samples and expressed in kg ha⁻¹. The available NPK was estimated through nitrogen by Micro-Kjeldahl distillation method, phosphorus by Colorimetric phosphor-Vando Molybdate method and potassium by Flame photometer method in the dried leaf samples of palak respectively. The uptake of nutrients was computed by using the following formulae.

Uptake of nutrient (kg ha⁻¹) =

$$\frac{\text{Percentag of nutrient} \times \text{Total drymatter in kg ha}^{-1}}{100}$$

The data were analyzed statistically applying the analysis of variance procedures for Randomized Block Design as stated by Panse and Sukhatme, (1967).

RESULTS AND DISCUSSION

The experiment conducted on the effect of integrated nutrient management practices on dry matter production and nutrient uptake of major nutrients of N, P and K in palak revealed that the application of 100% RDF through inorganic sources @ 80:40:50 kg of NPK ha⁻¹ recorded the highest total production (Table 1) (5395.00 kg ha⁻¹)

which was significantly superior to all other treatments. This was followed by 75% RDF through inorganic fertilizers + 25% RD of nitrogen through poultry manure 5298.88 kg ha⁻¹ and the treatment dose of 75% RDF through inorganic fertilizers + 25% RD of nitrogen through vermicompost (5222.77 kg ha⁻¹) and they were significantly superior to rest of the treatments. The lowest total dry matter production (3517.77 kg ha⁻¹) was recorded with 100% RD of nutrients supplied through organic manures. This could be attributed to increased plant height, number of leaves and higher leaf area during the crop growth period in respective treatment doses. These factors might have contributed more to the photosynthetic leaf surface area, higher carbohydrate assimilation with better supply of nutrients and the inadequate availability of nitrogen due to its slow release from organic manures might have resulted in shorter plants and reduced leaf area which has ultimately resulted in reduced photosynthetic efficiency and crop growth leading to low dry matter production as conformed by Vachani and Patel 7(1993) and Raghava Rao (2003) in onion.

The nutrient uptake is a positive function of dry matter yield (Ramakal *et al.* 1988). The highest N, P and K uptake @ 102.81, 18.06, and 98.67 kg ha⁻¹ and dry matter production respectively was recorded with 100% RDF through inorganic (5395.00 kg ha⁻¹) which was significantly superior to all other treatments but was on par with 75% RDF through inorganic fertilizers + 25% RD of nitrogen through poultry manure (5298.88 kg ha⁻¹). The lowest N, P and K uptake at harvest was observed with 100% nitrogen through organic sources along with bio-fertilizers application (Table 2). The increased N, P, and K uptake resulted in increased dry matter yield and the lowest N, P, and K uptake in 100% organic sources of nutrients resulted in the decreased dry matter yield. This is in consonance with the findings of Mallangouda *et al.* (1995) in onion and Prabakaran (2003) in tomato. The uptake of N P K was higher with poultry manure because of higher nutritive value in respect to major nutrients and also the improvement of soil condition by the organic manure. Similar results were reported by Raghava Rao, (2003) in garlic.

Table 1. Studies on integrated nutrient management practices on dry matter production in leaves (kg ha⁻¹) in palak cv. Arka Anupama

Treatments	Total
T ₁ : 75% RDF through inorganic fertilizers + 25% RD of nitrogen through VC	5222.77
T ₂ : 75% RDF through inorganic fertilizers + 25% RD of nitrogen through FYM	5092.22
T ₃ : 75% RDF through inorganic fertilizers + 25% RD of nitrogen through PM	5298.88
T ₄ : 50% RDF through inorganic fertilizers + 50% RD of nitrogen through VC	4670.55
T ₅ : 50% RDF through inorganic fertilizers + 50% RD of nitrogen through FYM	4506.66
T ₆ : 50% RDF through inorganic fertilizers + 50% RD of nitrogen through PM	4787.77
T ₇ : 25% RDF through inorganic fertilizers + 75% RD of nitrogen through VC	4006.66
T ₈ : 25% RDF through inorganic fertilizers + 75% RD of nitrogen through FYM	3866.66
T ₉ : 25% RDF through inorganic fertilizers + 75% RD of nitrogen through PM	4168.89
T ₁₀ : 100% RD of nutrients through organic manures (33.3% VC + 33.3% FYM + 33.3% PM)	3517.77
T ₁₁ : 100% RDF through inorganic (80:40:50 kg of NPK ha ⁻¹)	5395.00
Mean	4593.99
SEM±	45.71
C.D at 5%	135.81

Table 2. Studies on integrated nutrient management practices on nutrient uptake (kg ha⁻¹) at harvest in palak cv. ArkaAnupama

Treatments	N	P	K
T ₁ : 75% RDF through inorganic fertilizers + 25% RD of nitrogen through VC	98.60	16.18	95.91
T ₂ : 75% RDF through inorganic fertilizers + 25% RD of nitrogen through FYM	95.53	15.42	94.60
T ₃ : 75% RDF through inorganic fertilizers + 25% RD of nitrogen through PM	100.00	17.83	96.54
T ₄ : 50% RDF through inorganic fertilizers + 50% RD of nitrogen through VC	88.56	12.76	90.80
T ₅ : 50% RDF through inorganic fertilizers + 50% RD of nitrogen through FYM	85.60	12.39	89.66
T ₆ : 50% RDF through inorganic fertilizers + 50% RD of nitrogen through PM	90.86	13.39	91.80
T ₇ : 25% RDF through inorganic fertilizers + 75% RD of nitrogen through VC	78.36	10.14	85.93
T ₈ : 25% RDF through inorganic fertilizers + 75% RD of nitrogen through FYM	76.56	9.69	84.50
T ₉ : 25% RDF through inorganic fertilizers + 75% RD of nitrogen through PM	80.42	10.38	86.83
T ₁₀ : 100% RD of nutrients through organic manures (33.3% VC + 33.3% FYM + 33.3% PM)	70.93	7.68	81.27
T ₁₁ : 100% RDF through inorganic (80:40:50 kg of NPK ha ⁻¹)	102.81	18.06	98.67
Mean	88.02	13.11	90.57
SEm±	1.56	0.57	0.93
C.D at 5%	4.63	1.71	2.78

REFERENCES

- Mallangouda, B., Salikeri, G.S., Hulamani, N.C., Murthy, B. and Madalgeri, B.B. 1995. Effect of NPK and FYM on growth parameters of onion, garlic and coriander current Research UAS Bangalore 24 (11): 212-213.
- Panse, R.P and Sukhatme, P.V. 1967. Statistical methods for agricultural workers. *Indian Council of Agricultural Research*, New Delhi.
- Prabakaran, C. 2003. Nutrient uptake and yield of tomato (*Lycopersicon esculentum*) with different organic manures. *Journal of Research, Birsa Agricultural University*. 15(1): 131-134.
- Raghava Rao, M. 2003. Studies on integrated nutrient management with poultry manure, Vermicompost and fertilizers in garlic (*Allium sativum* L.) Leafy Hibiscus based cropping system. Ph.D. Thesis submitted to Acharya N.G. Ranga Agricultural University, Hyderabad.
- Ramakal, K.S., Khera, A.P., Bhatia, R.N., Gupta, S.P and Duhan, B.S. 1988. Effect of combined application of FYM and inorganic fertilizer on grain yield and soil Fertility status in Bajra wheat crop sequence. *Haryana Journal of Agronomy*. 4(1): 42-47.
- Sarkar, M.C and Rattan, R.K. 1995. Integrated nutrient management for sustainable agriculture. In soil nutrient management proceedings of training cum seminar organized by Division of Soil Science and Agricultural chemistry, IARI, New Delhi, pp 62-74.
- Vachani, M.U and Patel, Z.G. 1993. Effect of nitrogen, phosphorus and Potash on bulb yield and quality of onion (*Allium cepa* L.). *Indian Journal of Agronomy*. 38(2): 333-334.
- Veeraragavathatham, D. 1998. Vegetable culture. *Suri Associates*. pp: 228-231.