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Effect of different organic and inorganic sources of nutrients on nutrient content and nutrient uptake in palak (*Beta vulgaris* var. bengalensis Hort.)

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ABSTRACT

Palak or spinach beet (*Beta vulgaris* var. *bengalensis* Hort.) is one of the most popular leafy vegetables of tropical and subtropical region and is grown widely in India. Its tender soft succulent leaves are used as vegetable. It is commonly cultivated as cold season vegetable. Palak is highly nutritious contains higher fibrous matter which provides necessary roughage in the diet that stimulate intestinal action and prevents constipation it also rich in vit. A. It is grown in energy starving areas with minimum external sources of nutrients exploiting much lower than its potential yield. The sustainable yield of palak can be achieved through integrated nutrient management practices. The present investigation focused on improving the productivity of Palak through organic and inorganic nutrient sources.

Key words : Fulvic acid, Agrimagic, Nutrient content, Nutrient uptake

Palak or spinach beet (*Beta vulgaris* var. bengalensis Hort.) is one of the most popular leafy vegetables of tropical and subtropical region and is grown widely in India. Its tender soft succulent leaves are used as vegetable. It is commonly cultivated as cold season vegetable. Palak is highly nutritious contains higher fibrous matter which provides necessary roughage in the diet that stimulate intestinal action and prevents constipation it also rich in Vit. A. It is grown in energy starving areas with minimum external sources of nutrients exploiting much lower than its potential yield. The sustainable yield of palak can be achieved through integrated nutrient management practices. The present investigation focused on improving the productivity of palak through organic and inorganic nutrient sources.

MATERIALS AND METHODS

A field experiment was conducted at the Horticultural research farm, University of Agricultural Sciences, GKVK, Bangalore during *rabi* season under irrigated condition to study the "Nutrition of palak (*Beta vulgaris* var. bengalensis Hort.) through organic and inorganic nutrient sources". The study area is situated at 12^0 58' North latitude and 77^0 35' east longitudes with an altitude of 930 m above mean sea level. The Palak variety All green released by IARI, New Delhi. It is suitable for multi cutting (6-7) with a genetic potential of 125 q ha^{-1}.

The experiment was laid out in randomized complete block design with sixteen treatments having three replications. Three treatment consists of T_1-Control, T_2-$N_{150}P_{100}K_{100}$+ FYM_{20}, T_3-$N_{75}P_{50}K_{50}$+ FYM10, T_4-$N_{112.5}P_{75}K_{75}$+ FYM_{15},T_5-, $N_{150}P_{100}K_{100}$+Agrimagic 280 kg/ha, T_6-$N_{112.5}P_{75}K_{75}$+ FYM_{15}+ Agrimagic 280 kg/ha,

T_7- $N_{112.5}P_{75}K_{75}$+ FYM_{15}+ Agrimagic 560 kg/ha, T_8-$N_{75}P_{50}K_{50}$+ FYM_{10} + Agrimagic 280 kg/ha, T_9-$N_{75}P_{50}K_{50}$+ FYM_{10} + Agrimagic 560 kg/ha, T_{10}- Agrimagic 560 kg/ha, T_{11}- $N_{150}P_{100}K_{100}$, T_{12}-$N_{150}P_{100}K_{100}$ + Agrimagic equivalent to FYM on N basis, T_{13}- $N_{150}P_{100}K_{100}$+ 27 kg of fulvic liquid + seed line granular + two post plant spray, T_{14}- $N_{112.5}P_{75}K_{75}$+27 kg of fulvic liquid + seed line granular + two post plant spray, T_{15}- $N_{112.5}P_{75}K_{75}$+ 36 kg of fulvic liquid + seed line granular + two post plant spray and T_{16}- $N_{75}P_{50}K_{50}$+ 36 kg of fulvic liquid + seed line granular + two post plant spray.

The soils were sandy loam with low in available soil nitrogen (156 kg ha^{-1}), phosphorus (16.54 kg ha^{-1}) and potassium (136.62 kg ha^{-1}) with normal pH (6.7). the nitrogen was applied in three equal splits while P_2O_5 and K_2O were applied as basal at the time of sowing. Composites of surface soil samples to a depth of 315 cm were collected before sowing and after harvest of the crop. Plant samples were collected for estimation of dry matter production per plant and powdered dry samples used for estimating N, P and K contents using the methods indicated by Jackson (1973) The nutrient uptake per hectare was computed using the following given below:

Nutrient uptake= Nutrient content (%) x Dry matter per hectare (kg/plant)

The nutrient composition of Agri magic was 1.119 % N, 0.007 % P and 0.152 % K and applied as per the treatment combination. Fulvic liquid and seed line granular (110 kg ha^{-1}) was applied according to treatment

combination for seed line granular agrimagic placed in a row before sowing. Fulvic acid liquid was extracted from agrimagic by soaking two kg of agrimagic in five liters of water for a period of 36 hours diluted the same according to requirement used for both soil and foliar spray at 20 DAS and 30 DAS.

RESULTS AND DISCUSSION

The results of the experiment revealed that significant differences were obtained with regard to NPK content in root and haulm at harvest among the treatments (Table 1). Significantly higher N (4.3 %), P (0.7 %) and K (0.9%) content in root at harvest was recorded with the application of $N_{150}P_{100}K_{100}$+ Agrimagic equivalent to FYM on N basis (8.87 t ha^{-1}). However, it was significantly on par with application of $N_{150}P_{100}K_{100}$+ FYM_{20} (4.22, 0.65 and 3.51 per cent NPK, respectively). The similar trend in N content in haulm at harvest was followed with the application of $N_{150}P_{100}K_{100}$+ Agrimagic equivalent to FYM on N basis. The lower NPK content in roots and haulms of palak was noticed in control without application of fertilizers and application of agrimagic @560 kg ha^{-1}. The reason attributed for enhanced nutrient content in roots and haulm of palak was combined application of organic and inorganic sources nutrients improves the synchrony in nutrient release and crop demand in addition to higher quantity of nutrient supplied through all the sources. The similar results with respect to nutrient composition of palak with the application of different sources of nutrient were reported by Loskove and Urbanc (1972) and Peavey and Grieg (1972) and Stanilova, *et al.* (1972)

The similar trend was noticed with reference to nutrient uptake by palak as presented in Table 2. Application of $N_{150}P_{100}K_{100}$+ Agrimagic equivalent to FYM on N basis (8.87 t ha^{-1}) recorded significantly higher nutrient uptake by root (10.22, 1.63 and 8.84 NPK kg ha^{-1}), shoot (46.57, 8.70 and 41.84 NPK kg ha^{-1}) and total (56.79, 10.33 and 50.68 NPK kg ha^{-1}). However, it was significantly at par with the application of $N_{150}P_{100}K_{100}$+ FYM_{20} and lowest in control and application of agrimagic 560 kg ha^{-1}. There was no much influence on nutrient content and uptake with the application of fulvic acid and seed line granular along with two post plant spray. The nutrient composition and quantity of fulvic acid and seed line granular applied was much lower than farm yard manure and agrimagic. The similar results also reported by Jana *et al.* (1999), Dhillon *et al.* (1987) and Nawawi, *et al.* (1986)

From the investigation it can be concluded that the results obtained with the application of organic (FYM on N basis) and inorganic sources of nutrients enhances the nutrient content and nutrient uptake. However, farm yard manure can be applied on quantity based or on N

Table 1 : Effect of application of organic and inorganic sources of nutrients on nutrient content (%) of Palak

Treatment	N		P		K	
	Root	Haulm	Root	Haulm	Root	Haulm
Control	3.00	3.84	0.41	0.52	2.98	3.76
$N_{150}P_{100}K_{100}$+ FYM_{20}	4.22	4.87	0.65	0.86	3.51	4.20
$N_{75}P_{50}K_{50}$+ FYM_{10}	3.04	4.32	0.53	0.65	3.27	3.98
$N_{112.5}P_{75}K_{75}$+ FYM_{15}	3.48	4.59	0.58	0.72	3.43	4.05
$N_{150}P_{100}K_{100}$+Agrimagic 280 kg/ha	4.01	4.68	0.62	0.82	3.48	4.16
$N_{112.5}P_{75}K_{75}$+ FYM_{15}+ Agrimagic 280 kg/ha	3.50	4.63	0.58	0.72	3.43	4.05
$N_{112.5}P_{75}K_{75}$+ FYM_{15}+ Agrimagic 560 kg/ha	3.53	4.64	0.59	0.74	3.44	4.06
$N_{75}P_{50}K_{50}$+ FYM_{10} + Agrimagic 280 kg/ha	3.09	4.34	0.54	0.64	3.29	3.98
$N_{75}P_{50}K_{50}$+ FYM_{10} + Agrimagic 560g/ha	3.12	4.36	0.56	0.65	3.29	4.00
Agrimagic 560g/ha	3.01	3.90	0.48	0.58	3.10	3.81
$N_{150}P_{100}K_{100}$	3.57	4.38	0.62	0.80	3.49	4.16
$N_{150}P_{100}K_{100}$+ Agrimagic equivalent to FYM on N basis	4.32	4.92	0.69	0.92	3.74	4.42
$N_{150}P_{100}K_{100}$+ 27 kg of fulvic liquid + seed line granular + two post plant spray	4.03	4.76	0.64	0.79	3.50	4.18
$N_{112.5}P_{75}K_{75}$+27 kg of fulvic liquid + seed line granular + two post plant spray	3.69	4.62	0.60	0.75	3.45	4.07
$N_{112.5}P_{75}K_{75}$+ 36 kg of fulvic liquid + seed line granular + two post plant spray	3.73	4.65	0.61	0.76	3.45	4.09
$N_{75}P_{50}K_{50}$+ 36 kg of fulvic liquid + seed line granular + two post plant spray	3.15	4.37	0.56	0.67	3.28	4.04
S.E. $\pm$	0.144	0.116	0.013	0.028	0.072	0.079
C.D. (P=0.05)	0.41	0.33	0.037	0.083	0.2	0.22
CV %	7.08	4.49	3.88	6.9	3.69	3.38

Table 2 : Effect of application of organic and inorganic sources of nutrients on nutrient uptake (%) of Palak

Treatment	N (kg/ha)			P (kg/ha)			K (kg/ha)		
	Root	Haulm	Total	Root	Haulm	Total	Root	Haulm	Total
Control	0.8	7.0	7.8	0.1	0.9	1.1	1.0	6.8	7.8
$N_{150}P_{100}K_{100}$+ FYM_{20}	8.3	41.5	49.9	1.3	7.3	8.6	7.0	35.8	42.8
$N_{75}P_{50}K_{50}$+ FYM_{10}	1.9	18.9	20.8	0.3	3.4	3.8	2.6	17.4	19.9
$N_{112.5}$ $P_{75}K_{75}$+ FYM_{15}	4.0	28.2	32.2	0.7	4.4	5.1	3.9	24.9	28.8
$N_{150}P_{100}K_{100}$+Agrimagic 280 kg/ha	7.8	32.0	39.7	1.2	5.6	6.8	6.7	28.4	35.1
$N_{112.5}P_{75}K_{75}$+ FYM_{15}+ Agrimagic 280 kg/ha	4.3	28.1	32.4	0.7	4.3	5.1	4.2	24.6	28.8
$N_{112.5}P_{75}K_{75}$+ FYM_{15}+ Agrimagic 560 kg/ha	4.9	29.8	34.6	0.8	4.7	5.6	4.7	26.0	30.7
$N_{75}P_{50}K_{50}$+ FYM_{10} + Agrimagic 280 kg/ha	2.0	21.3	23.3	0.3	3.1	3.5	2.1	19.5	21.6
$N_{75}P_{50}K_{50}$+ FYM_{10} + Agrimagic 560g/ha	2.3	21.4	23.7	0.4	3.2	3.6	2.4	19.4	21.8
Agrimagic 560g/ha	1.2	8.6	9.8	0.2	1.3	1.5	1.2	8.4	9.6
$N_{150}P_{100}K_{100}$	7.0	30.1	37.1	1.2	5.5	6.7	6.9	28.6	35.4
$N_{150}P_{100}K_{100}$+ Agrimagic equivalent to FYM on N basis	10.2	46.6	56.8	1.6	8.7	10.3	8.8	41.8	50.7
$N_{150}P_{100}K_{100}$+ 27 kg of fulvic liquid + seed line granular + two post plant spray	7.8	35.3	43.1	1.2	5.8	7.1	6.6	30.9	37.5
$N_{112.5}P_{75}K_{75}$+27 kg of fulvic liquid + seed line granular + two post plant spray	4.9	27.0	31.9	0.8	4.4	5.2	4.6	23.8	28.4
$N_{112.5}P_{75}K_{75}$+ 36 kg of fulvic liquid + seed line granular + two post plant spray	5.4	29.4	34.8	0.9	4.7	5.5	5.0	25.9	30.8
$N_{75}P_{50}K_{50}$+ 36 kg of fulvic liquid + seed line granular + two post plant spray	1.9	18.5	20.4	0.3	2.8	3.2	2.0	16.2	18.2
S.E.±	0.515	1.78	1.69	0.09	0.31	0.31	0.50	1.59	1.48
C.D. (P=0.05)	1.49	5.13	4.89	0.25	0.89	0.88	1.45	4.58	4.27
CV %	19.09	11.61	9.43	19.51	12.31	10.30	19.95	11.61	9.16

equivalent basis.

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