

## Effect of organic and inorganic nutrient sources on growth and yield components of Palak (*Beta vulgaris* var. *bengalensis* Hort.)

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### ABSTRACT

A field experiment was conducted at horticulture research farm, University of Agricultural Sciences, Bangalore during *rabi* season of 2002. The research results revealed that application of  $N_{150}P_{100}K_{100}$  + Agrimagic equivalent to FYM on N basis gave significantly higher plant height, number of leaves, leaf area per plant, leaf area index and total chlorophyll content of leaf. It also recorded higher total dry matter production per plant (2.36), green leaf yield in main crop (157.2 q/ha), ratoon- I (143.8 q/ha) and ratoon (131.5 q/ha).

**Key words :** Palak, Nitrogen, Phosphorus, Potash, FYM, Agrimagic, Ratoon

### INTRODUCTION

Palak or spinach bean is rich in fat (0.8g), calcium (380 mg) and iron (62 mg) it also contains higher fibrous matter which provides necessary roughage in the diet that stimulate intestinal action and prevents constipation. It is highly popular vegetable due to relatively easy cultivation and short duration. Nutritionists recommend that the per capita consumption of leafy vegetables should be at least 110 g per day. It is grown in energy starving areas with minimum external sources of nutrients exploiting much lower than its potential yield. Nutrition through organic or inorganic means is a holistic system approach focusing on the system rather than an individual crop. Required productivity and sustainability can be achieved by supplying both organic and inorganic fertilizers. It also ensures synchrony in nutrient demand by the crop and nutrient release. Nutrient efficiency can be enhanced by right quantity with right proportion, time and method. The sustainable yield of palak can be achieved through integrated nutrient management practices. The present investigation focused on improving the growth and yield 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° 58' north latitude and 77° 35' East longitudes with an altitude of 930 m above mean sea level. The Palak variety All Green released by IARI, New Delhi was used. It is suitable for multicutting (6-7) with a genetic potential of 125 q ha<sup>-1</sup>.

The experiment was laid out in Randomized Complete Block Design (RCBD) with sixteen treatments having three replications. Three treatment consists of T<sub>1</sub>-Control, T<sub>2</sub>-  $N_{150}P_{100}K_{100}$  + FYM<sub>20</sub>, T<sub>3</sub>- $N_{75}P_{50}K_{50}$  + FYM<sub>10</sub>, T<sub>4</sub>- $N_{112.5}P_{75}K_{75}$  + FYM<sub>15</sub>, T<sub>5</sub>- $N_{150}P_{100}K_{100}$  + Agrimagic 280 kg/ha, T<sub>6</sub>- $N_{112.5}P_{75}K_{75}$  + FYM<sub>15</sub> + Agrimagic 280 kg/ha, T<sub>7</sub>- $N_{112.5}P_{75}K_{75}$  + FYM<sub>15</sub> + Agrimagic 560 kg/ha, T<sub>8</sub>- $N_{75}P_{50}K_{50}$  + FYM<sub>10</sub> + Agrimagic 280 kg/ha, T<sub>9</sub>- $N_{75}P_{50}K_{50}$  + FYM<sub>10</sub> + Agrimagic 560 kg/ha, T<sub>10</sub>-Agrimagic 560 kg/ha, T<sub>11</sub>-  $N_{150}P_{100}K_{100}$ , T<sub>12</sub>- $N_{150}P_{100}K_{100}$  + Agrimagic equivalent to FYM on N basis, T<sub>13</sub>-  $N_{150}P_{100}K_{100}$  + 27 kg of fulvic liquid + seed line granular + two post plant spray, T<sub>14</sub>-  $N_{112.5}P_{75}K_{75}$  + 27 kg of fulvic liquid + seed line granular + two post plant spray, T<sub>15</sub>-  $N_{112.5}P_{75}K_{75}$  + 36 kg of fulvic liquid + seed line granular + two post plant spray and T<sub>16</sub>-  $N_{75}P_{50}K_{50}$  + 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<sup>-1</sup>), phosphorus (16.54 kg ha<sup>-1</sup>) and potassium (136.62 kg ha<sup>-1</sup>) with normal pH (6.7). The nitrogen was applied in three equal splits while P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O were applied as basal at the time of sowing. Composites of surface soil samples to a depth of 31.5 cm were collected at before sowing and after harvest of the crop.

The nutrient composition of Agrimagic was 1.119, 0.007 and 0.152 per cent NPK and applied as per the treatment combination. Fulvic liquid and seed line granular (110 kg ha<sup>-1</sup>) 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 growth and yield of palak was significantly influenced by application of different levels of both organic and inorganic sources of nutrients (Table 1). Combined application of either agrimagic or FYM as organic manure and chemical fertilizer was effective in improving the growth and development of palak. Agrimagic serves as an alternate source of organic manure with high nutrient content. Significantly higher plant height, number of leaves per plant, leaf area per plant, leaf area index and total chlorophyll content with the application of  $N_{150}P_{100}K_{100}$  + Agrimagic equivalent to FYM on N basis. It was followed by  $N_{150}P_{100}K_{100}$  + FYM<sub>20</sub>,  $N_{150}P_{100}K_{100}$  + Agrimagic 280 kg/ha and  $N_{150}P_{100}K_{100}$  + 27 kg of fulvic liquid + seed line granular + two post plant spray. Significantly lower growth parameters were recorded in control and agrimagic @ 560 kg/ha. The rest of the treatments were found to be intermediate. This might be due to availability of nutrients in a balanced proportion from both the forms improves the growth and yield of palak. The faster availability of nutrients from inorganic fertilizers and slow release through out the cropping period enhances nutrient requirement of the crop. The similar results were reported by Ramachandra and Thimmaraju (1983), Ching Fang *et al.* (1994) and Dhillon *et al.* (1987).

Among different fertility levels application of  $N_{150}P_{100}K_{100}$  + Agrimagic equivalent to FYM on N basis

(Table 2) gave significantly higher green leaf yield in main crop (157.2 q/ha), ratoon crop-I (143.75) and ratoon-II (131.45 q/ha) but significantly at par with  $N_{150}P_{100}K_{100}$  + FYM @ 20 t/ha. The results are in conformity with the findings of Panda *et al.* (1991) in amaranthus leafy vegetable and Kumaran *et al.* (1998) and Duraisamy *et al.* (1999) However, significantly lower green leaf yield during main crop, ratoon-I and ratoon-II was recorded in control and with the application of Agrimagic @ 560 kg/ha. The haulm (1.89 g), root (0.47 g) and total (23.6 g) dry matter production per plant was significantly higher with the application of  $N_{150}P_{100}K_{100}$  + Agrimagic equivalent to FYM on N basis followed by  $N_{150}P_{100}K_{100}$  + FYM @ 20 t/ha. Significantly lower haulm, root and total dry matter production per plant was recorded in control and application of agrimagic @ 560 kg/ha. The lower green leaf yield of palak might be due to lower nutrient availability and slow nutrient released by agrimagic as compared to combined application of organic and inorganic sources of fertilizers. The nutrient status of soil after three crops was higher in agrimagic applied plots as compared to FYM.

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 improves the growth and yield of palak. However, agrimagic can be an alternative source of manure applied on N equivalent basis.

**Table 1: Effect of organic and inorganic fertilizers on the growth parameters of palak**

Treatments	Plant height (cm)	No. of leaves	Leaf area (cm <sup>2</sup> /plant)	Leaf area index	Total chlorophyll (mg g <sup>-1</sup> )
Control	14.0	6.5	94.6	0.5	1.0
$N_{150}P_{100}K_{100}$ + FYM <sub>20</sub>	25.8	13.0	255.2	1.3	1.5
$N_{75}P_{50}K_{50}$ + FYM <sub>10</sub>	20.7	7.3	147.0	0.7	1.1
$N_{112.5}P_{75}K_{75}$ + FYM <sub>15</sub>	21.4	9.1	198.5	1.0	1.3
$N_{150}P_{100}K_{100}$ + Agrimagic 280 kg/ha	24.7	10.2	214.7	1.1	1.4
$N_{112.5}P_{75}K_{75}$ + FYM <sub>15</sub> + Agrimagic 280 kg/ha	21.6	9.3	199.6	1.0	1.3
$N_{112.5}P_{75}K_{75}$ + FYM <sub>15</sub> + Agrimagic 560 kg/ha	22.6	9.7	200.3	1.0	1.3
$N_{75}P_{50}K_{50}$ + FYM <sub>10</sub> + Agrimagic 280 kg/ha	21.4	7.6	156.1	0.8	1.1
$N_{75}P_{50}K_{50}$ + FYM <sub>10</sub> + Agrimagic 560 kg/ha	20.1	8.0	142.6	0.7	1.1
Agrimagic 560 kg/ha	13.9	5.5	100.6	0.5	1.0
$N_{150}P_{100}K_{100}$	23.5	9.8	216.0	1.1	1.4
$N_{150}P_{100}K_{100}$ + Agrimagic equivalent to FYM on N basis	28.2	13.2	273.1	1.4	1.5
$N_{150}P_{100}K_{100}$ + 27 kg of fulvic liquid + seed line granular + two post plant spray	25.9	10.9	220.5	1.1	1.4
$N_{112.5}P_{75}K_{75}$ + 27 kg of fulvic liquid + seed line granular + two post plant spray	21.0	8.0	202.0	1.0	1.3
$N_{112.5}P_{75}K_{75}$ + 36 kg of fulvic liquid + seed line granular + two post plant spray	21.5	8.5	203.0	1.0	1.4
$N_{75}P_{50}K_{50}$ + 36 kg of fulvic liquid + seed line granular + two post plant spray	18.5	6.5	156.2	0.8	1.1
S.E.±	0.904	0.556	8.342	0.043	0.011
C.D. (P=0.05)	2.61	1.6	24.09	0.12	0.033
CV %	7.27	10.73	7.76	7.98	1.58

**Table 2: Effect of organic manures and inorganic fertilizers on dry matter accumulation and green leaf yield per**

Treatments	Dry matter accumulation (g/plant)			Green leaf yield (q/ha)		
	Haulm	Root	Total	Main crop	Ratoon I	Ratoon II
Control	0.36	0.06	0.42	59.89	49.06	39.16
N <sub>150</sub> P <sub>100</sub> K <sub>100</sub> + FYM <sub>20</sub>	1.70	0.39	2.09	149.99	138.33	125.16
N <sub>75</sub> P <sub>50</sub> K <sub>50</sub> + FYM <sub>10</sub>	0.87	0.12	0.99	105.2	90.72	85.22
N <sub>112.5</sub> P <sub>75</sub> K <sub>75</sub> + FYM <sub>15</sub>	1.23	0.23	1.46	117.7	109.37	106.65
N <sub>150</sub> P <sub>100</sub> K <sub>100</sub> +Agrimagic 280 kg/ha	1.35	0.38	1.73	141.25	123.74	118.12
N <sub>112.5</sub> P <sub>75</sub> K <sub>75</sub> + FYM <sub>15</sub> + Agrimagic 280 kg/ha	1.21	0.24	1.45	120.62	96.97	95.41
N <sub>112.5</sub> P <sub>75</sub> K <sub>75</sub> + FYM <sub>15</sub> + Agrimagic 560 kg/ha	1.28	0.23	1.51	123.22	106.45	103.22
N <sub>75</sub> P <sub>50</sub> K <sub>50</sub> + FYM <sub>10</sub> + Agrimagic 280 kg/ha	0.98	0.13	1.11	106.35	85.93	75.31
N <sub>75</sub> P <sub>50</sub> K <sub>50</sub> + FYM <sub>10</sub> + Agrimagic 560 kg/ha	0.97	0.14	1.11	112.29	87.81	80.6
Agrimagic 560 kg/ha	0.44	0.08	0.52	68.75	53.95	44.58
N <sub>150</sub> P <sub>100</sub> K <sub>100</sub>	1.37	0.39	1.76	136.45	112.61	87.6
N <sub>150</sub> P <sub>100</sub> K <sub>100</sub> + Agrimagic equivalent to FYM on N basis	1.89	0.47	2.36	157.2	143.75	131.45
N <sub>150</sub> P <sub>100</sub> K <sub>100</sub> + 27 kg of fulvic liquid + seed line granular + two post plant spray	1.48	0.38	0.38	140.62	116.51	110.62
N <sub>112.5</sub> P <sub>75</sub> K <sub>75</sub> +27 kg of fulvic liquid + seed line granular + two post plant spray	1.17	0.26	1.43	125.51	95.41	87.91
N <sub>112.5</sub> P <sub>75</sub> K <sub>75</sub> + 36 kg of fulvic liquid + seed line granular + two post plant spray	1.26	0.29	0.29	128.19	95.62	93.01
N <sub>75</sub> P <sub>50</sub> K <sub>50</sub> + 36 kg of fulvic liquid + seed line granular + two post plant spray	0.84	0.12	0.96	110.19	84.78	75.31
S.E. ±	0.078	0.026	0.08	5.763	3.65	2.533
C.D. (P=0.05)	0.22	0.076	0.23	16.64	10.54	7.31
CV %	11.71	18.62	9.98	8.41	6.35	4.81

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