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Effect of foliar application of organic nutrients and inorganic fertilizers on NPK uptake, post harvest soil available nutrients and yield performance of palak (*Beta vulgaris* L. var *bengalensis*)

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Abstract : The experiment on effect of foliar application of organic nutrients and inorganic fertilizers on NPK uptake post harvest soil available nutrients and yield performance of palak (*Beta vulgaris* L. var. bengalensis) was carried out at the Orchard field unit, Department of Horticulture, Faculty of Agriculture, Annamalai University during January – March, 2010.Foliar organic nutrients *viz.,* panchagavya (3 and 4%) vermiwash (1:3 and 1:5 dilution ratio), humic acid (0.1 and 0.2%), water spray (control) and two levels of fertilizers (basal) 100% and 75% recommended dose of fertilizers were tried in this study. The nutrient uptake, post harvest soil available nutrients and total leaf yield by the crop were favourably influenced by the application of panchagavya 4 per cent + 100 per cent NPK which was followed by the application of panchagavya 4 per cent + 75 per cent NPK. Based on the results, it can be concluded that the application of panchagavya 4 per cent + 100 per cent NPK has been identified as the best treatment for increasing the yield of palak var. OOTY -1.

Key words : Foliar application, Organic nutrient, Panchagavya, Vermiwash, Palak

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Palak is also designated as 'Indian spinach' or spinach beet or beet leaf. Spinach beet or desi palak is the only cultivar of *Beta valgaris*, which is annual in duration. It is grown in autumn and spring in plains, while in mid hills, it is grown from July to September and in high hills, it is grown from March to June. In Tamil Nadu, palak cultivation has been popular in hilly regions comprising Ooty and Kodaikanal, knowing its importance, the Horticulture research station. Ooty (TNAU), has released its improved variety in palak namely Ooty-1. Interestingly the cultivation of palak in the plains of Tamil Nadu has also been spreading in recent times. Application of nutrients through foliar sprays demand less quantity of nutrients, with rapid and efficient absorption. Foliar nutrients usually penetrate the cuticle of the leaf and enter the cells. Hence, foliar nutrition is recognized as an important method of fertilization in modern agriculture.

RESEARCH METHODS

The present investigation to study the effect of foliar application of organic and inorganic nutrients on yield performance of palak. (*Beta valgaris* L. var. *bengalensis*) was carried out at the Orchard, field unit of the Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalai Nagar, Tamil Nadu. The experiment design was laid out following the principles of Randomized Block Design with 14 treatments. Each treatment was replicated thrice and 40 plants were maintained in each replication. The foliar spray of organic nutrients were given at 15, 30 and 45 DAS. The treatments were imposed according to the details given below. The treatments comprised of T_1 - Water spray + 100 per cent NPK (75:50:50 kg of N, P and K per hectare), T_2 - Panchagavya 3 per cent + 100 per cent NPK, T_3 - Panchagavya 4 per cent + 100 per cent NPK, T_4 - Vermiwash in the dilution ratio of 1:3 + 100 per cent

NPK, T_5 - Vermiwash in the dilution ratio of 1:5 + 100 per cent NPK, T_6 - Humic acid 0.1 per cent + 100 per cent NPK, T_7 - Humic acid 0.2 per cent + 100 per cent NPK, T_8 - Water spray + 75 per cent NPK (55:26:26 kg of N, P and K per hectare), T_9 - Panchagavya 3 per cent + 75 per cent NPK, T_{10} - Panchagavya 4 per cent + 75 per cent NPK, T_{11} - Vermiwash in the dilution ratio of 1:3 + 75 per cent NPK, T_{12} - Vermiwash in the dilution ratio of 1:5 + 75 per cent NPK, T_{13} - Humic acid 0.1 per cent + 75 per cent NPK, T_{14} - Humic acid 0.2 per cent + 75 per cent NPK.

Ten plants in each treatment in each replication were randomly tagged for recording observation. The yield and other biometric observations were recorded at four clipping stages at an interval of 15 days, first clipping commencing from 30 DAS and the last clipping ending at 75 DAS. The observations recorded were NPK uptake, post harvest soil available nutrients and total leaf yield per plot. The nitrogen uptake was recorded as per the procedure given by Humphries (1956), phosphorus and potassium uptake Jackson (1973) the nitrogen availability was recorded as per the procedure given by Subbiah and Asija (1956), phosphorus Olsen (1954) and potassium availability Stanford and English (1949).

Table 1 : Effect of foliar spray of organic nutrients and inorganic fertilizer on nutrient uptake (kg ha^{-1}) in palak

Clipping stages / Treatments	Nutrient uptake (kg ha^{-1}) N	P	K
T_1 - Water spray + 100% NPK	25.96	21.66	69.75
T_2 - Panchagavya 3%+100% PK	25.54	20.97	69.13
T_3 - Panchagavya 4%+100% NPK	25.02	20.68	68.52
T_4 - Vermiwash 1:3+100% NPK	24.86	19.63	68.14
T_5 - Vermiwash 1:5 +100% NPK	24.43	19.46	67.36
T_6 - Humic acid 0.1% +100% NPK	24.17	19.06	67.07
T_7 - Humic acid 0.2%+100% NPK	25.68	18.79	66.68
T_8 - Water Spray + 75% NPK	25.36	18.46	66.19
T_9 - Panchagavya 3%+75% NPK	25.01	18.05	65.88
T_{10} - Panchagavya 4%+75% NPK	24.86	17.87	65.23
T_{11} - Vermiwash 1:3 + 75% NPK	24.57	17.42	64.96
T_{12} - Vermiwash 1:5 + 75% NPK	24.13	17.09	64.53
T_{13} - Humic acid 0.1%+75% NPK	23.89	16.52	64.18
T_{14} - Humic acid 0.2%+ 75% NPK	23.80	16.30	63.87
S.E. $\pm$	0.09	0.12	0.10
C.D. (P=0.05)	0.18	0.24	0.20

RESEARCH FINDINGS AND DISCUSSION

The data on the nitrogen uptake is presented in Table 1. The nitrogen uptake varied significantly among the various treatments. The maximum value of 25.96 kg ha^{-1} was recorded in T_1 (water spray + 100% NPK) followed by T_7 (humic acid 0.2% + 100% NPK), which recorded a value of 25.68 kg ha^{-1}. The minimum value of 23.80 kg ha^{-1} recorded in T_{14} (humic acid 0.2% + 75% NPK). Nitrogen is involved in the cell division, cell enlargement and in respiration. Positive effects of higher nitrogen levels and uptake was reported earlier by Barani (2002) in bhendi.

Significant differences was observed between the treatments with respect to phosphorus uptake. The treatment T_1 (water spray + 100% NPK) recorded the maximum value of 21.66 kg ha^{-1}. The minimum value of 16.30 kg ha^{-1} was recorded in T_{14} (humic acid 0.2% + 75% NPK). The higher uptake of phosphorus may be due to better utilization of phosphorus for the development of pods, may be due to enhanced root activity (Antil, 1995).

Among the various treatments, the maximum potassium uptake (69.75 kg ha^{-1}) was recorded in T_1 (water spray + 100% NPK), followed by T_2 (panchagavya 3% + 100% NPK), which recorded a value of 69.13 kg ha^{-1}. The minimum value of 63.87 kg ha^{-1} was recorded in the T_{14} (humic acid 0.2% + 75% NPK). The use of organic and inorganic nutrients increased the potassium content, which may be ascribed to its role in improving soil properties, leading to better penetration of roots, thereby resulting in greater uptake of potassium from native source (Budhawan, 1994).

The data on the available nitrogen in the post–harvest soil are presented in Table 2. The maximum value of 92.81 mg g^{-1} was recorded in T_{13} (humic acid 0.1% + NPK). The minimum value of 74.40 mg kg^{-1} recorded in T_{14} (water spray + 75% NPK).

Significant differences between the treatments with respect to available phosphorus in the post-harvest soil. The treatment T_8 (water spray + 75% NPK) recorded the minimum value of 14.48 mg kg^{-1}. The maximum value of 19.82 mg kg_{-1} was recorded in T_1 (water spray + 100% NPK).

Among the various treatments, the maximum value (148.60 mg kg^{-1}) of available K was recorded in T_1 (water spray + 100% NPK), the minimum value of 119.60 mg kg^{-1} was recorded in the T_8 (water spray + 75% NPK). The available N, P and K in the soil was highest in the treatment T_1(water spray + 100% NPK), followed by T_2 (3% panchagavya + 100% NPK). This might be due to the slow release of nutrients from the organics, resulting in lesser loss and further availability of nutrients can also be achieved in due course of time, due to the microbial degradation of manures. As suggested by Hangarge *et al.* (2004), application of panchagavya along with other

Table 2 : Effect of foliar spray of organic nutrients and inorganic fertilizer on post-harvest soil available nutrients (mg kg^{-1}) in palak

Clipping stages / Treatments	Post-harvest soil available nutrients (mg kg^{-1})		
	N	P	K
T_1 - Water spray + 100% NPK	76.60	19.82	148.60
T_2 - Panchagavya 3%+100% PK	75.97	15.33	124.50
T_3 - Panchagavya 4%+100% NPK	77.51	15.20	123.20
T_4 - Vermiwash 1:3+100% NPK	79.04	18.09	138.96
T_5 - Vermiwash 1:5 +100% NPK	80.57	17.63	136.55
T_6 - Humic acid 0.1% +100% NPK	82.10	17.16	134.14
T_7 - Humic acid 0.2%+100% NPK	83.63	16.25	138.96
T_8 - Water spray + 75% NPK	85.16	14.48	119.60
T_9 - Panchagavya 3%+75% NPK	88.22	15.79	125.91
T_{10} - Panchagavya 4%+75% NPK	86.69	14.87	122.09
T_{11} - Vermiwash 1:3 + 75% NPK	89.75	9.01	143.78
T_{12} - Vermiwash 1:5 + 75% NPK	91.28	18.55	141.37
T_{13} - Humic acid 0.1%+75% NPK	92.81	18.47	146.19
T_{14} - Humic acid 0.2%+ 75% NPK	74.40	16.71	131.73
S.E.±	0.75	0.21	1.16
C.D. (P=0.05)	1.50	0.43	2.38

organics help in the improvement of nitrogen fixation. Similar findings were reported by Basak *et al.* (1990).

It can be observed that the effect of foliar spray of organic nutrients and inorganic fertilizers on the total leaf yield per plot was found to be significant Table 3. The treatment, T_3 (panchagavya 4% + 100% NPK) was found to be the best as it recorded the highest total leaf yield of 2.39kg plot^{-1}.The minimum value of 1.54kg plot^{-1} was recorded in the treatment T_8 (water spray + 75% NPK). The increase in number of leaves per plant may be due to increased absorption of primary nutrients which resulted in increased synthesis of carbohydrates, proteins and fats which are utilized in building up of new cells, similar results were reported by Panda *et al.* (1991) in amaranthus.

Table 3 : Effect of foliar spray of organic nutrients and inorganic fertilizers on total leaf yield per plot (kg) in palak

Treatments	Total leaf yield per plot (kg)
T_1 - Water spray + 100% NPK	1.71
T_2 - Panchagavya 3%+100% PK	2.31
T_3 - Panchagavya 4%+100% NPK	2.39
T_4 - Vermiwash 1:3+100% NPK	1.91
T_5 - Vermiwash 1:5 +100% NPK	2.00
T_6 - Humic acid 0.1% +100% NPK	2.08
T_7 - Humic acid 0.2%+100% NPK	2.21
T_8 - Water spray + 75% NPK	1.54
T_9 - Panchagavya 3%+75% NPK	2.19
T_{10} - Panchagavya 4%+75% NPK	2.36
T_{11} - Vermiwash 1:3 + 75% NPK	1.73
T_{12} - Vermiwash 1:5 + 75% NPK	1.95
T_{13} - Humic acid 0.1%+75% NPK	1.81
T_{14} - Humic acid 0.2%+ 75% NPK	2.14
S.E. ±	0.02
C.D. (P=0.05)	0.04

Panchagavya has significantly increased the yield due to presence of useful microorganisms, nitrogen, calcium, cytokinin, glucose, minerals etc. This nutrients might have triggered rapid cell division, proliferation and speedy growth. Moreover, foliar application of panchagavya might have resulted in higher vegetative growth. The results of present study are in accordance with those of Arjunan (2005) in tomato, Selvaraj *et al.* (2003) in New Zealand spinach and French bean.

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