Environment & Ecology 36 (1) : 156—159, January—March 2018
Website: environmentandecology.com ISSN 0970-0420

Response of Different Organic Manures and Biofertilizers on Yield and Economics of Palak (*Beta vulgaris* var *bengalensis*) under Foothill Condition of Nagaland

Moakala Changkija, Waluniba, Aastik Jha, Yongkongtula, S. P. Kanaujia

Received 24 August 2017; Accepted 26 September 2017; Published on 14 October 2017

Abstract A field experiment was carried out at the experimental farm in 2015 and 2016 to study the response of different organic manures and biofertilizers on yield and economics of palak under foothill condition of Nagaland. The experiments were laid out in randomized block design (RBD) comprising of 7 (seven) treatments with 3 (three) replications. Among the different treatments, application of Vermicompost 5 t ha^{-1} + PSB + *Azospirillum* (each 5 kg ha^{-1}) significantly recorded the maximum fresh yield (211.20 q ha^{-1}) of palak which was found significantly superior over other treatments. Among different treatments, maximum B : C ratio (1 : 7.67) was obtained in the treatment of FYM 20 t ha^{-1}.

Keywords Palak, Organic manures, Fresh yield, Economics.

Moakala Changkija*, Waluniba, Aastik Jha,
Yongkongtula, S. P. Kanaujia
Department of Horticulture,
School of Agricultural Sciences and Rural Development,
Medziphema Campus, Nagaland University,
Nagaland 797106, India
e-mail : moaka88@gmail.com
*Correspondence

Introduction

Palak (*Beta vulgaris* var *bengalensis*) is a member of Chenopodiaceae family. Green leafy vegetables like palak, is a much valued vegetable, widely consumed everywhere because of its delicate texture, jade green color and its nutritional value. It is a fast growing, hardy cool weather crop, grown for use as a cooked green vegetable or for salad greens. It is a nutritive annual leafy vegetable and is rich in vitamins especially vitamin A and other vitamins like ascorbic acid, riboflavin, and thiamine. There are also appreciable quantities of minerals like iron and calcium making it a very beneficial food. Palak is great source of chlorophyll, which speed up digestion. The leaves contain low oxalic acid. However, palak is considered as an underutilized crop and has, until recently, received little research attention particularly in the North-Eastern region.

Organic production that relies on animal manures, organic wastes, crop rotations, legumes and aspects of biological pest control avoids the use of synthetically produced fertilizers, pesticides, growth regulators and livestock additives. It is the ecological production management system that promotes and enhances biodiversity, biological cycles and biological activity of the soil, thus, making the soil capable of supplying all the essential nutrients to the crop for its proper growth and development. Organic crop production in the organic farming system is gradually gaining momentum worldwide. It is based on the minimal cost of the off-farm inputs and man-

agement practices that restore, maintain and sustain ecological harmony.

Application of organic manures to acidic soil reduces the soluble and exchangeable Al temporarily by forming complex and provides better environment for growth and development in addition to improvement in physical, chemical and biological properties of soil [1]. Biofertilizers (*Azotobacter* and phosphate solubilizer) play a very significant role in improving soil fertility by fixing atmospheric nitrogen, both in association with plant roots and without it, solubilize insoluble soil phosphates and produces plant growth substances in the soil. Being environmental friendly and low cost input, greater emphasis has been given on application of bio-fertilizers with organic manures which plays a significant role in plant nutrition. The role of biofertilizers is perceived as growth regulators besides biological nitrogen fixation collectively leading to much higher response on various growth and yield attributing characters [2].

The agro-climatic condition prevailing in the low hills of Nagaland has been found to be highly favorable for palak cultivation. But very limited information is available about the nutrient requirement of spinach beet in North Eastern region including acidic soils of Nagaland in particular. Taking into account the various facts and aspects, the present investigations was undertaken to study the response of different organic manures and biofertilizers on yield and economics of spinach beet under foothill condition of Nagaland.

(The completion of this study could not have been possible without the technical and financial support provided by PC Cell, ICAR-AICRP (VC), Indian Institute of Vegetable Research, Varanasi. Special gratitude to everyone involved in making this study a success).

Materials and Methods

The experiment was carried out in the experimental farm, Department of Horticulture, Nagaland University, School of Agricultural Sciences and Rural Development, Medziphema Campus, Nagaland in 2015 and 2016. The field is located at the altitude of 304.8 m above mean sea level with geographical location at 20° 45′ 43″ N latitude and 93° 53′ 04″ E longitudes. Plot size measured 1.8 m × 1.8 m and spacing was maintained at 30 × 10 cm. The experiments were laid out in randomized block design (RBD) with three replications. The treatments consisted of T_1- Recommended NPK (100 : 50 : 50 kg ha^{-1}), T_2-Vermicompost 5t ha^{-1}, T_3-FYM 20 t ha^{-1}, T_4-Pig manure 15 t ha^{-1}, T_5 - Vermicompost 5 t ha^{-1} + PSB + *Azospirillum* (each 5 kg ha^{-1}), T_6-FYM 20 t ha^{-1} + PSB + *Azospirillum* (each 5 kg ha^{-1}), T_7 -Pig manure 15 t ha^{-1} + PSB + *Azospirillum* (each 5 kg ha^{-1}). N, P and K were given through Urea, SSP and MOP respectively. Full dose of P and K and half dose of N were applied at the time of transplanting and remaining half dose of N was given in two equal doses i.e. 30 and 60 days after transplanting. Manures viz., FYM, Pig manure and vermicompost were incorporate as per treatment in respective plot prior to transplanting. Biofertilizers were inoculated to seedling prior to transplanting as seedling dip method @ 5 kg ha^{-1}. Data were recorded on fresh yield of palak. Treatment-wise economics was carried out by calculating the cost of cultivation based on prevailing rates of input and output. Gross income was calculated by yield multiplied by whole sale rate of palak Rs 20 kg^{-1}. Net income was estimated by deducting the total cost of cultivation (fixed cost + treatment cost) from gross income of the particular treatment and benefit cost ratio was worked out by dividing net income from total cost of cultivation. The statistical analysis was carried out as per standard procedure.

Results and Discussion

Fresh yield

The organic manures along with biofertilizers alone or in combination were found to have significant effect on yield of palak as compared to control. Pooled data on response of different organic manures and biofertilizers on yield of palak is given in Table 1. As evident from the table, the highest fresh yield of palak (211.20 q ha^{-1}) was recorded with application of Vermicompost 5 t ha^{-1} + PSB + *Azospirillum* (each 5 kg ha^{-1}). The lowest fresh yield (178.86 q ha^{-1}) was recorded with application of rec-

Table 1. Response of different organic manures and biofertilizers on yield and economics of spinach beet (mean of two years). FYM (0.5% N) - Rs 500 t^{-1}, Pig maure (0.75% N) - Rs 700 t^{-1}, Vermicompost (1.5% N) - Rs 10,000t^{-1}.

Treatments	Fresh yield (q ha^{-1})	Gross income (Rs)	Cost of cultivation (Rs)	Net income (Rs)	B : C
T_1	178.86	357720	43116	314604	1 : 7.30
T_2	192.13	384260	86000	298260	1 : 3.47
T_3	199.37	398740	46000	352740	1 : 7.67
T_4	190.77	381540	46500	335040	1 : 7.21
T_5	211.20	422400	87000	335400	1 : 3.86
T_6	196.89	393780	47000	346780	1 : 7.38
T_7	191.03	382060	47500	334560	1 : 7.04
SEm±	2.83				
CD at 5%	6.89				

ommended NPK (100 : 50 : 50 kg ha^{-1}).

Maximum fresh yield was recorded from organics combined with biofertilizers which may be due to continuous nutrient supply by increased microbial activity and increased rate of mineralization. Organic manures supply essential nutrient in balanced ratio and improved physical, chemical and biological properties of soil which helps in better nutrient absorption and utilization by plant resulting higher value of yield attributing characters. The vermicompost would have improved the physical, chemical and biological properties of soil which helps in better nutrient absorption and utilization by plant resulting in better plant growth. This might be attributed to certain growth promoting substances secreted by the biofertilizers which in turn might have led to better root development, better transportation of water, uptake and deposition of nutrients. Application of Vermicompost 5 t ha^{-1} + Phosphotika + *Azospirillum* @ each 5 kg ha^{-1} gave the highest palak fresh yield (52.29 q ha^{-1}) [3]. These findings are in agreement with Ansari [4], Revathi [5], Shukla [6], Sharma and Agarwal [7], Moakala et al. [8].

Economics

Pooled data on response effect of different organic manures on leaf yield of palak is given in Table 1. It clearly indicates that the most profitable treatment was FYM 20 t ha^{-1} giving the highest net return (Rs 352, 740) which also showed highest cost benefit ratio (1 : 7.67) which was very much in par with FYM 20 t ha^{-1} + PSB + *Azospirillum* (each 5 kg ha^{-1}) with 1 : 7.38.

It is evident from the findings that the most profitable way for cultivating palak could be achieved by application of FYM 20 t ha^{-1} + PSB + *Azospirillum* (each 5 kg ha^{-1}) which gave the highest net return of Rs 352,740 along with cost benefit ratio of 1 : 7.67 closely followed by Rs 346,780 with the application of FYM 20 t ha^{-1} + PSB + *Azospirillum* (each 5 kg ha^{-1}). The reason of high net economic return (profit) in the treatment of FYM 20 t ha^{-1} and FYM 20 t ha^{-1} + PSB + *Azospirillum* (each 5 kg ha^{-1}) was due to low input cost and high yield. Lowest net return of Rs 298,260 was obtained in the treatment of Vermicompost 5 t ha^{-1} due to high cost of vermicompost (Rs 10,000 t^{-1}). Similar results were also reported by Patel et al [9] and earlier results [8].

Conclusion

It can be concluded from the above results that the application of vermicompost in combination with biofertilizers are more effective in enhancing yield while FYM alone or with combination of biofertilizers found best in getting highest net return and benefit cost ratio. Hence, FYM 20 t ha^{-1} or FYM 20 t ha^{-1} + PSB + *Azospirillum* (each 5 kg ha^{-1}) may be recommended for sustainable production of palak and to nourish the soil fertility under the foothill condition of Nagaland.

References

1. Avitoli K, Singh AK, Kanaujia SP, Singh VB (2012) Quality production of *kharif* onion (*Allium cepa* L.) in response to biofertilizers inoculated organic manures. Ind J Agric Sci 82 : 236—240.
2. Yeptho V, Kanaujia SP, Singh VB, Sharma A (2012) Effect of integrated nutrient management on growth, yield and quality of tomato under polyhouse condition. J Soils and Crops 22 : 246—252.
3. Tumchopemo (2016) Effect of different sources of fertilizers on the productivity of amaranth (*Amaranthus tricolor* L.) under acidic conditions of Nagaland. MSc (Ag) thesis. SASRD, Nagaland Univ.
4. Ansari AA (2012) Effect of vermicompost and

vermiwash on the productivity of spinach (*Spinacia oleracea*), onion (*Allium cepa*) and potato (*Solanum tuberosum*). World J Agric Sci 4 : 554—557.

5. Revathi K (2011) Impact of biofertilizers on nutrient content and antioxidant activity of spinach beet (*Beta vulgaris*). MSc (Ag) thesis. Acharya N. G. Ranga Agric Univ, Rajendranagar. Hyderabad.
6. Shukla DK, Pratap Tej, Prasad Birendra (2012) Productivity of grain amaranth (*Amaranthus hypochondriacus* L.) in relation to organic nutrition under rainfed condition of Western Himalayas. J Hill Agric 3 : 87—90.
7. Sharma J, Agarwal S (2014) Impact of organic fertilizers on growth, yield and quality of spinach. Ind J Pl Sci 3 : 37—43.
8. Moakala, Kanaujia SP, Maiti CS, Sharma SK (2015) Effect of integrated nutrient management of yield and economics of broccoli grown in Nagaland. Agric Sustain Develop 3 : 69—72.
9. Patel BM, Ravindrababu Y, Patel PG, Patel MM (2005) Effect of integrated nutrient management in light textured soil on grain amaranth (*Amaranthus hypochondriacus* L.). J Soils and Crops 15 : 260—263.