Effect of organic manures and leaf cuttings on growth, yield and quality of palak (*Beta vulgaris* var. *bengalensis*)

Abstract

The present study was aimed at studying the effect of organic manures and the number of cuttings on the growth, yield and quality of palak. The field experiment was conducted during the Rabi season, 2021 at the experimental unit of the Department of Horticulture, Tilak Dhari PG College, Jaunpur (U.P.). The experiment was laid out in a factorial randomized block design with nine treatment combinations, which were replicated three times. The treatments comprised the various levels, *i.e.*, M_0 (without manure), C_0 (without cutting), M_1 (vermicompost), C_1 (two cutting), M_2 (farm yard manure), C_2 (four cutting), etc. The green leaf yield of palak from different treatment combinations was studied for growth, yield and quality attributes. The result revealed that growth and yield parameters, namely: height of plants (cm), number of leaves per plant, length of leaves (cm), width of leaves (cm), length of petiole (cm), dry matter (g), moisture content (%), and leaf yield (g), were significantly influenced by the application of organic manures and the number of cuttings.

Keywords: Palak, Manures, leaf cuttings, growth and yield etc.

Introduction

Palak, or spinach beet *(Beta vulgaris var. bengalensis*, *2n = 18),* is one of the most popular leafy vegetables grown widely in India. It belongs to the Chenopodiaceae family. Spinach beet is most probably a native of Indo-Chinese regions (Salaria and Salaria, 2009) and was known in China as early as 647 AD. In India, it is grown on a large scale. The major palak-growing states in the country are Uttar Pradesh, West Bengal, Haryana, Bihar, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, and Gujarat. Spinach beet leaves are valued for their medicinal properties. It is a good source of natural antioxidants such as flavonoids, polyphenols, vitamins, and folic acid. According to the Indian Council of Medical Research, New Delhi, leafy vegetables weighing 125 g, root vegetables weighing 100 g, and other vegetables weighing 75 g are required per day per person for a balanced diet (Rao, 2013). Leafy vegetables are very important because they have a good amount of iron, carotene, calcium, vitamin A, vitamin C, riboflavin, and folic acid (Mohan Ram and Ramadasmurty, 1984).It is rich in minerals and hence called "mines of minerals" and a cheap source of iron, vitamin A, calcium, protein, vitamin K, vitamin E, vitamin D, vitamin C, folic acid, thiamine, riboflavin, nicotinic acid, pyridoxine, and antioxidants such as carotene flavones, indoles, potassium, manganese, copper, and zinc, which are important components of cells and body fluids to control heart and blood pressure, the antioxidant enzyme superoxide dismutase, and antioxidants for production of red blood cells, sperm generation, digestion (Thamburaj and Singh, 2015), and Palak is a cool-season leafy

vegetable, generally cultivated in subtropical and temperate conditions. Though it is an integral part of home gardens across the world (Spore 2005), the requirement for commercial fresh leaf and seed production is totally different. Also, the nonavailability of quality seed is a major constraint in cultivation. Several factors, like the sowing period and leaf cuttings, have direct influences on seed yield and quality. Singh and Gill (1983) obtained the highest palak seed yield when the crop was cut once. Whereas, Phor and Mangal (1991) stated that one cutting at 40 days after sowing gave better quality and higher seed yield, and Lal *et al.* (1979) found cuttings to be profitable for seed yield in palak. Similarly, gobhi-sarson gave better seed yield when cut once than uncut (Gupta and Saini 1986). They obtained a significantly high seed yield in a November-sown crop with one cutting of fenugreek. Khan *et al.* (2003) reported the influence of cutting levels on plant growth parameters, which were reflected in final seed yield and quality in grams. The edible portion of palak consists of a compact rosette of leaves prior to the stock's formation. It is cultivated for its fresh, green leaves, which become ready for harvest in about 30–35 days from sowing. Green and leafy vegetables keep people healthy, help the children grow strong, and are cheap to buy, making them a boon to the vegetarians and to the poor and vulnerable groups, including weaned and growing children, pregnant and lactating women, and convalescents. On the other hand, organic manures have been reported to play a vital role in the nutrient management of crops through the amelioration of the physical and biological conditions of the soil and the supply of macro- and micronutrients to the crops. In India, farm yard manure (FYM) remains the most popular organic manure applied to fields.Yield of palak leaf and seed can be increased by sowing at proper spacing. Taking adequate number of leaves cuttings (Singh *et al.*2015).

Materials and Methods

The experiment was conducted during the rabi season of the year 2021 at the experimental unit of the Department of Horticulture, Tilak Dhari PG College, Jaunpur (U.P.). The design that was followed was a factorial randomized block design with nine treatments and three replications. Geographically, Jaunpur is situated in the eastern part of Uttar Pradesh, which lies between 25° 44’ 0” north latitude and 82° 41’ 00” east longitude at an elevation of 83.230 m above mean sea level. The plants were randomly allotted to the plot in each replication, with row to row and plant to plant spacing of 45 cm by 10cm. The package of practices was followed as per the recommendation for good and healthy racing. Five plants were selected in each plot in each replication, excluding border plants, for recording and observation. Data were recorded on eight characters, namely: height of plants (cm), number of leaves per plant, length of leaves (cm), width of leaves (cm), length of petiole (cm), dry matter (g), moisture content (%), and leaf yield (g).

Result and Discussion

The maximum plant height was observed in (Table 1) the treatment (M_2) FYM and without cuttings (C_0), but after the second cutting, plant height reduced due to minimum moisture, less nutrient uptake, and an increase in temperature. Similar results were given by

Dadiga *et al.*(2015) and Bahavand *et al.*(2014) when they experimented on coriander and Indian spinach with the use of FYM, vermicompost, and compost mixtures. They reported that the use of vermicompost along with RDF of 50 kg per ha increased the vegetative growth of palak and coriander, respectively. The maximum number of leaves under (Table 1) the treatment FYM (M_2) and four times as many cuttings (C_2) were due to the fact that the number of cuttings (C_2) was four. Therefore, in four cuttings, the number of leaves will increase because of the addition of leaves for each cutting. This result corroborated the finding of Naik *et al*. (2010), who did an experiment on spinach beet with the use of FYM and vermicompost mixtures. The maximum length of leaves was observed in (Table 1) the treatment (M_2) FYM and without cuttings (C_0). However, due to a lack of moisture and an increase in temperature after the second cutting, the length of leaves per plant decreased. Dadiga *et al.* (2015), and Bharad *et al*. (2013) also obtained similar results when they carried out experiments on coriander. Indian spinach, and with the use of FYM and vermicompost. They reported that the use of FYM along with RDF of 50 kg/ha increased the vegetative growth of palak and coriander. The maximum width of leaves was shown in (Table 2) this treatment (M_2), FYM, and without cuttings (C_0). However, after the second cutting, the width of the leaves per plant decreased due to a lack of moisture, decreased nutrient uptake, and an increase in temperature. This result supported the findings of Dadiga *et al.* (2015). Bharad *et al.* (2013), Baharvend *et al.* (2014),Gautam *et al.* (2022) and Türkkan*et al.*(2022) found similar results when they experimented on coriander, Indian spinach, FYM, and vermicompost. They reported that the use of FYM along with RDF of 50 kg/ha increased the vegetative growth of palak and coriander. The highest length of petiole was reported in (Table 2) that this treatment (M_1) was done with vermicompost and without cuttings (C_0). But after second cuttings, the length of petiole per plant was reduced due to poor nutrient uptake, minimum moisture, and increased treatment. This result is quite similar to that reported by Dange *et al.* (2011). When they experimented on spinach beet with the use of treatment 50% RDF + 50% N, poultry manure gave the best result in terms of growth in terms of plant, number of leaves per plant, and length of petiole at all stages of growth. The maximum dry leaf weight per plant was recorded under (Table 2) the treatments M_2, FYM, and second cuttings (C_1). Reduce the dry weight after the first cuttings due to lower moisture content and nutrient uptake. The maximum moisture content was reported under (Table 3) the treatment without manure (M_0) and without cuttings (C_0). But after second cuttings, the moisture content is reduced due to temperature increases. The highest green leaf yield per plant was reported under (Table 3) treatment (M_2 FYM) and the second cutting (C_1). But after second cuttings, green leaf yields are reduced because of a decrease in the vegetative part due to low moisture, less nutrient uptake, and an increase in temperature. However, the maximum green leaf yield/ha was calculated under (Table 3) the treatment (M_2), FYM, and fourth cutting (C_2). But after second cuttings, green leaf yield was reduced because of a decrease in the vegetative part due to low moisture, fewer nutrients, and an increase in temperature.

Conclusion

The results of the present investigation revealed that, among the organic fertilizers, the application of FYM was found to be the best treatment for growth and yieldof palak. In the case of the number of leaf cuttings, it was seen that four times the number of cuttings produced the maximum green leaf yield. But vegetative growth and leaf quality parameters were improved in the case of two time cuttings. Therefore, it may be concluded that combined treatments of FYM

and vermicompost application along with four-time leaf cuttings may be the best for increasing the leaf yield and quality of palak grown under Purvanchal conditions.

Table 1: Effect of organic manures (M) and cuttings (C) on height of plant (cm), number of leaves plant^{-1}and length of leaves (cm) of palak

Treatments	Height of Plant (cm)			Number of leaves plant^{-1}			Length of leaves (cm)		
	Number of cuttings			Number of cuttings			Number of cuttings		
Manures	**C_0**	**C_1**	**C_2**	**C_0**	**C_1**	**C_2**	**C_0**	**C_1**	**C_2**
M_0	20.19	18.65	17.19	09	09	10	09.80	10.09	09.87
M_1	19.76	19.01	17.45	10	10	11	10.45	10.31	10.63
M_2	20.38	18.41	18.37	11	11	10	10.98	10.87	10.89
Mean	20.01	19.69	17.67	10	10	10.33	10.41	10.42	10.46
Sem(+)	0.001	0.001	0.002	0.111	0.111	0.192	0.002	0.002	0.004
$CD_{(P=0.05)}$	0.004	0.004	0.007	0.336	0.000	0.582	0.007	0.007	0.012

Table 2: Effect of organic manures (M) and cuttings (C) on width of leaves (cm), length of petiole (cm) and dry weight (g) of 10 leaves of palak

Treatments	Width of leaves (cm)			Length of petiole (cm)			Dry weight (g) of 10 leaves		
	Number of cuttings			Number of cuttings			Number of cuttings		
Manures	**C_0**	**C_1**	**C_2**	**C_0**	**C_1**	**C_2**	**C_0**	**C_1**	**C_2**
M_0	3.91	4.01	3.87	4.96	4.99	4.08	4.15	4.86	4.69
M_1	4.26	4.39	4.61	5.87	5.78	5.13	4.52	4.98	4.76
M_2	4.98	4.95	4.35	5.59	5.61	5.27	5.12	5.78	5.46
Mean	4.38	4.45	4.27	5.47	5.46	4.82	4.59	5.20	4.97
Sem(+)	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.001	0.002
$CD_{(P=0.05)}$	0.001	0.001	0.002	0.001	0.001	0.001	0.004	0.004	0.007

Table 3: Effect of organic manures (M) and cuttings (C) on green leaf yield (g) and moisture content (%) of leaves of palak

Treatments	Green leaf yield (g)			Moisture content % of leaves		
	Number of cuttings			Number of cuttings		
Manures	**C_0**	**C_1**	**C_2**	**C_0**	**C_1**	**C_2**
M_0	804.61	818.12	795.86	82.21	81.83	81.59
M_1	837.59	846.75	801.15	81.95	80.21	80.19
M_2	861.95	836.82	824.76	80.99	80.78	80.64
Mean	834.7167	833.8967	807.2567	81.71667	80.94	80.80667
Sem(+)	0.143	0.143	0.247	0.095	0.095	0.165
$CD_{(P=0.05)}$	0.432	0.432	0.748	0.288	0.288	0.499

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