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AGRONOMY

Optimisation of nitrogen level and cutting interval for growth and yield of *Ipomoea reptans*

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ABSTRACT

A field experiment was carried out during summer season of 2015 at Horticultural Research Station, Mondouri, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal to optimise different levels of nitrogen level and cutting intervals for growth and yield of *Ipomoea reptans*. The experiment was laid out in a Randomized Block Design with four levels of nitrogen doses (*i.e.* 60, 80, 100, 120 kg/ha) with two cutting treatments at 20 days and 30 days intervals and four replications. Result revealed that growth and yield parameters increases with the increase dose of nitrogen and cutting frequencies. Maximum plant height of 47.87 cm obtained under 120 kg/ha nitrogen with 30 days of cutting condition. Highest weight of leaves and weight of stems per plant were recorded 116 g and 56.13g, respectively under 120 kg/ha nitrogen application with 30 days of cutting interval. The highest total green yield (52.46 ton/ha) was obtained at 120 kg/ha nitrogen application 20 days of cutting. It was found that 11.15% more yield has been obtained that the yield of 30 days of cutting. It has been noticed green yield per hectare has been increased from first cutting to second cutting whereas after second cutting the yield declined which concludes cutting management was beneficial for improving yield and yield attributing characters.

Highlights:

- Treatment combination of 120 kg/ha nitrogen with 20 days cutting interval produced maximum yield.
- 120 kg/ha nitrogen with 30 days cutting interval can also be suggested.

Keywords: Cutting, Growth, *Ipomoea,* Nitrogen, Yield.

Ipomoea reptans poir (syn. *I. aquatica*) commonly known as swamp cabbage or kalmi, karmi, patuasag in Hindi, (family- Convolvulaceae) is a very important cultivated crop in all the south Asian countries of high nutritional value (Hashimoto *et al.* 1985), where it has superior bushy varieties that are grown with much care either as an upland or a lowland crop. Because of its quick growth and efficient absorption of various substances, it has been suggested to be useful for sequestration of environmental pollutants as well as offering a source of medical materials (Khamwan *et al.* 2003). It is found trailing on moist soil or mud along the margins of stagnant streams, fresh water, ponds, ditches, marshes and wet rice fields and it occurs both wild and cultivated in India. The young terminal shoots and leaves are used as leafy vegetables and salad. It has high potential for commercial cultivation for its certain desirable characteristics, such as high nutrient value, agreeable taste, freedom from the attack of serious pests and diseases and its ability to grow under excessively humid condition. Cutting of stems significantly effects branching and enhances flowering in most of the crops (Ahmed and Oladiaran, 2012). Since in most of the leafy vegetables several cuttings are possible, they require a good amount of fertilizer for quick growth. After decapitation of main stems, new shoots form from each stem nodule, making continuous harvest possible and is beneficial in

improving total yield (Jana *et al.* 1999, Thapa and Maity, 2004, Datta *et al.* 2005, Datta *et al.* 2008). Nitrogen is essential for vegetative growth of the plant resulting in higher green and seed yield (Tehelan and Thakral, 2008, Tunctruk *et al.* 2011). Increased addition of nitrogen usually results in increased yield of crop plant (Korus and Lisiewska, 2009). Application of nitrogen to increase yield in leafy vegetables is a well-recognized practice. Nitrogen deficiency exerts its effect on plant growth through reduced leaf area index and hence low light interception and low dry matter production (Masinde and Agong, 2012). Information regarding this crops and about its management practices in India is meagre. Under such situations it is necessary to determine the fertilizer requirement and cuttings effect before going for large scale production. With this view mind, the present work has, therefore, been designed with the objective to determine the nitrogenous fertilizer requirement and cutting effect of gimakalmi.

Materials and methods

The experiments were conducted at Horticultural Research Station of Bidhan Chandra Krishi Viswavidyalaya, Mondouri, Nadia, West Bengal during summer season of 2015. The treatments comprising of four levels of nitrogen (60, 80, 100, 120 kg/ha) and two cutting treatments (20 days and 30 days intervals). First harvesting was taken at 30 days after sowing and then accordance to treatments. The treatments were arranged in factorial randomized design with three replications. The size of plot was 2.5m x 2m. The seeds collected from Kolaghat Midnapore (W.B.) were sown on 28th May, 2015 maintaining the spacing of 30 cm x 10 cm. A basal dose of 60 kg/ha of P_2O_5 and 40 kg/ ha of K_2O along with 1/3 rd or 1/4 th dose of nitrogen according to 30 days interval or 20 days interval cutting respectively were applied at the time of sowing through single super phosphate, muriate of potash and urea, respectively. The remaining N was applied as top dressing in two or three equal splits according to number of cut-tings after each cutting taken. The cutting were taken leaving the plants 5 cm above the ground. The data were analysed statistically Panse and Sukhatme, 1978.

Results and discussion

Growth Performance

Plant height under different nitrogen levels and cutting intervals was influenced significantly. Highest plant height 47.87 cm obtained under 120 kg/ha nitrogen with 30 days interval of cutting condition. While lowest plant height 30.97 cm was recorded under 60 kg/ha nitrogen with 20 days interval of cutting condition. It is may be due to

Table 1: Effect of different nitrogen levels and cutting intervals on the growth performance of *Ipomoea reptans*.

Treatments	Plant height (cm)	No. of vines/ plant	No. of leaves/ plant	Leaf length (cm)	Leaf breadth (cm)	Stem girth (cm)	Leaf weight/ plant (g)	Stem weight plant (g)	Leaf-stem ratio
N_1C_1	30.97	6.27	71.8	11.23	3.41	2.37	45.80	25.17	1.82
N_1C_2	40.33	9.00	124.4	11.31	3.41	2.43	76.67	39.27	1.95
N_2C_1	33.07	7.40	83.6	11.47	3.45	2.38	49.67	27.47	1.81
N_2C_2	41.87	10.13	143.5	11.51	3.45	2.47	86.27	45.00	1.92
N_3C_1	35.20	7.87	94.5	11.65	3.53	2.39	57.07	31.13	1 83
N_3C_2	45.80	11.13	162.0	11.67	3.50	2.50	95.87	49.80	1.93
N_4C_1	37.07	8.33	103.8	11.95	3.55	2.41	64.13	34.17	1.86
N_4C_2	47.87	12.20	191.3	12.04	3.57	2.51	116.00	56.13	2.07
C.D. at 5%	1.309	0.484	3.529	NS	NS	NS	3.953	2.356	0.075
SEm(±)	0.655	0.242	1.764	NS	NS	NS	1.976	1.178	0.037

NS = Not Significant; N_1C_1= 60 kg/ha Nitrogen+ 20 days cutting interval; N_1C_2= 60 kg/ha Nitrogen+ 30 days cutting interval; N_2C_1= 80 kg/ha Nitrogen+ 20 days cutting interval; N_2C_2= 80 kg/ha Nitrogen+ 30 days cutting interval; N_3C_1= 100 kg/ha Nitrogen+ 20 days cutting interval; N_3C_2= 100 kg/ha Nitrogen+ 30 days cutting interval; N_4C_1= 120 kg/ha Nitrogen+ 20 days cutting interval; N_4C_2= 120 kg/ha Nitrogen+ 30 days cutting interval

Table 2: Effect of different nitrogen levels and cutting intervals on the fresh and dry yield of *Ipomoea reptans.*

Treatments	Green Yield (ton/ha)			Total Yield (ton/ha)	
	1st Harvesting	2nd Harvesting	3rd Harvesting	Fresh yield	Dry yield
N_1C_1	9.323	12.00	12.12	43.23	4.15
N_1C_2	9.380	13.32	15.29	38.66	3.72
N_2C_1	10.01	12.35	12.32	45.19	4.38
N_2C_2	10.08	15.19	16.26	41.53	4.03
N_3C_1	11.27	13.31	15.29	51.07	4.95
N_3C_2	11.32	16.37	17.54	45.23	4.39
N_4C_1	12.15	13.43	15.49	52.46	5.09
N_4C_2	12.20	16.98	18.02	47.20	4.58
C.D. at 5%	0.154	0.205	0.185	0.596	0.087
SEm(±)	0.079	0.109	0.101	0.122	0.021

N_1C_1= 60 kg/ha Nitrogen+ 20 days cutting interval; N_1C_2= 60 kg/ha Nitrogen+ 30 days cutting interval; N_2C_1= 80 kg/ha Nitrogen+ 20 days cutting interval; N_2C_2= 80 kg/ha Nitrogen+ 30 days cutting interval; N_3C_1= 100 kg/ha Nitrogen+ 20 days cutting interval; N_3C_2= 100 kg/ha Nitrogen+ 30 days cutting interval; N_4C_1= 120 kg/ha Nitrogen+ 20 days cutting interval; N_4C_2= 120 kg/ha Nitrogen+ 30 days cutting interval

the activity of nitrogenous fertilizer. Cutting also influenced the stem elongation. Harahap (1994) reports that nitrogen fertilizer application led to a significant increase of plant height. Number of vines and leaves produced by *Ipomoea reptans* under the treatment condition influenced significantly, Number of vines and number of leaves per plant were highest with 120 kg/ha nitrogen coupled with 30 days interval of cutting (Table 1). Nashrin *et al.* (2002) also reports that increased doses of nitrogen has a positive effect on total number of leaves per plant in case of *Ipomoea reptans*. Highest number of vines and leaf number recorded 12.20 and 191.3 respectively. The result is in conformation with Akand *et al.* (2015). Cutting interval and nitrogen application did not influence significantly on leaf length, leaf breadth and stem girth. Maximum leaf length (12.04 cm), leaf breadth (3.57 cm) and stem girth (2.51 cm) obtained from the cutting interval of 30 days with 120 kg/ha N application. Highest weight of leaves and weight of stems per plant were recorded 116 g and 56.13g, respectively under 120 kg/ha nitrogen application with 30 days cutting interval. The maximum fresh weight of leaves per plant of 220.67 g was recorded by Solangi *et al.* (2015) in spinach with the application of 150 kg of N per hectare. The leaf stem ratio was obtained highest in 120 kg/ha nitrogen applications with 30 days cutting interval (2.07) and lowest (1.81) in 80 kg/ha nitrogen with 20 days interval of cutting. The leaf stein ratio variation may be due to cumulative effect of the difference of stem girth, leaf size and stern length.

Green and total yield:

First harvest of the crop was taken at 30 days after sowing (DAS) and the highest green yield (12.2 ton/ha) was obtained under 120 kg/ha nitrogen application with 30 days cutting interval and the lowest green yield (9.32 ton/ha) was recorded under 60 kg/ha nitrogen application when cuttings were taken at 20 days interval. This may be due to that for leafy growth of the requirement of nitrogenous fertilizer is more important which pronounced well leafy growth. During the second harvest, the highest green yield (16.98 t/ah) was recorded under 120 kg/ha nitrogen with 30 days interval of cutting. It was 39.18% more than first harvest yield. It may be due to the vigorous growth and production of more branches after first cutting. The highest green yield of 18.02 ton/ha was recorded from the treatment combination where cuttings were taken at 30 days interval and 120 kg/ha nitrogen was applied. It was 6.12% more than yield obtained in second cutting. Increased level of nitrogen increases the yield of leafy vegetables was also reported by Boroujerdnia and Ansari (2007), Ayodele *et al.* (2002) and Wang *et al.* (2007). The highest total green yield (52.46 ton/ha) was obtained at 120 kg/ha nitrogen application with 20 days interval of cutting. It was 11.15% more than the total yield obtained at 30 days interval.

This was due to one more cutting was taken at 20 days interval of cutting. The total dry yield was also highest in 120 kg/ha nitrogen with 20 days interval of cutting (Table 2). The result is in conformation with Satapathy *et al.* (2007). Sarkar *et al.* (2014) also finds that cutting interval along with nitrogenous fertilizer application has a great influence on fresh yield of *Ipomoea reptans*. A significant variation was also found in case of total yield which varies from3.72 ton/ha to 5.09 ton/ha. Maximum total dry yield of 5.09 ton/ha was obtained from the treatment where nitrogen was a applied at 120 kg/ha rate and cuttings were taken at 20 days interval. Guan *et al.* (2006) studied the growth, yield formation and absorption of nitrogen in Malabar spinach (*Basella sp*.) and reported that nitrogen has a direct effect on yield of the crop.

Conclusion

From the experiment it can be concluded that, the 120 kg N/ha has shown best result when cuttings were taken at 20 days interval regarding yield. But in case of growth characters, best results has been observed for most of the parameters when cuttings were taken at 30 days interval and 120 kg/ha of nitrogen was applied. So, from economic return of point, the combination of treatment (120 kg/ha nitrogen along with 20 days cutting interval) can be suggested to the farmers as it was found superior amongst all other remaining treatment combinations with respect to growth and yield of Ipomoea reptans. Regarding cutting management it was also noticed that green yield per hectare has been increased from first cutting to second cutting whereas after second cutting the yield declined which concludes cutting management was beneficial for improving yield and yield attributing characters.

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