Journal BiNET
Scientific Publication

Published with Open Access at Journal BiNET
Vol. 05, Issue 01: 24-29

Journal of Bioscience and Agriculture Research

Home page: www.journalbinet.com/jbar-journal.html

Growth and yield of Gimakalmi (*Ipomoea acquatica*) as influenced by combinations of nitrogen and cowdung

***Most. Altaf-Un-Nahar*[a], *Md. Rezaul Karim*[b] *and Mostafizur Rahman*[b]**

[a]*Dept. of Biotechnology, EXIM Bank Agricultural University, Bangladesh*
[b]*Dept. of Horticulture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh*

ABSTRACT

The effect of different doses of nitrogen in combination with cowdung (CD) on the growth and yield of Gimakalmi was investigated at the Horticulture Farm of Bangladesh Agricultural University, Mymensingh. Single factor experiment consisted of four nitrogen-cowdung treatment combinations, i.e., 0 kg N + 0 ton CD ha^{-1} (without nitrogen and CD), 25 kg N + 5 ton CD ha^{-1}, 50 kg N + 10 ton CD ha^{-1} and 75 Kg N + 15 ton CD ha^{-1}. The experiment was laid out in a randomized complete block design with four replications. The results of the study revealed that higher doses of nitrogen with CD produced the tallest (30.22 cm), highest number of leaves and branches (160.64 and 21.81, respectively) plant^{-1}, fresh weight leaves and foliage (49.96 g and 58.39 g, respectively) plant^{-1} as well as yield (6.92 t ha^{-1}).

Key words: *Nitrogen, cowdung, growth, yield and Gimakalmi (Ipomoea acquatica)*

Please cite this article as: Nahar, M. A., Karim, M. R. & Rahman, M. (2015). Growth and yield of Gimakalmi (*Ipomoea acquatica*) as influenced by combinations of nitrogen and cowdung. *Journal of Bioscience and Agriculture Research,* 05(01), 24-29.

I. Introduction

Gimakalmi (*Ipomoea acquatica* Poir) is one of the most important leafy vegetables belongs to the family *Convolvulaceae*. It was developed from an introduced strain of Kangkong from Thailand by the Citrus and Vegetable Seed Research of Bangladesh Agricultural Research Institute (Hossain and Siddique, 1982). At present, it is an important and widely grown vegetable in South-East Asian countries including Bangladesh. It is an excellent source of vitamins such as vitamin A, B, C, and minerals like calcium and iron (Anonymous, 1983a; 1983b). In Bangladesh, most of the vegetables are grown in summer and winter season. In between these two seasons, there is a long period when a few vegetables are available in the market. During this lean period, cultivation of Gimakalmi could partially supplement the deficiency of vegetable supply in the market in the country.

Gimakalmi can be grown both in the summer and in the rainy seasons (Shinohara, 1980). Although similar but aquatic type of local Kalmi is naturally grown in ponds or marshy land of Bangladesh, Gimakalmi has a special significance, because it grows in upland soil with an appreciable yield

Corresponding author email: altaf.nahar@yahoo.com (Nahar, M. A.)

eISSN: 2312-7945, © Nahar *et al.* (2015), Research paper

potential of foliage. Unlike the Bangladeshi local Kalmi, Gimakalmi grows erect producing heavy foliage (Rashid, 1993). Since it requires low input, easy to grow, and is suitable for growing in summer, its cultivation should be increased. There are signs of its gaining popularity among the Bangladeshi vegetable growers and consumers.

Successful crop production mostly depends on the application of fertilizer at the right time and at the proper dose (BARC, 2012). Among the fertilizers used in crop production, nitrogenous fertilizer is the most important particularly for leafy vegetables including Gimakalmi (Nashrin *et al*., 2002 and Akand *et al*., 2015). Nitrogen increases the vegetative growth of plants and produces good quality foliage and promotes carbohydrate synthesis (Rai, 1981). The use of nitrogenous fertilizer for the production of Gimakalmi is particularly important when several harvests are done from a single plant. In Bangladesh, urea is mostly used as the source of nitrogen and split application of this fertilizer is commonly practiced for leafy vegetable production (Hossain, 1990). At the same time, organic manure like cowdung improves soil health and increases crop productivity (Islam, 2003).

Few research works have been conducted on the influence of different doses nitrogen fertilizer in combination with cowdung on growth and yield of Gimakalmi. It has been reported that significant variation was observed due to the application of different levels of nitrogen fertilizer (Nashrin *et al*., 2002 and Akand *et al*., 2015). Application of nitrogen fertilizer in combination with organic manures increased the salable yield of Gimakalmi (Akand *et al*., 2015). But an optimum amount of these inorganic and organic components is necessary for proper plant growth and to obtain high yield (Yoshizawa and Roan, 1981). Among the various reasons for low yield of Gimakalmi thoughtful fertilizer management is one of them (Rashid *et al*., 1985). Excessive application is not only uneconomical but also makes crops vulnerable to many physiological disorders. Since fertilizer is a costly agricultural input and its judicious application needs to be adjusted through standardizing the appropriate doses of fertilizer for the cultivation of Gimakalmi. Therefore, the present study was undertaken to investigate the combined effect of nitrogen and cowdung on growth and yield of Gimakalmi.

II. Materials and Methods

The experiment was conducted at the Horticulture Farm of Bangladesh Agricultural University, Mymensingh during the period from May to August, 2014 to investigate the influence of different levels of nitrogen in combination with different doses of cowdung (CD) on growth and yield of Gimakalmi. Seeds of Gimakalmi (variety Gimakalmi-1) were collected from Olericulture Division of Bangladesh Agricultural Research Institute (BARI). Single factor experiment was laid out following randomized complete block design with four replications comprised of four different levels of nitrogen in combination with CD namely, 0 kg N + 0 ton CD, 25 kg N + 5 ton CD, 50 kg N + 10 ton CD and 75 kg N + 15 CD ha^{-1}. In addition, the crop was fertilized with triple super phosphate (TSP) and muriate of potash (MoP) @ 10 ton, 75 kg and 25 kg ha^{-1} (BARC, 2012), respectively. Nitrogen was applied in the form of urea and the quantity of urea for the relevant doses of nitrogen (0, 25, 50 and 75 kg ha^{-1}) was 0, 54.35, 135.86 and 195.65 kg ha^{-1}, respectively. The entire dose of CD, TSP, MoP and one third of urea were applied as basal dose during final land preparation. The remaining nitrogen was applied as top dressing after each harvest except final harvest. There were 16 experimental plots. The size of the unit plot was 1.5 m x 1.0 m.

Seeds were sown in each planting hole at 1 cm depth maintained 30 cm x 25 cm spacing between row and plant, respectively. Then the seeds were covered with a thin layer of soil. Thinning was done seven days after sowing (DAS) and only one healthy seedling was allowed to grow in each hill. Weeding and mulching were done as and when necessary. The plots were irrigated with watering cane. The first harvesting was done at 30 DAS and the plants were cut leaving 2 cm from the base of the plants. Harvesting was done at 30, 45, 60, 75 and 90 DAS. Ten plants were selected from each unit plot for the collection of data. The data were recorded on several parameters such as plant height, the number of leaves and branches per plant, fresh weight of leaves (only leaves) and foliage (leaves + stem) per plant and yield per hectare. The collected data were statistically analyzed following MSTAT program. The analysis of variance for all the characters under study was performed by F (variance ratio) test.

Corresponding author email: altaf.nahar@yahoo.com (Nahar, M. A.)

eISSN: 2312-7945, © Nahar *et al.* (2015), Research paper

The mean differences were evaluated by least significant difference (LSD) test (Gomez and Gomez, 1984).

III. Results and Discussion

Plant height

Application of different amounts of nitrogen showed the significant variation on plant height at different days after sowing i.e., different harvesting dates (Table 01). Over all, during the plant growth the highest plant height was recorded when 75 kg N + 15 ton cowdung (CD) ha^{-1}was applied and the lowest was found in 0 kg N ha^{-1}. During first harvest at 30 DAS the longest (24.69 cm) plant was produced when nitrogen was applied at rate of 50 kg plus 15 ton CD ha^{-1} which was closed to 24.38 cm (50 kg N + 10 ton CD ha^{-1}) followed by 25 kg N + 5 ton CD ha^{-1}, while the shortest (22.87 cm) plants was obtained from control plots those did not receive any nitrogen. At 90 DAS, the maximum plant height (28.10 cm) was recorded against the application of 75 kg N + 15 ton CD ha^{-1} which was statistically different from rest of the treatments and the minimum (25.60 cm) was found from the control condition i.e. the plots did not received any nitrogen. Such effect might be attributed to the usual role of nitrogen on vegetative growth. The finding is similar with that of Nashrin *et al*., 2002 and Akand *et al*., 2015 who reported that plant height of Gimakalmi increased with the increased doses of nitrogen plus organic manures application.

Number of leaves per plant

Application of different doses nitrogen fertilizer significantly influenced the number of leaves per plant at all dates of harvests (Table 01). It was appeared that the number of leaves increased with the increasing doses of nitrogen together with the advancement of time. During the first harvest at 30 DAS, the maximum number of leaves (31.88) per plant was obtained from N_3 (75 kg N + 15 ton CD ha^{-1}) which is statistically similar to N_2 (50 kg N + 10 ton CD ha^{-1}) followed by N_1 (25 kg N + 5 ton CD ha^{-1}) while the lowest (22.87) was obtained from control condition. During the second harvest at 45 DAS, The highest number of leaves (78.89) was recorded from N_3 (75 kg N + 15 ton CD ha^{-1}) and the lowest (73.24) number of leaves per plant was found in control plots. A similar trend was also observed at 60, 75 and 90 DAS in regards to doses of nitrogen fertilizer application and leaf production rate (Table 01). At 90 DAS, The highest number (160.64) leaves per plant was produced by the application of highest levels of nitrogen (75 kg N + 15 ton CD ha^{-1}). Akand *et al.,* 2015 concluded that application of different doses of nitrogen together with organic manures significantly produced the higher number of leaves per plant in Indian spinach.

Table 01. Effects different levels of nitrogen and cowdung on plant height and number of leaves per plant at different days after sowing

Treatments	Plant height (cm) at					Number of leaves plant^{-1} at				
	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS
N_0	22.87	28.78	23.55	27.32	25.60	31.81	73.24	78.89	75.91	141.12
N_1	23.34	29.54	23.61	29.11	27.91	33.26	74.25	77.79	78.56	152.67
N_2	24.35	30.17	24.85	30.55	27.84	32.77	74.12	79.53	78.99	156.41
N_3	24.69	30.15	25.24	30.22	28.10	31.88	78.89	78.99	82.14	160.64
LSD $_{(0.01)}$	*0.76*	*0.45*	*0.61*	*0.46*	*0.63*	*1.15*	*0.58*	*0.57*	*0.54*	*0.68*
Level of significance	**	**	**	**	**	**	**	**	**	**

N_0 = Control (without nitrogen and cowdung), N_1 = 25 kg N + 5 ton ha^{-1}, N_2 = 50 kg N + 10 ton CD ha^{-1}, N_3 = 75 kg N + 15 ton CD ha^{-1}; DAS = Days after sowing; ** = significant at 1% level of probability.

Number of branches per plant

The number of branches per plant was increased significantly due to the application of increased doses of nitrogen (Table 02). The highest number of branches (21.81) per plant was recorded at 90

Corresponding author email: altaf.nahar@yahoo.com (Nahar, M. A.)

eISSN: 2312-7945, © Nahar *et al.* (2015), Research paper

DAS when nitrogen was applied at 75 kg plus 15 ton CD ha^{-1} followed by 50 kg N + 10 ton CD ha^{-1} (201.2) and the lowest (18.18) was found in control plots. Nashrin *et al.*, 2002 reported that the highest doses of nitrogen produced a maximum number of branches $plant^{-1}$.

Fresh weight of leaves per plant

Fresh weight leaf per plant showed significant variation due to the application of different doses nitrogen at all harvests (Table 02). During first harvest at 30 DAS, the maximum (22.81 g) fresh leaves was obtained from the application of nitrogen at 50 kg with 15 ton CD ha^{-1} followed by 50 kg N + 10 ton CD ha^{-1} (22.67 g) and the lowest (22.47 g) was from the control treatment. The highest (49.96 g) fresh leaves was recorded from N_3 which was statistically similar to N_2 and the lowest (40.67 g) fresh leaves per plant was found from the control plots at 45 DAS during second harvest. During third harvest at 60 DAS, the highest (35.52 g) fresh leaves per plant were recorded from N_3 and the lowest (30.82 g) was obtained from control treatment. The similar trend of fresh weight leaves per plant was found at 75 and 90 DAS (Table 02).

Table 02. Effect of different levels of nitrogen and cowdung on number branches per plant and fresh weight of leaf per plant at different days after sowing

Treatments	Number of braches $plant^{-1}$ at					Fresh weight (g) of leaves $plant^{-1}$ at				
	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS
N_0	4.63	9.10	9.55	11.48	18.81	22.47	40.67	30.82	16.32	14.42
N_1	4.80	9.25	10.59	12.45	19.95	22.56	45.89	30.91	19.43	19.39
N_2	4.91	9.78	12.87	12.67	20.12	22.67	49.51	31.77	22.63	21.14
N_3	4.97	9.87	12.95	12.95	21.81	22.81	49.96	35.52	29.81	22.90
LSD (0.01)	*0.42*	*0.73*	*0.49*	*0.67*	*0.65*	*1.52*	*0.96*	*1.41*	*0.64*	*0.92*
Level of significance	**	**	**	**	**	**	**	**	**	**

N_0 = Control (without nitrogen and cowdung), N_1 = 25 kg N + 5 ton ha^{-1}, N_2 = 50 kg N + 10 ton CD ha^{-1}, N_3 = 75 kg N + 15 ton CD ha^{-1}; DAS = Days after sowing; ** = significant at 1% level of probability.

Fresh weight of foliage per plant

Fresh weight of foliage per plant was significantly influenced by different doses nitrogen at 30, 45, 60, 75 and 90 DAS (Table 03). At 90 DAS, the maximum fresh weight (37.67 g) per plant was obtained from the application of 75 kg N + 15 ton CD ha^{-1} and the lowest (21.16 g) per plant was from the control plants i.e., 0 kg N $^{-1}$. Similar trends were found at 30 and 75 DAS but at 45 and 60 DAS, the maximum fresh weight of foliage (77.75 and 58.39 g) was observed in plant received 75 kg N +15 ton CD ha^{-1}. At 45 DAS, the highest fresh weight of foliage was obtained and decreased in later harvests (Table 03). This is might be happened due to the shortage of nitrogen during later harvests and the availability and utilization of maximum nitrogen produced higher yield at 45 DAS.

Table 03. Effect of different levels of nitrogen and cowdung on fresh weight of foliage per plant and yield of Gimakalmi at different days after sowing

Treatments	Fresh weight (g) of foliage $plant^{-1}$ at					Yield (t/ha)				
	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS
N_0	30.52	68.68	45.63	24.65	21.16	4.65	7.81	5.17	4.13	4.11
N_1	31.68	71.14	46.12	36.85	30.51	4.89	7.92	6.88	6.18	5.38
N_2	32.83	74.17	57.19	37.75	31.50	5.21	9.29	7.91	6.98	5.41
N_3	38.65	77.75	58.39	46.52	37.67	5.53	9.97	8.44	7.01	6.92
LSD (0.01)	*1.56*	*1.24*	*0.45*	*0.67*		*0.43*	*0.51*	*0.29*	*0.32*	*0.41*
Level of significance	**	**	**	**	**	**	**	**	**	**

N_0 = Control (without nitrogen and cowdung), N_1 = 25 kg N + 5 ton ha^{-1}, N_2 = 50 kg N + 10 ton CD ha^{-1}, N_3 = 75 kg N + 15 ton CD ha^{-1}; DAS = Days after sowing; ** = significant at 1% level of probability.

Corresponding author email: altaf.nahar@yahoo.com (Nahar, M. A.)

eISSN: 2312-7945, © Nahar *et al.* (2015), Research paper

Yield per hectare

Application of nitrogen at different doses exhibited significant differences for yield at all harvest dates i.e., 30.45, 60, 75 and 90 DAS (Table 03). During the first at 30 DAS, the highest (5.53 t ha^{-1}) was recorded when nitrogen was applied at 75 kg with 15 ton CD ha^{-1} which was statistically similar (5.21 t ha^{-1}) to 50 kg N + 10 ton CD ha^{-1} and the lowest (4.65 t^{-1}) was recorded from control plants. Among the all harvest dates, the highest yield (9.97 t ha^{-1}) was noted when nitrogen was applied at 75 kg together with 15 ton CD ha^{-1} at 45 DAS and the lowest (4.11 t ha^{-1}) from control plants. Application of nitrogen together with organic manures at higher doses increased the yield of Gimakalmi as reported by (Aditya *et. al.*, 1995; Nashrin *et al.*, 2002 and Akand *et al.*, 2015).

IV. Conclusion

Results of the experiment showed that four different levels of nitrogen in combination with cowdung had significant variations on yield and yield components of Gimakalmi. Among the treatments, application of nitrogen 75 kg N + 15 ton cowdung ha^{-1} performed the best compared to other treatments in respect of all parameters studied.

V. Acknowledgement

Authors are thankful to the Olericulture Division of Bangladesh Agricultural Research Institute, Gazipur for providing Gimakalmi seeds.

VI. References

[1]. Aditya, D. K., Sarder, P. K. & Ahmed, S. U. (1995). Effect of spacing and different levels of nitrogen on the production of Pak Choi (*Brassica chinensis* L.) cv. Batisak. *Progressive Agriculture*, 6: 65-69.
[2]. Akand, M. H., Mazed, H. E. M. K., Pulok, M. A. I., Chowdhury, M. S. N. & Moonmoon, J. F. (2015). Influence of different doses of fertilizers management on growth and yield of Gimakalmi (*Ipomoea reptants* Poir). *International Journal of Applied Research*, 1(5): 98-101.
[3]. Anonymous. (1983a). A booklet on Gimakalmi a new summer leafy type vegetable (Bengali). CVSRC, Bangladesh Agricultural Research Institute (BARI), Joydevpur, Gazipur.
[4]. Anonymous. (1983b). Influence of different basal dose and top dressing of urea on the yield of Gimakalmi. *In:* Annual Report, CVSRC, Bangladesh Agricultural Research Institute (BARI), Jodevpur, Gazipur. pp. 34-36.
[5]. BARC, (2012). Fertilizer Recommendation Guide-2012. Bangladesh Agricultural Research Council, Farmgate, Dhaka. 126p.
[6]. Gomez, K. A. & Gomez, A. A. (1984). Statistical Procedures for Agricultural Research. 2nd edn. A Wiley-Inter science Publication. John Wiley and Sons. pp: 28-192.
[7]. Hossain, M. M. &Siddique, M. A.(1982). Effect of plant density on the yield of two cultivars of kangkong. *Bangladesh. J. Agri. Sci.*, 9(2): 241-244.
[8]. Hossain, M. Z. (1990). Effects of nitrogen and suplhur on growth, yield and nutrient content of rice. M.Sc. thesis, Department of Soil Science, Bangladesh Agricultural University, Mymensingh. 17p.
[9]. Islam, M. M. (2003). Response of grain amaranth (*Amaranthus hypochondriacus*) to plant density. *Indian J Agric Sci.*, 65(11): 818-820.
[10]. Nashrin, S. A., Farooque, A. M., Siddiqua, M. K., Rahaman, M. M. & Khanam, M. R. (2002). Effect of nitrogen and spacing on the growth and yield of Gimakalmi, *Ipomoea reptans* Poir. *OnLine Journal of Biological Sciences*, 2(3): 170-174.
[11]. Rai, M. M. (1981). Principles of Soil Science.Machillan India Limited, Calcutta. pp. 179-182.
[12]. Rashid, M. A., Ahmad, M. S., Hussain, M. A. & Hussain, A. M. M. A.(1985). Gimakalmi-a new leafy vegetable for rainy season of Bangladesh. *Bangladesh Horticulture*, 13(1-2): 79-81.
[13]. Rashid, M. M. (1993). Sabjibiggan(Bengali). Bangla Academy, Dhaka, Bangladesh. pp. 423-426.

Corresponding author email: altaf.nahar@yahoo.com (Nahar, M. A.)

eISSN: 2312-7945, © Nahar *et al.* (2015), Research paper

[14]. Shinohara, S. (1980). Book for Development of Vegetable Horticulture with Capable Seed Production in Bangladesh. Central Extension Resources Development Institute, Joydebpur, Gazipur. 218p.

[15]. Yoshizawa, T. M. C. H. & Roan, Y. C. (1981). Management of Summer Amaranth. AVRDC, Shanhua, Taiwan, 1981, 12.

Corresponding author email: altaf.nahar@yahoo.com (Nahar, M. A.)

eISSN: 2312-7945, © Nahar *et al.* (2015), Research paper