Journal of Agroforestry and Environment

Volume 16, Issue 1, 2023

Journal DOI:

Journal homepage: www.jagroforenviron.com

Effect of Organic Amendments and Shade Levels on Growth Performances of Diabetic Plant (*Gynura procumbens*)

Md. Abu Sayed Robi[1], Sanjia Jahir Prova[1], Subrata Das[1], Md. Ashraf-Ul-Alam Mridha[3], Mohammad Samiul Ahsan Talucder[1,2*] and Md. Sharaf Uddin[1]

[1]Climate-Smart Agriculture Lab, Department of Agroforestry and Environmental Science, Sylhet Agricultural University, Sylhet-3100, Bangladesh.
[2]Interdisciplinary Research for Future Agriculture, Sylhet Agricultural University, Sylhet-3100, Bangladesh.
[3]Faculty of Veterinary, Animal and Biomedical Science, Sylhet Agricultural University, Sylhet, Bangladesh, Email:
*Correspondence: talucdermsa.aes@sau.ac.bd , Tel: +8801711974124.

Received: 01/01/2023

Accepted: 29/01/2023

Available online: 02/02/2023

Abstract: The longevity spinach (*Gynura procumbens*) also recognized as a diabetic plant, contains many medicinal values but is rarely available in local markets and near at hand. Indoor gardening can help in getting the plant within reach easily. The research was conducted to investigate the growth performance of *G. procumbens* under various organic amendments and shade levels. The experiment was consisted of two factors: different organic amendments and shade levels. Under the first factor, three organic amendments, namely O_1= Cow dung, O_2= vermicompost, and O_3= Trichocompost were included and under the second factor, two shade levelsviz. S_1= Full shade (4×100 lux) and S_2= Semi-shade (125×100 lux) were imposed. The experiment was designed in a factorial Randomized Complete Block Design (RCBD) with three replications. Plant height (cm), number of leaves, and number of stems per plant were measured and statistically analyzed at 50, 80, and 110 days after transplanting. Means were compared with the DMRT values. Results revealed that, the treatment combination of trichocompost and semi-shade (O_3S_2) showed highly significant maximum number of leaves (159.33) and stems (18.67) at 110 DAT ($p \leq 0.01$). Trichocompost (O_3) under semi-shade (S_2) condition performed as the best practice for *G. procumbens* plant growth. Therefore, application of trichocompost under semi-shade conditions could be recommended for *Gynura procumbens* cultivation.

Keywords: *Gynura procumbens;* Trichocompost; Vermicompost; Cowdung; Shade level.

INTRODUCTION

Rapid urbanization and population increase are keeping a high demand on urban food supply systems in the modern day. About 54% world population is living in these rapid urbanization areas which are expected to rise to 66% by 2050 (Becker *et al.*, 2015). The rapid depletion of green space is an issue that affects every region on the earth, and as a result, the impacts of heat islands are getting worse. Urban agriculture or simple farming can successfully tackle these problems. (Smit *et al.*, 2001). Rooftop gardening (RTG) and indoor gardening are two practical modern solutions to rapid urbanization growth and urban deforestation challenges. Rooftops and indoor gardens are eco-friendly outdoor living areas built on top of residential or commercial buildings (Hossain, 2014).

On the rooftop garden and indoor garden, many kinds of herbs, shrubs, and trees are cultivated. Bangladesh has a record of more than five hundred various species of medicinal plants (Anjum *et al.*, 2021). *Gynura procumbens* is also a medicinal plant used for gardening on the rooftop and indoor spaces and have popularity as a diabetic plant in Bangladesh.

Gynura procumbens, commonly known as "Baibingca," "Bai Bing Cao," and "Sambung Nyawa" in China, is a plant of the Asteraceae family and genus *Gynura* that was first found on the African continent millennia ago (Rahman and Asad, 2013; Mou and Dash, 2016; Tan *et al.*, 2016). In Bangladesh and South Asia, it is also utilized as a diabetic plant. It is an annual, evergreen medicinal plant that typically reaches a level of 1 to3 m and has a fleshy stems with a purple colour tint which is well known for having a wide

range of phytochemicals and pharmacological effects (Rosidah *et al.*, 2008; Rahman and Asad, 2013; Tan *et al.*, 2016). The non-toxic, lanceolate or ovate-elliptic leaves are 3.5 to8.0 cm long and 0.8 to 3.5 cm wide (Rosidah *et al.*, 2008; Rahman & Asad, 2013; *Tan et al.*, 2016). Flowering heads are 1.0 to 1.5 cm long, panicled, and narrowly yellow. The plant has no seeds. The plant grows readily from stem cuttings and does best in well-drainage, fertile soil that is always kept wet. (Rahman and Asad, 2013; Mou and Dash, 2016). In several regions of Southeast Asia, including Indonesia, Myanmar, the Philippines, Malaysia, and Thailand, *Gynura procumbens* is broadly distributed. (Kim *et al.*, 2006; Rosidah *et al.*, 2008; Rahman and Asad, 2013; Mou and Dash, 2016). The plant's popular and traditional applications include the treatment of eruptive fevers, skin infections, kidney disease, migraines, constipation,arteriosclerosis, hypertension, prehypertension, hyperlipidemia, diabetes mellitus, viral skin diseases, heart disease, obesity, urinary tract infection, rheumatism, cancer and alleviate inflammation (Kim *et al*., 2006; Rosidah *et al*., 2008; Rahman and Asad, 2013; Mou and Dash, 2016; Tan *et al.*, 2016).

Some researchers (Dudai *et al*., 1992; Saha et al., 2005; Roy *et al.*, 2010; Keshavarz, 2019) have found how organic matter influences on the growth of various medicinal plants. There are very few studies on how organic matter enhances medicinal plant growth in different shade conditions. There

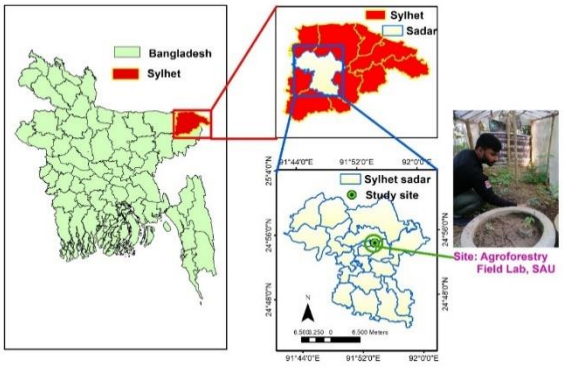

Figure 1. Experimental site map.

hasn't yet been comparison research that analyzes how the growth of diabetic plants is affected by organic matter and shade levels. Moreover, a comprehensive study is needed to know the attitude of variations of diabetic plant growth with the organic matter and shade conditions.

This study was aimed to compare the growth performance of *Gynura procumbens* under different organic matter and shade conditions.

MATERIALS AND METHODS

The research was conducted at the nursery of department of agroforestry and environmental science and cornice of the building of Agriculture Faculty, Sylhet agricultural university, Sylhet during the summer season from April 2019. The location of the site is about 5 kilometers northeast of Sylhet city with $24^0 54´$N to $33^0 67´$N latitude and $91^0 54´$ to $95^0 88´$E longitude and elevation of 88 feet from the sea level (Das *et al.*, 2022). The soil of the experiment site is deep brown in texture and highly acidic in nature (Rahman *et al*., 2003) and climate is subtropical during May to September which is characterized by high temperature, heavy rainfall and high humidity (Figure 1). The research was carried out following the factorial experiment in a Randomized Complete Block Design (RCBD) with three replications. Different organic matter and shade levels were the following factors which were used in this experiment. Cowdung, vermicompost and trichocompost were used as organic matter. At shade level full shade (4×100 lux) and semi-shade (125×100 lux) were used in the experiment. Altogether 18 plants; nine plants for each replication were transplanted after four weeks under two distinct shed levels where intensity of full sunlight was 790×100 lux. Pot size dimension was 37 cm surface diameter × 22 cm bottom diameter × 31 cm depth per height. Plant characteristics such as height of plant, no. of leaves and stems of each plant at 50 DAT, 80 DAT and 110 DAT were recorded. Experimental data were entered in Microsoft Excel and Statistics 10 software for ANOVA (analysis of variance) and means were separated by DMRT at 5 % level of significance.

RESULTS AND DISCUSSIONS

Effect of organic amendments on growth of diabetic plant

All the plant growth parameters varied significantly due to the application of different organic matter (Table 1). The result showed that, the highest plant height was recorded (31.00 cm) at 110 DAT by using trichocompost and the lowest (18.08 cm) was recorded for the treatment vermicompost. Highly significant differences were observed in respect of total no. of leaves plant^{-1} ($p \leq 0.01$). The highest total number of leaves were produced (140.50) at 110 DAT by using Trichocompost. The lowest number of leaves were observed (114.67) by using vermicompost. Total number of stems per plant were significantly influenced by the effect of organic substances except at 110 DAT (Table 1).

The result showed that, the highest total number of stems were produced (17.00) at 110 DAT by using trichocompost, where the lowest were produced (7.83) by using cowdung. All plant growth parameters were influenced by Trichocompost (O_3) application. It may be due to fact that Trichocompost (O_3) producing plant growth regulatory material and phytohormones such as Indole acetic acid (IAA) is a prominent active chemical auxin that is produced by a number of microorganisms, including PGPR (Plant Growth Promoting Rhizobacteria) (Lynch, 1985).

DOI: https://doi.org/10.55706/jae1604

Table 1. Effect of organic amendments on the growth of diabetic plant.

Treatment	Height of plant(cm)			No. of leaves			No. of stems		
Organic substances	**50DAT**	**80DAT**	**110DAT**	**50DAT**	**80DAT**	**110DAT**	**50DAT**	**80DAT**	**110DAT**
O_1	14.90a	18.45a	22.73b	79.17a	102.83b	115.50b	3.83c	6.00c	7.83c
O_2	11.90b	14.52b	18.08c	73.83b	93.33c	114.67b	4.67b	7.33b	10.50b
O_3	7.00c	14.50b	31.00a	83.50a	111.83a	140.50a	6.67a	11.33a	17.00a
Level of significance	**	**	**	**	**	**	**	**	**
LSD $_{(0.05)}$	1.00	1.82	3.99	4.41	5.68	5.45	0.61	0.56	1.24

Note: Figures similar to the letters do not differ significantly. * Significant at 5% level, ** Significant at 1% level, O_1 = Cow dung, O_2 = Vermicompost, O_3 = Trichocompost; DAT = Days after transplanting, LSD = Least significant difference.

Effect of shade level on the growth of diabetic plant

Shade level showed a statistically significant effect on all the parameters of plant growth (Table 2). Plant height per plant was significantly influenced by the effect of shade level except for 110 DAT. The result showed that, higher plant height was produced (29.47 cm) at 110 DAT in semi-shade and lower plant height was produced (27.16 cm) in full shade condition. Shading effect was significant on total number of leaves (Table 2). The result showed that, higher number of leaves were produced (132.11) at 110 DAT in semi-shade, where the lower were produced (115) in full shade. The same trend was observed at 80 DAT, although significant difference was not observed at 50 DAT. For number of stems, there was no significant effect of shade at 50, 80 and 110 DAT. The stems number pot^{-1} was insignificantly influenced by the effect of shade level. All plant growth parameters were influenced by Semi-shade (S_2). It may be due to the diabetic plant performs best on sites with partial sun or light shade exposure.

Table 2. Effect of shade levels on growth contributing characters of diabetic plant.

Treatment	Height of Plant(cm)			No. of leaves			No. of stems		
Shade level	**50DAT**	**80DAT**	**110DAT**	**50DAT**	**80DAT**	**110DAT**	**50DAT**	**80DAT**	**110DAT**
S_1	10.19b	14.40b	23.20a	80.33a	95.00b	115.00b	5.11a	8.00a	12.11a
S_2	12.34a	17.24a	24.68a	77.33a	110.33a	132.11a	5.00a	8.44a	11.44a
Level of significance	**	**	NS	NS	**	**	NS	NS	NS
LSD $_{(0.05)}$	0.82	1.48	3.26	3.61	4.63	4.45	0.49	0.46	1.01

Note: Figures similar to the letters do not differ significantly. * Significant at 5% level, ** Significant at 1% level, S_1 = Full shade, S_2 = Semi-shade, DAT = Days after transplanting, LSD = Least significant difference.

Interaction effect of organic amendments and shade levels on growth of the diabetic plant

The combined effect of different organic amendments and shade levels per pot was observed statistically significant (Table 3). The highest plant height was produced (34.0 cm) at 110 DAT from the combined effect of tricocompost and full shade (O_3S_1), where the lowest plant height was observed (12.00 cm) from the interaction between vermicompost and full shade (O_2S_1). It was found that the highest total number of leaves were recorded (159.33) at 110 DAT from the combined effect of Trichocompost and semi-shade (O_3S_2), where the lowest number of leaves were produced (108.00) from the combined effect of cowdung and full shade (O_2S_1. The interaction effect of different organic substances and shade-levels per pot was influenced significantly except at 110 DAT. It was found that, the highest total number of stems were produced (18.67) at 110

DOI: https://doi.org/10.55706/jae1604

DAT from the combined effect of tricocompost and semi-shade (O_3S_2), where the lowest were produced (7.00) for the treatment combination vermicompost and full shade (O_1S_2). The same trend was observed at 50 and 80 DAT for number of leaves and stems. It may be due to the combined effect of organic matter and shade level that increased the entire plant growth contributing parameters superior and also for the application of Trichoderma (O_3) with semi-shade level (S_2) condition. Because *Trichoderma spp*. can produce phytohormones is the key factor in the increase in Plant height (cm), Number of leaves and Number of the stem. Shade treatments can reduce canopy temperature by about 2-4°C as compared to exposure to full sunlight which reduces evapotranspiration Geromel *et al*., 2008; Muschler, 2002; Vaast *et al*., 2006; Guyot *et al.*, 1996). This increases water retention capacity, which promotes plant growth.

Table 3. Combined effect of organic amendments and shade levels on growth of the diabetic plant.

Treatment	Height of Plant(cm)			No. of leaves			No. of stems		
Interaction	**50DAT**	**80DAT**	**110DAT**	**50DAT**	**80DAT**	**110DAT**	**50DAT**	**80DAT**	**110DAT**
O_1S_1	14.77a	19.53a	23.60bc	87.33a	104.67b	115.33bc	3.67c	5.67d	8.00d
O_1S_2	15.03a	17.37a	21.87c	71.00c	101.00b	115.67bc	4.00c	6.33d	7.67d
O_2S_1	7.80b	9.33c	12.00d	74.67bc	80.67c	108.00c	5.00b	8.33c	13.00c
O_2S_2	16.00a	19.70a	24.17bc	73.00bc	106.00b	121.33b	4.33bc	6.33d	8.00d
O_3S_1	8.00b	14.33b	34.00a	79.00b	99.67b	121.67b	6.67a	10.00b	15.33b
O_3S_2	6.00c	14.67b	28.00b	88.00a	124.00a	159.33a	6.67a	12.67a	18.67a
Level of significance	**	**	**	**	**	**	NS	**	**
LSD $_{(0.05)}$	1.42	2.57	5.64	6.26	8.03	7.70	0.86	0.79	1.75
CV (%)	6.94	8.93	12.95	4.36	4.30	3.43	9.32	5.29	8.15

Note: Figures similar to the letters do not differ significantly. * Significant at 5% level, ** Significant at 1% level, O_1 = Cowdung, O_2 = Vermicompost, O_3 = Trichocompost; S_1 = Full shade, S_2 = Semi-shade, DAT = Days after transplanting, CV = Co-efficient of variation, LSD = Least significant difference.

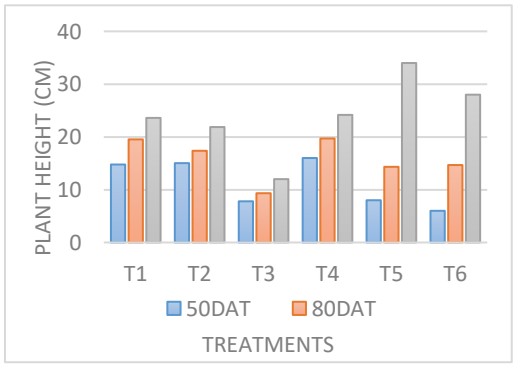

Figure 2. Combined effect of organic amendments and shade levels on plant height (cm) of diabetic plant**.**

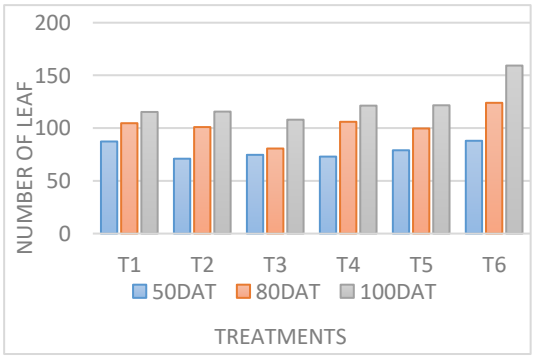

Figure 3. Combined effect of organic amendments and shade levels on number of leaves of diabetic plant.

DOI: https://doi.org/10.55706/jae1604

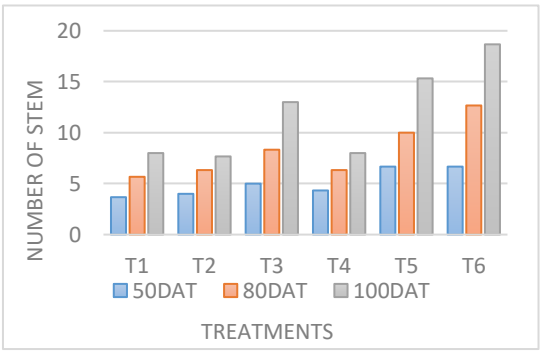

Figure 4. Interaction effect of organic amendments and shade levels on Number of stems of diabetic plant.

CONCLUSION

This study revealed that the combination of tricocompost and semi-shade condition had significant effect on plant growth characters of *Gynura procumbens*. Among different organic amendments, trichocompost performed better concerning height of plant, number of leaves and stems. Semi-shade condition produced maximum plant height, number of leaves and stems. The combined effect of trichocompost (O_3) under semi-shade level (S_2) condition appeared as a better practice for diabetic plant cultivation. Use of tricocompost in semi-shade condition could be suggested for diabetic plant production as the leaves and stem are used for controlling the diabetics/blood sugar level of the diabetic patients.

Acknowledgment

The first author extends his sincere thanks and appreciation and appreciation to the "Ministry of Science and Technology, Bangladesh (MoST)" and "Sylhet Agricultural University Research System (SAURES)" for providing research funds.

Conflicts of Interest

The authors declared there were no conflict of interests.

REFERENCES

Anjum, N., Hossain, M. J., Haque, M. R., Chowdhury, A., Rashid, M. A., and Kuddus, M. R. 2021. Phytochemical investigation of *Schleichera oleosa* (lour.) oken leaf. Bangladesh Pharmaceutical Journal, 24(1): 33-36.

Das, M., Hussain, M., Chakrabarty, P., Rahman, A., Talucder, M. S. A., Sharif, M. O., & Khan, A. U. 2022. Growth Performances of BRRI dhan55 under Integrated Nutrient Management. Journal of Agroforestry and Environment, 15(2): 69-74.

Dudai, N., Putievsky, E., Ravid, U., Palevitch, D., and Halevy, A. H. 1992. Monoterpene content in *Origanum syriacum* as affected by environmental conditions and flowering. Physiologia Plantarum, 84(3): 453-459.

Geromel, C., Ferreira, L. P., Davrieux, F., Guyot, B., Ribeyre, F., dos Santos Scholz, M. B. and Marraccini, P. 2008. Effects of shade on the development and sugar metabolism of coffee (*Coffea arabica* L.) fruits. Plant Physiology and Biochemistry, 46(5-6): 569-579.

Guyot, B., D. Gueule, J. C. Manez, J. J. Perriot, J. Giron, and L. Villain. 1996. Influence de l'altitude et de l'ombrage Sur La Qualité Des Cafés Arabica. Plant Rech. Dévelop 3:272–83.

Hossain, T. 2014. Plant Species Diversity of Roof Top Garden In Dhaka City (Doctoral dissertation, DEPT. OF AGROFORESTRY & ENVIRONMENTAL SCIENCE).

Smit, J., Nasr, J., and Ratta, A. 2001. "Urban Agriculture Food, Jobs and Sustainable Cities." Advances in Agricultural Animal Welfare: Science and Practice 241–57.

Mou, K. M., and Dash, P. R. 2016. A comprehensive review on Gynura procumbens leaves. International Journal Of Pharmacognosy, 3(4): 167-174.

Keshavarz, H., Modarres-Sanavy, S. A. M., and Mahdipour Afra, M. 2018. Organic and chemical fertilizer affected yield and essential oil of two mint species. J Essential Oil Bear Plant, 21 (6): 1674–1681.

Kim, M. J., Lee, H. J., Wiryowidagdo, S., and Kim, H. K. 2006. Antihypertensive effects of *Gynura procumbens* extract in spontaneously hypertensive rats. Journal of Medicinal Food, 9(4): 587-590.

Lynch, M. 1985. Discipline and the material form of images: An analysis of scientific visibility. Social studies of science, 15(1): 37-66.

Muschler, R. G. 2002. Shade Improves Coffee Quality in a Sub-Optimal Coffee-Zone of Costa Rica. Entomologia Experimentalis et Applicata 103(3): 239–48.

Rahman, A. F. M. Mustafizur, and Md. Sharif Al Asad. 2013. Exploiting Column Chemistry for Chromatographic Separation and Quantification of Caffeoylquinic Acids in *Gynura Procumbens*. Acta Chromatographica 33(2): 170–78.

Rahman, M. A., Alam, M. S., Ahmed, Q. N., Khan, M. A. I., & Mahbub, A. A. 2003. Genetic analysis on yield and its component traits of Tomato (*Lycopersicon esculentum* Mill.). The Agriculturists, 1(1): 21-26.

Rosidah, Y. M., Sadikun, A., and Asmawi, M. 2008. Antioxidant potential of *Gynura procumbens*. Pharmaceutical Biology, 46(9): 616-625.

Roy, S., Arunachalam, K., Dutta, B. K., and Arunachalam, A. 2010. Effect of organic amendments of soil on growth and productivity of three common crops viz. *Zea mays*, *Phaseolus vulgaris* and *Abelmoschus esculentus*. Applied Soil Ecology, 45(2), 78-84.

Ghosh, B. C., Mittra, B. N., Saha, R., and Palit, S. 2003, Performance of *Aloe vera* as influenced by organic and inorganic sources of fertilizer supplied through fertigation. In III WOCMAP Congress on Medicinal and Aromatic Plants-Volume 2: Conservation, Cultivation and Sustainable Use of Medicinal and 676: 171-175.

Tan, H. L., Chan, K. G., Pusparajah, P., Lee, L. H., and Goh, B. H. 2016. *Gynura procumbens*: An overview of the biological activities. Frontiers in pharmacology, 7, 52.

Vaast, P., Bertrand, B., Perriot, J. J., Guyot, B., and Genard, M. 2006. Fruit thinning and shade improve bean characteristics and beverage quality of coffee (*Coffea arabica* L.) under optimal conditions. Journal of the Science of Food and Agriculture, 86(2): 197-204.