



Article

Study on Effect of Different Organic Manures on Growth of Ornamental Aquatic Plant *Vallisneria spiralis*

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Abstract: Present study was undertaken to determine the effect of different organic manures viz. vermicompost, pig dung, raw buffalo dung and combinations of vermicompost & pig dung, pig dung & raw buffalo dung, vermicompost & raw buffalo dung on the growth of *Vallisneria spiralis* under laboratory conditions. The runners with initial length of 10 ± 0.30 cm was planted in containers (100 g capacity) containing soil and sand-mixture. The experimental containers were prepared by mixing 2% of different organic manures and soil layers which were used for planting runners of *Vallisneria* for 28 days in triplicates. Statistical analysis with one-way ANOVA showed significant difference ($P < 0.05$) among different manures used, while non-significant difference was found among the treatments for water parameters. The highest average percentage gain in length (65.48) and specific growth rate (68.39 ± 10.36) was observed in the treatment with 2 % buffalo dung (dry) as organic manures in mixture of sand and soil in the 1:1 ratio and same was found as best treatment when compared to other treatments.

Keywords: Organic manures, water parameters, soil nutrients and *Vallisneria spiralis*

1. Introduction

Aquatic plants are ecologically important in the aquatic ecosystem because they provide habitat for many benthic and pelagic organisms. Several types of aquatic plants are grown in aquaria for beautification and to maintain water quality. Aquatic plants provide food, shed, shelter and breeding places to fishes and absorb many harmful nutrients and pollutants from water, as a buffer strip. Aquatic plant can significantly impact the assimilation of pollutants such as nitrogen and phosphorus from water. In India, aquatic plant cultivation is in nascent stage and not progressed to the level of ornamental fish trade. To develop, the plant cultivation into small scale business, there is

a need to develop techniques of culturing ornamental aquatic plants. This in turn will help to fulfill the need of hobbyist and traders in India.

Among many aquatic plants, *Vallisneria spiralis* (Family: Hydrocharitaceae) is widely used for maintaining water quality. This is one of the beautiful, submerged aquatic plants with conspicuous darker bands on leaves. Often leaves are coiled and float horizontally beneath the water surface. The plant has runners to the base through which vegetative propagations takes place.

Through these experiments, an attempt was made in the present study to grow *V. spiralis* by using locally available organic manures individually and in combination under laboratory conditions.

2. Materials and Methods

Aquatic plant *Vallisneria spiralis* was procured from local aquarium plant supplier. All organic manures were collected from local sources. Plants were grown using seven different types of organic manures as detailed in the Table 1.

Table-1. Different ingredients used as treatments for experiment and their ratio.

Sr. no.	Treatments	Ingredients	Percent combination / ratio
1.	T ₁ (Control)	Soil & Sand	80+20 %
2.	T ₂	Vermicompost	100 %
3.	T ₃	Pig dung	100 %
4.	T ₄	Raw buffalo dung	100 %
5.	T ₅	Vermicompost & pig dung	50 + 50 %
6.	T ₆	Pig dung & raw buffalo dung	50 + 50 %
7.	T ₇	Vermicompost & buffalo dung	50 + 50 %

Seven treatments were: T1 -Soil + Sand (Control), 80+20 %; T2 -Vermicompost, 100%; T3 -Pig dung, 100%; T4 -Raw buffalo dung, 100%; T5 -Vermicompost and pig dung, 50+50%; T6 -Pig dung and buffalo dung, 50+50% and T7 -Vermicompost and buffalo dung, 50+50% were used as organic manures for the study of plant growth. The experimental containers were prepared by mixing 2 % of different manures in the mixture of 1:1 ratio of sand and soil layer. These containers were used for planting runners of *V. spiralis* for 28 days in triplicates. The planted containers were kept in plastic pools of 350 l capacity. Various physicochemical parameters of water (table 3) like temperature (0C), pH, dissolved oxygen (mg/l), and Hardness (mg/l); and soil parameters (table 2) like available nitrogen (%) available phosphorus (%) and organic carbon (%) were analyzed and recorded during the experimental period by following standard protocol [1-3].

Table-2. Soil parameters of aquatic plant, *Vallisneria spiralis* grown in different organic manures for 28 days

Soil parameters	Treatments						
	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇
Available nitrogen (%)	0.12 - 0.16	0.11 - 0.14	0.09 - 0.15	0.12 - 0.16	0.16 - 0.20	0.10 - 0.12	0.12 - 0.14
Available phosphorus (%)	3.2 - 3.8	3.5 - 4.3	4.6 - 5.2	4.8 - 7.6	4.2 - 6.1	6.2 - 7.6	5.2 - 6.3
Organic carbon (%)	0.41 - 0.58	1.8 - 2.62	0.62 - 1.72	1.1 - 2.2	1.64 - 1.94	0.64 - 0.98	0.64 - 0.95

Table 3. Water parameters observed during the experiment for 28 days.

Water parameters	Treatments						
	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇
Temperature (°C)	26.2 - 27.8	26.1 - 27.6	25.9 - 27.8	26.2 - 27.4	26.7 - 27.2	26.4 - 27.5	26.2 - 27.6
pH	7.2 - 7.5	7.4 - 7.6	7.4 - 7.5	7.6 - 7.6	7.4 - 7.5	7.2 - 7.3	7.3 - 7.4
Dissolved oxygen (mg/l)	4.0 - 6.0	4.2 - 5.4	4.0 - 6.0	4.8 - 6.8	4.4 - 6.6	4.2 - 5.6	4.8 - 6.4
Hardness (mg/l)	140 - 162	142 - 158	148 - 164	150 - 166	144 - 148	148 - 156	148 - 152

The growth parameters of plant viz. length, number of leafs, runners and specific growth rate (SGR) were observed on the initial day and at the end of the experiment. All the data collected were further subjected to statistical analysis using One-way ANOVA for the significant difference ($P < 0.05$) using SPSS 16.0, SPSS Inc. Richmond, CA, USA. Values were presented as means \pm standard error of mean. Data for the growth parameters were tested for homogeneity of variances, and followed by Duncan's multiple comparison to find out the differences between treatments.

3. Results and Discussion

The growth parameters of *V. spiralis* are given in Table 4 and Fig 1-2. Average percentage gain in length of leaves, SGR, number of leaves, number of runners are presented. ANOVA results showed that the 2 % organic manure (dry) added with sand + soil mixture showed better results as compared to other treatments. Lower production in other treatments may be due to less quantity of nutrients availability. It was observed that average percentage gain in length of leaves, SGR, number of leaves, number of runners was observed in the manures which contain high available nitrogen.

Table 4. Growth parameters of aquatic plant, *Vallisneria* grown in different organic manures for 28 days

Growth Parameters	Treatments						
	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇
Initial length (cm)	10 ± 0.30	10 ± 0.30	10 ± 0.30	10 ± 0.30	10 ± 0.30	10 ± 0.30	10 ± 0.30
Final length (cm)	11.43 ^c ± 0.53	13.71 ^c ± 2.43	18.41 ^{bc} ± 6.23	29.15 ^a ± 2.96	17.11 ^{bc} ± 1.34	23.21 ^{ab} ± 1.45	20.01 ^{bc} ± 2.17
Average percentage gain in length (%)	12.43	25.41	41.42 ^{bc}	65.48 ^a	41.37	56.37	46.28
SGR	5.10 ^c ± 1.32	13.25 ^{bc} \pm 9.93	30.03 ^{bc} \pm 23.18	68.39 ^a \pm 10.36	25.39 ^{bc} \pm 4.23	47.17 ^{ab} \pm 6.39	35.75 ^{abc} \pm 15.27
Number of leafs	17.15	61.26	64.61	73.27	47.31	59.31	53.98
Number of runners	6.18	14.03	17.82	15.97	9.11	12.54	14.29

Mean (\pm S.E.) in the same column having different superscripts (^{a,b,c}) are significantly ($P < 0.05$) different

In present study, the treatment T4 with buffalo dung manure recorded highest growth rate as compared to other treatments. Similar studies on different organic manures on the growth of aquatic plants including their leaves, runners, length have been documented by other workers [4-6]. Highest number of leaves and runners were observed with combine effect of essential elements as well as physicochemical parameters are in accordance with scientists [7-9].

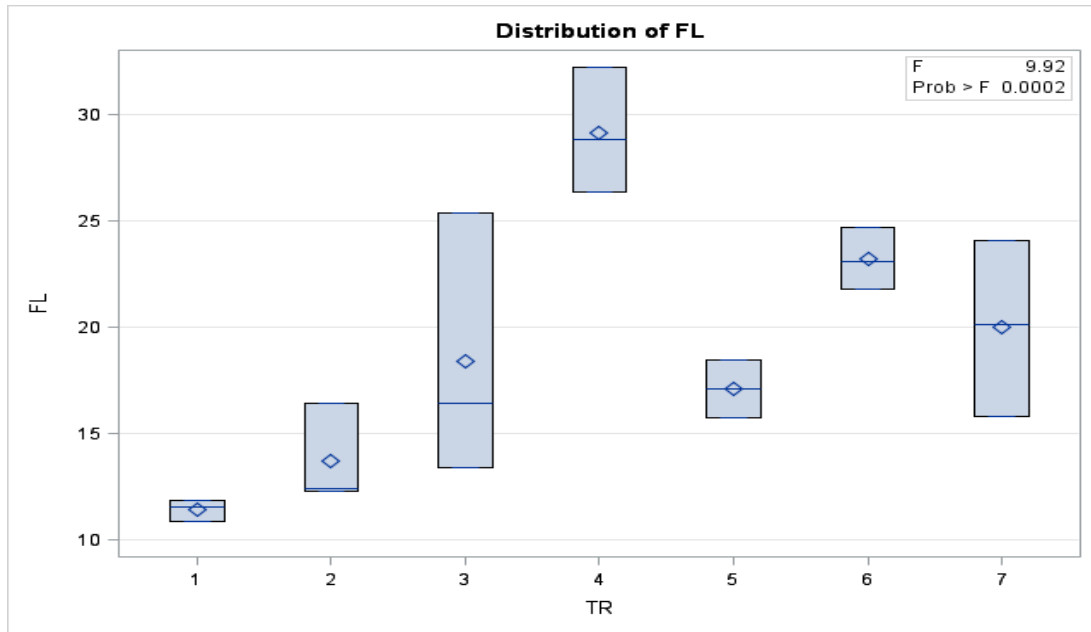


Fig. 1 Distribution of Final Length



Fig. 2 Distribution of SGR

Among physicochemical parameters in Table 2, hardness and pH were recorded higher in treatment T4 as compared to other treatments is in agreement with earlier different documents

[10-13]. During the investigation, dissolved oxygen recorded significantly highest with treatment T4 manure in comparison to other treatments, could be exert of photosynthetic resources accelerated the highest numbers leaves, better percentage of length, highest specific growth rate of plant and maximum numbers of runners is in agreement with earlier reports [14, 15].

In the current study, the free CO₂ was found absent throughout the experiment in all the treatments. This could be due to excessive use of CO₂ during photosynthesis which in turn liberates O₂ as end product along with carbohydrates [16]. Nutrients are being growth factor for plants [17] but is not in agreement with the present investigation are given in Table 2. This could not draw any substantial impression on the SGR of plant.

4. Conclusion

Present study demonstrated potential applications of organic manure employing 2 % of buffalo dung (dry) as organic manure in mixture of sand and soil in the ratio 1:1 as a growing media for culture and propagation of aquatic plants. In conclusion it is suggested that 2 % raw buffalo manure (dry) with soil and sand mixture in 1:1 ratio helps to increase plant biomass, total length and good quality leafs of aquatic ornamental plant, *Vallisneria spiralis*.

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Conflicts of interest: The authors declare no conflicts of interest.

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