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Md. Azhar Bintory
College of Horticulture, Bagalkot, Karnataka, India

Sumangala HP
ICAR-IIHR, Bangalore, Karnataka, India

Sateesh R Patil
College of Horticulture, Bagalkot, Karnataka, India

Balaji S Kulkarni
College of Horticulture, Bagalkot, Karnataka, India

Aswath C
ICAR-IIHR, Bangalore, Karnataka, India

Rupa TR
ICAR-IIHR, Bangalore, Karnataka, India

Selvakumar G
ICAR-IIHR, Bangalore, Karnataka, India

Laxman RH
ICAR-IIHR, Bangalore, Karnataka, India

Pavan Kumar P
College of Horticulture, Bagalkot, Karnataka, India

Corresponding Author:
Md. Azhar Bintory
College of Horticulture, Bagalkot, Karnataka, India

Effect of nutrients on the quality parameters of vertical landscape system ornamental plant species

Md. Azhar Bintory, Sumangala HP, Sateesh R Patil, Balaji S Kulkarni, Aswath C, Rupa TR, Selvakumar G, Laxman RH and Pavan Kumar P

Abstract
Current experimental study was carried out to understand the effect of interaction between different substrate and different ornamental plant species over plant qualitative growth parameters. The S_2 (*Sansevieria trifasciata* 'Hahnii') has shown lowest growth rate, plant coverage rate and overall plant quality whereas S_1 (*Chlorophytum comosum*) and S_3 (*Syngonium* 'White') were with highest plant coverage rate and overall plant quality and for growth rate S_1 (*Chlorophytum comosum*) and S_4 (*Peperomia obtusifolia* 'Variegata') were recorded maximum mean value. The substrate like F_2 (NPK-19:19:19 @ 0.1%), F_3 (NPK-19:19:19 @ 0.1% + foliar spray of % need based micronutrients), F5 (NPK-19:19:19 @ 0.2%) and F_6 (NPK-19:19:19 @ 0.2% + Foliar spray of % need based micronutrients) has shown best performance for growth rate, plant coverage rate and overall plant quality. The interaction effect showed a significant difference in the growth rate, plant coverage rate and overall plant quality. The F_4 (Water with no nutrients (Control)) interaction with ornamental species has shown lowest qualitative growth response. The obtained data can be utilized for further studies for betterment of vertical gardening.

Keywords: Growth rate, plant coverage rate, overall plant quality, Arka fermented Cocopeat (AFC), Lightweight Expandable Clay Aggregates (LECA), façade and vertical garden

Introduction

Bringing nature into urban environments will be one of the most challenging concerns of the twenty-first century, and the vertical garden may be the most useful and beautiful solution. As said by Yeang (1997). "The problem of more effectively linking and integrating plants to structures led to the development of facade planting. The idea is that vegetation is a vital indigenous feature of a location and, in addition to being crucial for the ecosystem, should be a key element of regionalist architecture. Additionally, it may be claimed that the urban environment needs to incorporate a lot more greenery than it does at the moment.

One of the important tasks is to choose flora that can flourish in the local climate, has an appropriate growth habit, has aesthetic appeal and the capacity to endure pruning is readily available and is long-lasting. Exotic plant species are often a primary cause of vertical garden failure, demanding plant replacement regularly. Green wall plants should ideally have a slow growth rate, a spreading nature and some unique features of attraction such as smooth, shiny leaves or feathery foliage or leaves of fancy shapes or hirsute and furry leaves or brightly coloured flowers or fronds with tiny leaves arranged in a beautiful pattern and should be visually catchy and soothing overall. The use of plants that are complementary to one another is also important. This is when a person's inventiveness comes into play. It's almost like an artist painting on a large canvas.

Furthermore, to make vertical gardens indestructible, nutrient delivery or fertigation must be precise. The primary variables of the vegetation's performance and survival are the concentration of the nutrient solution and the frequency with which it is irrigated. The fertilisers are usually added to the irrigation water and delivered at regular intervals. Foliar sprays may be used to supplement micronutrients. The appropriate concentration is crucial, as too much can cause the burning of the plants, while too little will result in a plant that is unattractive, drab and unattractive to the eye. Similarly, depending on changing weather conditions, the frequency of watering must be assessed and checked regularly to ensure that the plants have a healthy and radiant look. As a result, a classic vertical garden should be planned after considering all of the aforementioned criteria. No exact criteria relevant to any given area have yet been established in our nation.

The researchable challenges in installing vertical gardens must be solved as soon as possible, given the urgent need for a solution to mitigate the consequences of urbanisation.

Literature is not vast in relation to the mineral nutrition of ornamental plants, since floriculture is a relatively recent activity when compared to other commercial cultures. In many instances, producers rely on pre-established standards, and achieve excessive or insufficient fertilization, producing flowers with inferior quality and with an elevated cost.

Moreover, often the use of nutrients based on an empirical approach and at unsuitable times, prevents the plants from exhibiting their full production potential (Almeida *et al*., 2012) [1]. It is important to highlight that an adequate balance of nutrients, besides being related to high quality flower production, is also intimately linked to the resistance of the plants against pests and disease (Malavolta, 2006; Zambolim *et al*., 2012) [3, 7].

For most crops, nitrogen is the nutrient that is absorbed in greater quantity and accumulates in larger amounts in the dry mass of the plants. It is the main constituent of the earth's atmosphere; however plants absorb it and assimilate it mainly in the form of $NO3^-$, $NH4^+$, present in the soil solution (Martins *et al*., 2003) [5].

For most ornamental plants, potassium is the nutrient required in higher quantity. Potassium is directly related to the maintenance of the osmotic balance in plant cells, the process of the regulation of gas exchange and transpiration, enzyme activation, protein synthesis, photosynthesis, and stress resistance (Benites *et al*, 2010;. Marschner, 2012) [2, 4].

This paper aims to contribute to the knowledge of aspects of nutrition and its relation to the quality of ornamental plants.

Materials and Methods

Location

The experiments were conducted at ICAR-Indian Institute of Horticultural Research, Bengaluru. Which is in Hesaraghatta located 25 km away from Bangalore in Karnataka. The institute is spread over a land area of 263 hectares. Which is geographically situated at a Latitude of 13.135˚ N, Longitude of 77.493˚ E Altitude: of 890 meters above mean sea level.

Plant Nursery: An existing shade net facility was utilized to serve as the nursery for the plants. The young plants procured and produced by the division were left in the nursery to get acclimatised and uniform-sized plants were chosen for the study.

Substrate or Growing Media

A combination of Arka Fermented Cocopeat and LECA (Lightweight Expanded Clay Aggregate) in a ratio of 3:1 has been selected which has the most of the desired properties of vertical garden media such as

1. Weightless media
2. High Water holding capacity
3. High Nutrient holding capacity
4. Good Porosity
5. Neutral pH

The soil is not used since it increases the weight of the green walls.

Plant coverage

The spread of the plant was assessed by Visual Scoring methods and grades from 1-4 were given to the plants depending upon the percentage of plant coverage of the modules.

Grade Plant coverage (%)

1. 0-25
2. 26-50
3. 51-75
4. 76-100

Growth rate

The growth rate of the plants was observed and classified based on their speed of growth on a rating scale from 1 - 4.

Scale Growth

1. Very slow
2. Slow
3. Moderate
4. Vigorous

Overall plant quality

The plant species were rated according to their growth, coverage, survival rate, aesthetic and visual appearance *viz*., colour, pigmentation, texture, shapes and variations of leaves and size of foliage during their growth period. Quality was evaluated from 1 to 9 for each character mentioned and the mean was expressed in grades (Zollinger *et al.*, 2006) [8].

Scale	Quality
1-3	Poor
3-5	Regular
5-7	Good
7-9	Excellent

Irrigation

The vertical garden was irrigated by the drip irrigation method. A main line from the tank was laid vertically at one end of the framework from which narrow horizontal lines were run in such a way that the drip emitters were placed over each module. The emitters were connected with arrow drippers, which were directly inserted into the modules containing the growing medium. The discharge rate of the drippers was two litres per hour. Irrigation was done once in three-four days as per the conditions.

Nutrient application

The plants were fertigated with water-soluble N:P:K fertiliser (19:19:19) which was mixed with the irrigation water and irrigated once a month. A foliar spray of micronutrient formulation containing Zinc (3.6%), Iron (2.5%), Manganese (1.5%), Copper (1.3%), Boron (1%) and Molybdenum (0.1%) was given once in every 50 days at a concentration of 1g per litre.

Result and Discussion

The present investigation was undertaken with a view to assessing the effect of different nutrients on quality parameters in a vertical landscape system.

Growth rate

The plant species S_2 (*Sansevieria trifasciata 'Hahnii'*) recorded the lowest mean growth rate of 2.67 and the species S_3 (*Chlorophytum comosum*) and S_4 (*Peperomia obtusifolia'Variegata*) both were found to have the maximum mean growth rate of 3.67 (Table 1). There was a significant

difference in the growth rate of the species for the different nutrient treatments and the species in the treatments F_2, F_3, F_5 and F_6 showed the best growth rate with a mean value of 3.75, 3.75, 3.50 and 3.50 while the species in F_4 (Control) and F_1 were found to have the slowest growth rate with a mean value of 2.50 each (Table 1).

The interaction effect showed a significant difference in the growth rate and the treatments F_4S_1 (Water with no nutrients (Control) + *Syngonium 'White'*), F_4S_2 (Water with no nutrients (Control) + *Sansevieria trifasciata 'Hahnii'*), F_1S_1 (Basacote® Plus 6M + *Syngonium 'White'*) and F_1P_2 (Basacote® Plus 6M + *Sansevieria trifasciata 'Hahnii'*) recorded the slowest growth rate with a mean value of 2 (Figure 1).

The growth rate of the plants needs to be ideal as mentioned in the first experiment so that the modules are covered but at the same time the growth does not become unmanageable or necessitate frequent pruning, in the case of vertical landscape gardening. The growth rate of *Chlorophytum comosum* and *Peperomia obtusifolia'Variegata'* was faster than *Syngonium 'White'* and *Sansevieria trifasciata 'Hahnii'* but all four species had ideal growth rates suitable for green walls. Among the nutrient treatments, the plants in 0.1 per cent and 0.2 per cent NPK fertilizer both with and without chelated micronutrients had the best growth rate, again validating the finding implied by all other parameters studied. The plant coverage was graded as it is a factor of prime importance in green walls as they have a great impact on the aesthetic appearance of the wall. In our study, all four plant species had excellent plant coverage potential confirming our earlier findings on their performance studies. The plants in nutrient treatments with 0.1 per cent and 0.2 per cent solution of NPK (19-19-19) with and without micronutrient spray showed better coverage than the Basacote® Plus 6M and the control has the lowest coverage rate.

Plant coverage

There was a significant difference in the plant coverage grades of the different plant species and the species S_2 (*Sansevieria trifasciata 'Hahnii'*) recorded the lowest mean plant coverage grade of 3.00 and the species P_3 (*Chlorophytum*) and S_1 (*Syngonium 'White'*) were found to have the highest plant coverage with a mean value of 3.67. The different treatments showed a significant difference in their plant coverage grades and the treatments F_2, F_3, F_5 and F_6 recorded the maximum plant coverage, all with a mean scale value of 3.75. The treatments F_4 (Water with no nutrients (Control)) recorded the lowest mean plant coverage grade of 3.00 (Table 1).

The interaction effect showed a significant difference in their plant coverage grade and the treatments F_4S_4 (Water with no nutrients (Control) + *Peperomia obtusifolia 'Variegata*) recorded the lowest plant coverage with a mean value of 2 and all the other plant treatments recorded the maximum plant coverage with a mean value of 3 and 4 (Figure 1).

Overall plant quality

The overall plant quality of the different species in the different nutrient treatments was recorded based on grades given for parameters such as their growth and fullness, texture, shape and pattern, colour and pigmentation and aesthetic appearance and their mean values were found and presented.

The different plant species under study showed a highly significant difference in their overall plant quality and the plant S_1 (*Syngonium 'White'*) recorded the maximum overall plant quality grade with a mean value of 8.51 and the plant S_2 (*Sansevieria trifasciata 'Hahnii'*) was found to have the lowest plant quality with a mean grade of 7.58. There was a significant difference in the overall plant quality between the different treatments and the treatments F_3 (NPK-19:19:19 @ 0.1% + Foliar spray of 0.1% need-based micronutrients) recorded the maximum overall plant quality grade with a mean of 8.60 and the treatment F_4 (Water with no nutrients (Control)) was found to have the lowest mean overall plant quality of 7.36 (Table 1).

The interaction effect showed a very highly significant difference in the mean values for overall plant quality and the treatment F_1S_4 (Basacote® Plus 6M + *Peperomia obtusifolia 'Variegata*) was found to have the lowest mean overall plant quality of 6.92 and the treatments F_3S_1 (NPK-19:19:19 @ 0.1% + Foliar spray of 0.1% need-based micronutrients + *Syngonium 'White'*) recorded the highest overall plant quality with a mean value of 9.08 (Figure 1).

The overall plant quality is the deciding factor on the performance of plants in the study of vertical gardens and this was rated taking into account the growth and fullness of plants, texture, shape, pattern, colour, sheen and pigmentation of leaves and the overall visual appeal. *Syngonium 'White'* was found to have the best overall plant quality with its feathery leaves, beautiful green and white colour and full coverage, so beautifully covering the modules and captivating by drawing attention. *Chlorophytum comosum* had a high plant quality rating with its long grassy green-and-white-striped leaves. *Peperomia obtusifolia 'Variegata'* came next with its bushy, upright plant with thick stems and fleshy, glossy, cupped leaves providing a contrast that was appealing too.

Among the nutrient treatments, the plants with 0.1 percent and 0.2 percent concentration of NPK had the highest overall pant quality and control had the lowest. This rating was in accordance, summing up the results of all the parameters studied and their impact on plant growth and performance. The visual quality of plants and productivity is particularly important for ornamental species (Veatch-Blohm *et al*., 2012) [6].

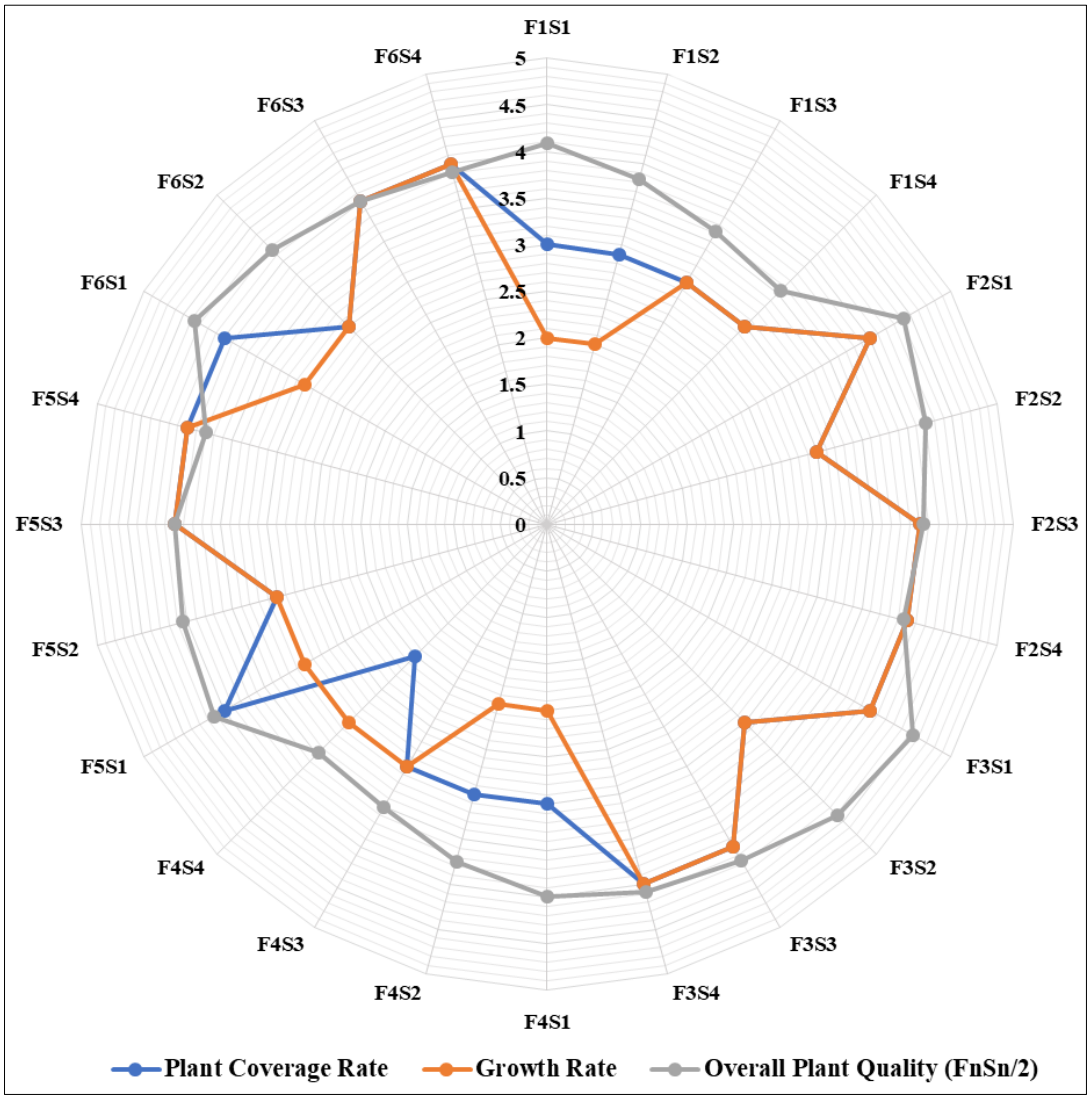

Fig 1: Interaction between nutrient treatments and ornamental plant species over different qualitative growth parameters

Table 1: Effect of nutrients on ornamental plant species qualitative growth parameters

Factors	Plant coverage rate	Growth rate	Overall plant quality
Differential nutrient concentrations			
F_1	3.00	2.50	7.54
F_2	3.75	3.75	8.31
F_3	3.75	3.75	8.60
F_4	2.75	2.50	7.36
F_5	3.75	3.50	7.98
F_6	3.75	3.50	8.23
Differential Ornamental plant species			
S_1	3.67	3.00	8.51
S_2	3.00	2.67	7.58
S_3	3.67	3.67	8.14
S_4	3.50	3.67	7.78

Where,
F1- Basacote® Plus 6M
F2- NPK-19:19:19 @ 0.1%
F3- NPK-19:19:19 @ 0.1% + Foliar spray of 0.1% need based micronutrients
F4- Water with no nutrients (Control)
F5- NPK- 19:19:19 @ 0.2%
F6- NPK-19:19:19 @ 0.2% + Foliar spray of 0.1% need based micronutrients
S1 - *Syngonium 'White'*
S2 - *Sansevieria trifasciata* 'Hahnii'
S3 - *Chlorophytum comosum*
S4 - *Peperomia obtusifolia'Variegata*

References

1. Almeida EAF, Duarte PDO, Frazao JEM, Santos FHS, Resende FA, Campos ML. Produçao de copo-de-leite em resposta à adubação com NPK e esterco bovino. Revista Brasileira de Horticultura Ornamental. 2012;2:129-134.
2. Benites VM, Carvalho MCS, Resende AV, Polidoro JC, Bernardi ACC, Oliveira FA, *et al.* (Ed). Boas Praticas para Uso Eficiente de Fertilizantes. International Plant Nutrition Institute. 2010;2:137-191.
3. Malavolta E. Manual de nutrição mineral de plantas. Sao Paulo: Editora Agronomica Ceres; c2006. p. 638.
4. Marschner H. Mineral nutrition of higher plants. 3ed. London: Academic Press; c2012. p. 651.
5. Martins CR, Pereira PAP, Lopes WA, Andrade JB. Ciclos globais de carbono, nitrogenio e enxofre: a importancia na quimica da atmosfera. Química Nova. 2003;5:28-41.
6. Veatch-Blohm ME, Malinowski M, Keefer D. Leaf water status, osmotic adjustment and carbon assimilation in colored calla lilies in response to saline irrigation. Sci. Hort. 2012;144:65-73.
7. Zambolim L, Ventura JA, Zanao JLA. Efeito da nutrição mineral no controle de doenças de plantas. Viçosa: UFV; c2012. p. 321.
8. Zollinger N, Kjelgren R, Cerny-Koenig T, Kopp K, Koenig R. Drought responses of six ornamental herbaceous perennials. Sci. Hort. 2006;109:267-274.