

THE EFFECTS OF WATERING RATES USING THE DRIP IRRIGATION METHOD ON THE ROOT MASS GROWTH OF BIRD'S NEST FERNS

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ABSTRACT: The increasing demands of gardeners have made peat moss a popular option as a planting material. However, the price of peat moss has increased recently. Therefore, alternative substances for use as a planting material need to be studied. The root of the bird's nest fern offers a cheaper, easier to produce and more readily available source for a planting material than peat moss. The objective of this research was to increase root mass growth by using drip irrigation. With an experimental design using CRD, two-year old bird's nest ferns with root mass sizes of 5 inches were watered by means of a drip irrigation method at rates of 200, 400, 600, 800 and 1,000 ml every 3 days. The data measured were root mass height, root mass diameter, leaf length, leaf width and canopy width. The data were analyzed by ANOVA and the differences between the means of treatment were compared by DMRT. The research found that the ferns which received water at a rate of 800 ml produced a root mass height of 11.06 cm and a root mass diameter of 11.93 cm. They were significantly different ($p < 0.05$). The ferns which received water at a rate of 200 ml produced a leaf length of 29.52 cm and a leaf width of 9.55 cm. The amount of water causes fern growth to significantly different ($p < 0.01$). The 800 ml rate of drip irrigation also produced the largest canopy width of 48.12 cm. #

Keywords: Drip irrigation, *Asplenium nidus*, Root mass bird-nest fern, Peat moss

1. INTRODUCTION

The bird's nest fern (*Asplenium nidus*) is an epiphyte fern. It is native to the tropical rain forests in South East Asia and Africa [1]. The fronds (leaves) are slender, like a sword, and grow from the top center of the rhizome in the root mass. The fronds can have many shapes: wide-short, narrow-long or some frond tips are forked. In the rainy season, some fronds can grow to lengths of 150 cm and widths of 20 cm. Fronds are shiny green, smooth, thin leaves with curly, black midribs. Dark brown indusium covered sorus, which develop from sporangium (spore producers), have many parallel lines arranged obliquely toward the center of the back of the fronds [2].

This fern provides an important role for the natural nutrient cycle in tropical rain forest canopies [3], [4], [5]. Moreover, it offers a cool and moist microhabitat for the canopy [6].

The bird's nest fern offers many advantages. It can be used for ornamental plants, potted plants, hanging plants, and even mounted plants on tree branches in gardens. It also possesses medicinal benefits. Its antibacterial qualities justify its usage in traditional medicines [7], [8]. Furthermore, it can be used as food [9].

In its natural state, the root mass of this fern protects the rhizomes which grow in the middle of it. These can attach to large tree branches or other things with root masses.

The roots of the bird's nest fern develop cellulose in cell wall appositions with yellow-brown pigments. There are different shapes and sizes which occur in the epidermal and the cortex of old roots [10]. When considering the benefits of natural materials such as these ferns, it is especially interesting to explore their use in making planting material.

Currently, the most popular plant growing material in horticulture is peat moss. In world production, about 50 percent of peat moss is used for agriculture purposes and the rest is used for energy [11]. In the growing media of almost all commercial greenhouses, peat moss is used because of its nutrient content and low pH [12]. Furthermore, it doesn't damage young plant roots, leaves plenty of air space for oxygen flow and allows for greater absorption of water for plant growth. This is why peat moss is popular for use as a planting material; it offers a high-quality horticultural growing media [13], [14], [15], [16]. Also, peat moss is suitable for fern spore germination in the early development stage of gametophytes and transitioning into the young sporophyte phase [17]. Gardeners can buy peat moss from garden centers or specialty shops but the price has increased rapidly [18]. Peat land is a source of atmospheric methane (CH₄) and a source of carbon (C) in the form of dissolved organic carbon (DOC) [19], [20]. Greater use of peat moss has been shown to damage the environment [21],

[22]. Peat moss extraction is a significant source of greenhouse gases as well as a user of large amounts of land for its growth [23], [24].

Research objectives need to focus on the possibility of using bird's nest fern roots instead of peat moss. This fern can be easily grown in the general climate [25]. But the roots of this fern can sometimes not be of sufficient size. Increasing root size by watering using the drip irrigation method has been shown to be successful in previous experiments with vegetables [26], [27]. Therefore, applying this methodology to the bird's nest fern roots should produce results that enhance their size.

2. METHOD

2.1 Material Preparation

2.1.1 Preparation of plants

A total of 80 plants were used in this study. All plants were two-year old bird's nest ferns. They were all planted in 6-inch pots.

2.1.2 Preparation of drip irrigation system

The system is made up of a drip head, capillary tube, joints and a water tank. All of these parts are connected to create the system, along with a cylinder and a measurement tool.

2.2 Experimental

With an experimental design using CRD, two-year old bird's nest ferns with root mass sizes of 5 inches were watered by means of a drip irrigation method at rates of 200, 400, 600, 800 and 1,000 ml every 3 days. The data measured were root mass height, root mass diameter, leaf length, leaf width and canopy width. The data were analyzed by ANOVA and the differences between the means of treatment were compared by DMRT.

3. RESULT

The growth of the root mass of bird's nest ferns as a result of using a drip irrigation method was studied over 12 weeks. The ferns which received water at a rate of 800 ml developed the best root mass height of 11.06 cm and the biggest root mass diameter of 11.93 cm. (Table 2, Fig.4,6,7) They were significantly different ($p < 0.05$). The ferns which received water at a rate of 200 ml produced the longest leaf length of 29.52 cm and the widest leaf width of 9.55 cm. (Table 2, Fig.1,8) The amount of water causes fern growth to significantly different ($p < 0.01$). The ferns which received water at a rate of 800 ml produced the largest canopy width of 48.12 cm. (Table 2, Fig.4,9)

3.1 Tables

Table 1 The growth of bird's nest ferns by drip irrigation every three days over 12 weeks

Water rate(ml)	Growth of bird's nest fern ($\bar{x}$ /cm)	
	RMH	RMD
200	10.93ab	11.68b
400	10.70ab	11.68b
600	10.56b	11.86ab
800	11.06a	11.93a
1,000	10.98ab	11.73ab
CV%	2.78	1.14
F test	*	*

RMH = Root Mass Height, RMD = Root Mass Diameter

* = significantly different ($p < 0.05$)

Table 2 The growth of bird's nest ferns by drip irrigation every three days over 12 weeks

Water rate(ml)	Growth of bird's nest fern ($\bar{x}$ /cm)		
	LL	LW	CW
200	29.52a	9.55a	47.19
400	25.03ac	8.32c	44.81
600	24.72c	8.12c	45.19
800	27.11b	9.21ab	48.12
1,000	25.15c	8.86b	46.56
CV%	4.68	3.95	6.55
F test	**	**	ns

LL = Leaf Length, LW = Leaf Width, CW = Canopy Width.

ns = non-significant, ** = significantly different ($p < 0.01$)

3.2 Figures



Fig. 1 watering rate at 200 ml



Fig. 2 watering rate at 400 ml



Fig. 3 watering rate at 600 ml



Fig. 4 watering rate at 800 ml



Fig. 5 watering rate at 1,000 ml

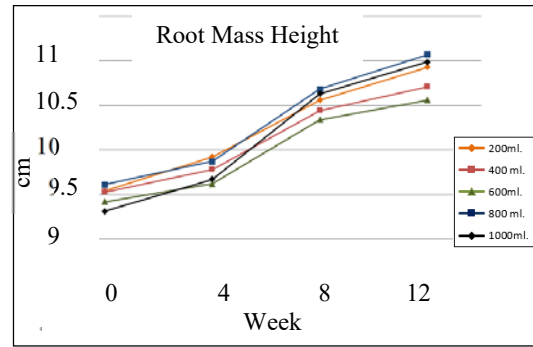


Fig. 6 Root Mass Height

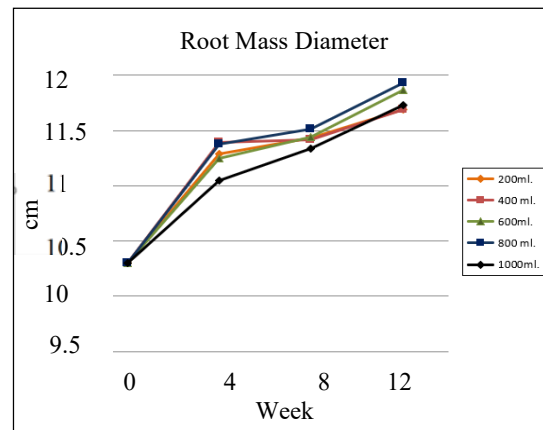


Fig. 7 Root Mass Diameter

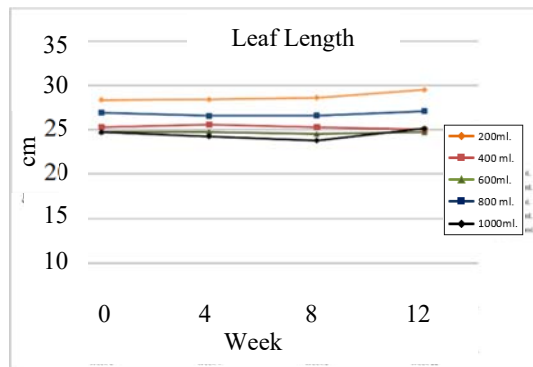


Fig. 8 Leaf Length

4. CONCLUSION

In this study, the priority was to analyze the growth of the root mass of bird's nest ferns under different rates of watering by the drip irrigation method. The study revealed that the largest root mass height and diameter came from the watering rate of 800 ml every 3 days. Some epiphyte ferns like dry and wet water such as stag horn ferns [17].

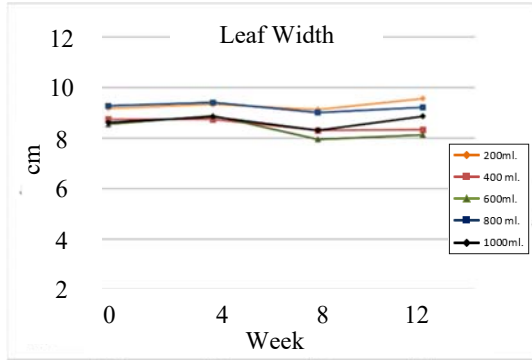


Fig. 9 Leaf Width

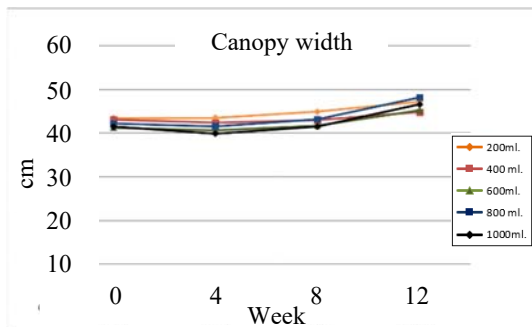


Fig. 10 Canopy Width



Fig. 11 Roots mass of bird's nest fern

In addition, when the root mass of the bird's nest fern becomes dry, it can absorb a lot of water during the rainy season [28]. The root mass of this fern can be used as a fern planting material [29]. Testing the use of roots mass of bird's nest fern as plant material in the epiphyte plant can grow (Fig.12, 13). And when fern roots are grinded able to cultivate fern spores (Fig. 14)



Fig. 12 Watermelon Dischidia (*Dischidia ovata* Benth.) grow on roots mass of bird's nest fern



Fig. 13 Oak-leaf fern (*Drynaria quercifolia* (L.) J. Sm.)

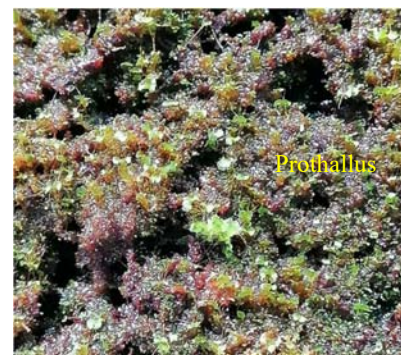


Fig. 14 Using roots mass of bird's nest fern, spore's fern cultivation instead peat moss

However, drip irrigation is not the best method for increasing the bird's nest fern root mass because the root epiphyte cannot absorb enough water. New studies of other methods of irrigation, including fog or mist watering, should be conducted to look for a better alternative.

4. ACKNOWLEDGMENTS

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