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Influence of water availability and potting media on the performance of Kalmegh (*Andrographis paniculata* Nees.)

Aniat Ul Haq[1*], Rashmi Vamil[2], Bilal Ahmad[1], Poonam Mehrotra[1]

[1]*Department of Botany, Bundelkhand University, Jhansi, India*

[2]*Department of Botany, SLS Khandari, DBRAU, Agra, India*

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Abstract

Andrographis paniculata Nees contains a bitter compound called andrographolide is commonly used for medicinal purposes. The herb has been revered for treating infectious diseases and highly regarded also as having a preventive effect from many diseases, due to its powerful immune strengthening benefits. Scientists today, however, are focusing on the herb's application in treating the 'killer' diseases that blight modern life, such as heart disease and cancer. Therefore to investigate whether sand amendments to soil could improve both soil properties and *A. paniculata* performance. We report the results of a research carried out in India to determine the effectiveness of different levels of sand amendments to soil and water patterns using *A. paniculata*. The present study was conducted with the objectives to determine optimum water requirements and impact of potting media on the growth behavior *A. paniculata*. Four different growing media including 1:0 soil + sand, 1:1 soil + sand , 1:3 soil + sand and 0:1 soil + sand were used to observe the growth medium that is most suitable for the growth of *A. paniculata*. The overall best performance was recorded in medium 1:1 soil + sand that were watered daily followed by soil alone and 1:3 soil + sand amendment. The least performance was observed in sand alone with alternate water pattern. But during the first thirty days, root length was observed highest in plants grown in sand alone.

***Corresponding Author:** Aniat Ul Haq ✉ enayathaq@gmail.com

Introduction

Andrographis paniculata Nees is an herbaceous plant, commonly known '' king of bitters," in the family Acanthaceae. It is widely cultivated in southern Asia. *Andrographis paniculata* contains a bitter compound called andrographloid; (alkaloid of pharmaceutical importance) is commonly used for medicinal purposes. *Andrographis paniculata* is a traditional Chinese, Southeast Asian and Indian herb , used for centuries in Ayurvedic medicine .The herb has been revered for treating infectious diseases and highly regarded as having a preventative effect from many diseases , due to its powerful immune strengthening benefits. The demand of *Andrographis paniculata* is increasing day by day due to its importance in the treatment of different ailments (Chauhan *et al*., 2009)

The herb is official in India Pharmacopoeia (Balachandran and Govindarajan, 2005) as a predominant constituent of at least 26 Ayurvedic formulations used to treat liver ailments. It is one of the herb, which can be used to treat neoplasm as mentioned in ancient Ayurvedic literature (Patarapanich *et al*., 2007). *Andrographis paniculata* is reported as a cold property herb in traditional Chinese medicine and is used to get rid of body heat and to expel toxins. The plant is particularly known for its bitter properties and is used traditionally as a remedy against common cold, dysentery, fever, tonsillitis, diarrhea, lever diseases, inflammation, herpes and so on (Mishra *et al*., 2007). Scientists today, however, are focusing on the herb's application in treating the 'killer' diseases that blight modern life, such as heart disease, cancer and even AIDS. Generally plant growth and their performance depend on the quality of soil, water and prevailing environmental conditions. Among these, perhaps the most important is the type of growing media and water pattern used. Due to the relatively shallow depth and limited volume of a container, growing media must be amended to provide the appropriate physical and chemical properties necessary for plant growth (Sahin *et al*., 2005). The most important physical properties of growing media for suitability are good aeration and drainage, and optimum water retention capacity (Cabrera, 2003). To improve the physical properties of soil and promote plant growth, soil conditioners can be used (Li *et al*., 2000). Soil amends have been suggested for use in soil to increase water and aeration. The relative balance of air and water within the soil's pore space is critical to plant growth (Bruckner U, 1997). Porosity can be functionally divided into three parts – total porosity, aeration porosity (macropores) and water holding porosity (micropores) (Landis *et al.,* 1990). The macropores (>100 µm diameter) supply drainage and aeration, the mesopores (100-30 µm diameter) supply water conductivity, and the micropores (30-3 µm diameter) supply water retention (Gemalmaz 1993). The water retention in ultramicropores (<3 µm diameter) is unavailable for plant use (Drzal *et al.,* 1999).The aim of the present investigation was to determine whether sand amendments to soil could improve both clay soil properties and *Andrographis* plant growth.

Material and methods

The experiment was carried out in the green house conditions at the Forest Research Institute Jhansi India. Seeds were germinated by placing them on different substrata in different containers. In each trial, 100 seeds per container and three replicates were made for each substrata. Sulphuric acid treated and non-treated seeds were used, seeds were considered germinated when the radical emerged by 5mm in length (Cavusoglu and Kabar 2007). After 15 days of growth various combinations of standard growing medium like soil, sand and soil-sand amendments were used to determine the growing medium that is best suitable for the vegetative growth of *Andrographis paniculata*. Randomized block design was utilized in all trials using four treatments and each treatment was replicated 12 times, both in daily as well as in alternate water patterning. Each plant replicate was planted in root trainers. Sand alone and soil alone were used as potting media in two different treatments and another two treatments were prepared by mixing soil

and sand in 1:1 and 1:3 soil:sand ratio's. After planting, the root trainers were labeled and irrigated accordingly. Data on vegetative growth of each treatment were collected to ascertain the media that is ideal for vegetative growth of the plant. The soil was collected from the forest areas of Jhansi. Sand was also collected from the near by rivers. The soil was crushed and the large particles were removed by passing the crushed soil through the sieve having the pore size 2mm. the sand was also sieved in order to remove the gravel particles. During the study data were collected after every fifteen days on the following parameters, root length, stem length, root weight, stem weight and leaf weight in both daily as well as in alternate water experiments.

Results and discussion

The survival of the plant usually depends upon the favorable environmental factors, growing media is one of the most important factors required for the survival and production *Andrographis paniculata*. Because, it not only supports the plant but also provides moisture and mineral nutrients to it. From the fig. 1 - 5 it can be inferred that potting soil + sand amendment in the ratio 1:1 gave maximum vegetative growth both in daily and alternate water patterning followed by soil alone. The minimum development of vegetative growth was observed in sand alone in both water patterns. The results here in reported seems also to indicate that the substrate may have a significant influence on the vegetative growth of *Andrographis paniculata*.

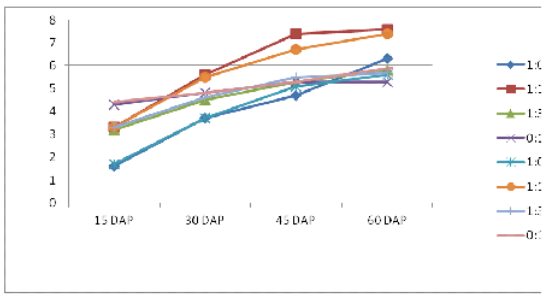

Fig 1. Influence of growth media and water patterns on the root length of *A. paniculata*.
D = Daily watering; ALT = Alternate watering
DAP = Days after planting

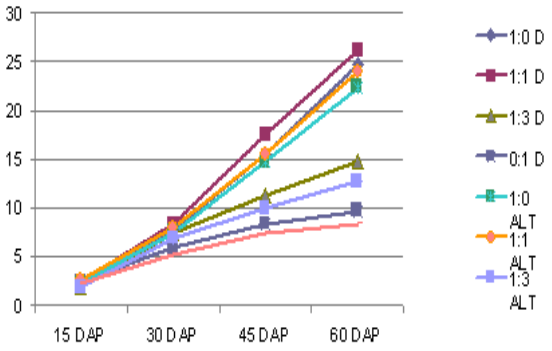

Fig. 2. Influence of growth media and water patterns on the Shoot length of *A. paniculata*
D = Daily watering; ALT = Alternate watering
DAP = Days after planting

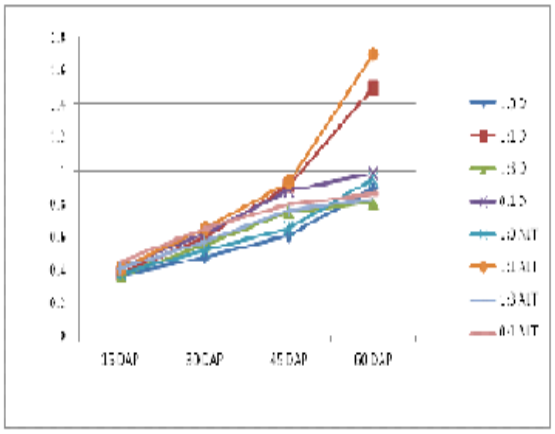

Fig. 3. Influence of growth media and water patterns on the root weight of *A. paniculata*.
D = Daily watering; ALT = Alternate watering
DAP = Days after planting

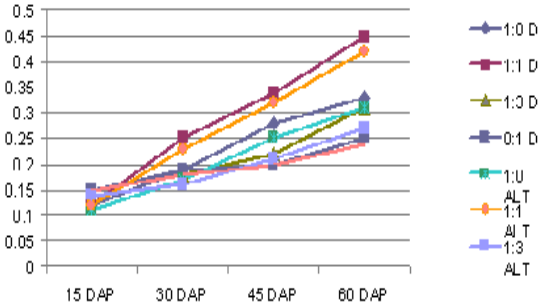

Fig. 4. Influence of growth media and water patterns on the stem weight of *A. paniculata*.
D = Daily watering; ALT = Alternate watering
DAP = Days after planting

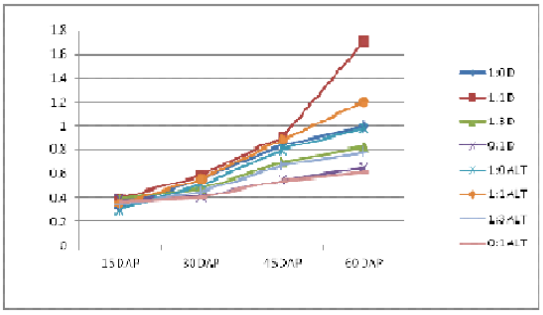

Fig. 5. Influence of growth media and water patterns on the leaf weight of *A. paniculata*.
D = Daily watering; ALT = Alternate watering
DAP = Days after planting

The substratum 1:1 soil-sand amendment revealed maximum root length in both daily as well as in the alternate water patterns (after 60 days of establishment, but during the earlier periods the growth was maximum in sand alone) followed by soil alone and 1:3 soil- sand amendments. Minimum length was observed in the plants grown in sand alone. When the water patterns where compared best results were shown by the plants that were watered alternately. Similar results was observed by Sahin *et al., 2005,* on strawberry. Stem length was observed maximum in the plants grown in the medium 1:1 followed by 1:0 and 1:3. Minimum stem length was observed in plants grown in sand alone in both the water patterns. The Similar results were observed by Messenger *et al.,* 2000, on avocado. By observing the effects of growth media and fertilizer application on biomass allocation and survival of Uapaca kirkiana Muell Arg seedlings Silesh *et al.*, 2007, find similar results. The highest root weight was observed in the plants grown in the medium 1:1 followed sand and soil. Plants grown in the 1:3 soil-sand amendments showed least root weight. When the water patterns were compared, maximum root weight was observed in alternate watering paterns. Same results were observed by Farzad *et a,. 2008 Tagetes erecta* L. and Abdul *et al.*, 2011 *on Vinca rosea*. Silesh *et al.*, 2007, also supports our findings. Significantly more stem weight per plant were produced by the plants grown in the medium 1:1 soil + sand amendment followed by 1:0 and 1:3. Least stem weight per plant was observed in the plants grown in the sand alone. For the stem weight daily watering were proved beneficial. Same results were observed by Farzad *et al., 2008 Tagetes erecta* **L.** and Abdul *et al.,* 2011 on *Vinca rosea*. Silesh *et al.*, 2007, also supports our findings. Leaf weight was more in 1:1 soil sand amendments and soil followed by 1:3 and sand alone. Leaf weight was more in plants that were watered daily. By using different amendments, Abdul *et al.*, 2011 observed similar results on *Vinca rosea*

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