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Design of Portable Fabric Pots by Hydroponic Method

Behnoosh Soltani[a], Salar Zohoori[b]*, Abolfazl Davodi Roknabadi[c]

[a]*Design & Clothing Department, Imam Javad University College, Yazd, Iran*
[b]*Design & Clothing Department, Imam Javad University College, Yazd, Iran*
[c]*Design & Clothing Department, Faculty of Art and Architecture, Yazd Branch, Islamic Azad University, Yazd, Iran*

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Research Article

Abstract

This article, which has been done by descriptive experimental method, has investigated the possibility of designing cloth pots and the growth and development of plants on the fabric bed. In this paper, the hydroponic method is used and the fabric is first supplemented with ammonium nitrate and two substrate samples are prepared for growing wheat seeds (soil, fabric) with the same conditions and parameters. Then seed growth on each substrate was examined for ten consecutive days. The altitude measured in these ten days showed that the plants had a gradual growth and did not show much deviation compared to the soil bed. Then, they designed fabric vases and in the fabric design of these vases, forms with vertical and horizontal lines, diagonal lines and accordion volumes were used. Also, in the color design section, dark spectrum colors have been used to prevent root rot that does not allow light to pass through, and finally, eight fabric pots have been designed and implemented.

Keywords: Fabric Vase; Portable Fabric Pots; Hydroponics

1. Introduction

The history of textile weaving in Iran dates back to millennia BC. Many ancient specimens have also been found in excavations. The spinning top is the first weaving machine that turns fibers into yarn. The evolution of this device has played an important role in the development of textile technology and has been the introduction of the emergence of spinning wheels. Archaeological

* Corresponding author. Tel: +98-9173067942.
E-mail address: s_textile@yahoo.com

findings indicate the use of the spindle from the Neolithic period. Numerous spindles have been found in many ancient sites of the Neolithic period in Iran. The seal obtained from the Choghamish area of Khuzestan, which belongs to 3300 Qom, shows a woman not spinning. The weaving machine is the next tool that dates back to the beginning of the fourth millennium BC. On the seal obtained from Susa, two people are engraved next to the knitting machine, which indicates the existence of this profession at the beginning of the urban era. This system is one of the achievements of the history of civilization in which the civilizations of Iran, China, Syria and Egypt have contributed a lot. The job of the knitting machine is to weave the thread with the weft. The knitting machine keeps the threads stretched to weave the wefts into it. The first weave found from Yahya Hill in Kerman, belongs to the fifth millennium BC and is made of threads made from animal fibers.1.2 (Ismaili, 2016) (Rohfar, 2012)

2. Geotextile

Geotextiles are the largest member of the family of geosynthetics. These products are actually fabrics that use synthetic fibers instead of yarn, wool and silk in their texture. Therefore, biodegradation is no longer a problem, or in other words, if we use these materials in the soil, We are no longer worried about the quality and decomposition of their texture. An important feature of these products is their porosity so that water can move through the cavities and inside the geotextile plate, albeit to different degrees. As mentioned, geotextiles are produced by conventional textile machinery. Based on the type of production process, current geotextiles can be classified into the following types:

Woven geotextile: Geotextiles that are produced by weaving two or more bundles of yarn (spun yarn composed of one or more fibers) at right angles to each other or other elements using conventional weaving processes by textile machines.

Nonwoven geotextile: A geotextile that is produced randomly by placing fibers in different directions. The connection between fibers or fibers can be in the form of partial thermal fusion, needle connection (needle punch) or chemical connection (glue, rubber or cellulose, latex, cellulose derivatives, etc.).

Round textured geotextiles: A geotextile produced by the loop weaving of one or more yarns (spun yarn) or other elements by a loom weaving machine, not a weaving machine.

Patched geotextile: A geotextile in which fibers or yarns, or both, are locked together by patching or stitching together.3.4.5.6 (setayesh, 2011) (Einabadi, 2018) (Nateghi and Haddad, 2017, p. 365) (Hossein Khani, 2008, pages 25,27).

3. Hydroponic Cultivation

Growing plants in soilless or hydroponic greenhouse method is one of the important ways to achieve maximum yield in the shortest time and with excellent quality. The term hydroponics was first coined by Greek, who in California managed to show plant production on a commercial scale without the use of soil, from early growth to fruiting. The term is a combination of a Greek word for hydro, meaning water, and the Latin word ponro, meaning to place, which in short means to put something in water. More precisely, hydroponics refers to the cultivation of plants in a soilless environment. In this method, materials are usually used to maintain the root system and the plant is fed through a nutrient solution that is added to the environment. The material used as a growth medium may be an organic matter (peat moss, bark or other organic matter) or an inorganic

substance such as perlite, vermiculite and rock wool. 7.8.9(Arzani, 2007) (Aberandabadi et al., 2015) (Dinpanah and Noori, 2013)

4. Ammonium Nitrate in Agriculture

Ammonium nitrate is a very important agricultural fertilizer with NPK equal to 0-3-34 (34% nitrogen), which of course has a lower purity than urea fertilizer. The advantage of ammonium nitrate fertilizer over urea is that it is more stable and does not lose nitrogen in the atmosphere.

Ammonium nitrate with urea is a good cover for spring use. At the beginning of their growth, do not hesitate to use plants in higher doses of nitrogen, and along with sulfur, this element is absorbed especially well and quickly. This feature is in the agrochemical composition. Because sulfur itself is not a nutrient found in plants. Physiologically, ammonium nitrate is an acidic fertilizer that does not acidify the soil at the same time with a natural pH reaction. But if you use ammonium nitrate on acidic soils, in parallel you need to use calcium carbonate at about 0.75 grams per 1 gram of nitrate. Because ammonium nitrate is needed for active saturation of plants with nitrogen. This is his main task which helps in addition to including the composition of macro and micro electron compounds.

This fertilizer is almost always produced using additives of different elements. The availability of such a wide range of broad geographies of ammonium nitrate utilization and efforts to adapt to agricultural needs in different climatic regions are described.10.11(rao,2014)(James,2017)

5. Plant Growth Cycle

Step 1: Seed

The growth and life cycle of a plant begins with the seed. We are all familiar with seeds and occasionally even feed on them. The seed has a coating called a shell. The bark contains substances that are in fact the basic ingredients of plant life.

Second stage: Germination and Growth

We need four things to grow a plant: oxygen, moisture, sunlight and the right temperature. If the conditions are right for the plant to grow, it is time for the buds to sprout. The roots protrude from the seed and enter the soil. This process is called germination.

Third stage: Seedling Growth

The young, delicate plant is called a seedling that grows out of the ground and begins to grow in the sun. During this time the plant must be well nourished by the soil in order to emerge from the soil. Seedlings from the sun should also be well nourished. The leaves of the plant are green pigments called chlorophyll. This pigment uses sunlight, water and carbon dioxide to produce the energy needed for the plant to grow.

Step 4: Mature Plant

Photosynthesis helps seedlings grow to become mature plants. The adult plant blooms, indicating that the life cycle continues. In fact, it shows that he is alive. The adult plant has leaves, roots and stems. The roots feed on the soil and water inside. These substances reach other parts of the plant through the stem. Leaves also produce energy through photosynthesis. A cycle that is constantly repeated. The flower is a part of the plant that reproduces many times. Flowers are made of different components. The petals are usually shiny and colorful to attract insects and aid in the pollination process. The other part of the flower, called the flag, produces pollen.

Pollen is a powdery substance that is often yellow and contains half of the genetic material for new plant production. The other part is called the stigma flower, which attracts pollen. Eggs form seeds when they are fertilized by pollen.

Step 5: Pollination

The process of absorbing pollen through the plant flag into another plant stigma is called pollination. Pollen can be transferred to another plant by wind, but insects are usually responsible for the transfer. Moths sometimes interact with other insects in the process. Bees, butterflies and other insects are attracted to the plant through the color of the petals. Insects drink nectar, the sweet liquid of the plant. When the insects are spinning around the plant, they drink nectar and the plant absorbs the pollen into the body or the foot of the insect. When an insect flies to another plant to drink its nectar, the pollen is transferred to the new plant.

Note that pollen contains half of the genetic material needed to produce a new plant. The egg, which is in the stigma, contains the other half of the genetic material. When the pollens reach the egg, they fertilize and form the seeds. The plant then fertilizes the seeds and disperses them with wind, water, or other animals, repeating the entire cycle described. 12 (Khosrojerdi, 2018)

6. Materials

In this article, a polyester / cotton fabric with the specifications listed in Table 1 and ammonium nitrate prepared by Sigma Aldrich Company with the specifications listed in Table 2 have been used.

Table 1 Characteristics of the fabrics used

Type of texture	Producer	Fabric	Scale (g/m2)	Tar density (1/cm)	Fabric density (1/cm)
Wreathy	Yazd Baf	Polyester/cotton	100	24	15

Table 2 Specifications of materials used

Device name	Manufacturer	Description
Oven	Iran	Grade 300
Ultrasonic device	-	-

7. Fabric Preparation

To prepare the fabric, the material was added to the Laboratory container and distilled water was poured on it until the Laboratory container volume reached 100 ml. Then place the Laboratory container in an ultrasonic bath for 30 minutes (temperature 60). At this stage, the fabric was added to the Laboratory container and the Laboratory container was placed in an ultrasonic bath at a temperature of 50 for several hours. The fabric was then washed with distilled water and dried at 80° C for 20 minutes.

8. Investigating the Effect of Fabric on Plant Growth

Plant measurements were continued for ten days and data were collected every ten days. After these ten days, it was observed that the growth of wheat germ in all crops was gradual.

The gradual increase in the height of wheat grains in different substrates is shown in Table 4 and it has been observed that the growth of plants in two textile cultivation substrates as well as in soil environment has been successful.

It has been observed that fabric-based substrates are actually responsible for supporting the growing roots of the plant. To better understand the growth of plants in different substrates, the

height measured in these ten days is shown in the diagram shown in Figure 1 and it was observed that the plants had a gradual growth and did not show much deviation compared to the soil substrate.

Table 4 Plant growth rate on two beds

Day	1	2	3	4	5	6	7	8	9	10
Growth rate on the fabric substrate (mm)	21	51	86	118	156	162	178	184	201	235
Growth rate on soil substrate (mm)	22	54	84	113	149	156	174	181	204	237

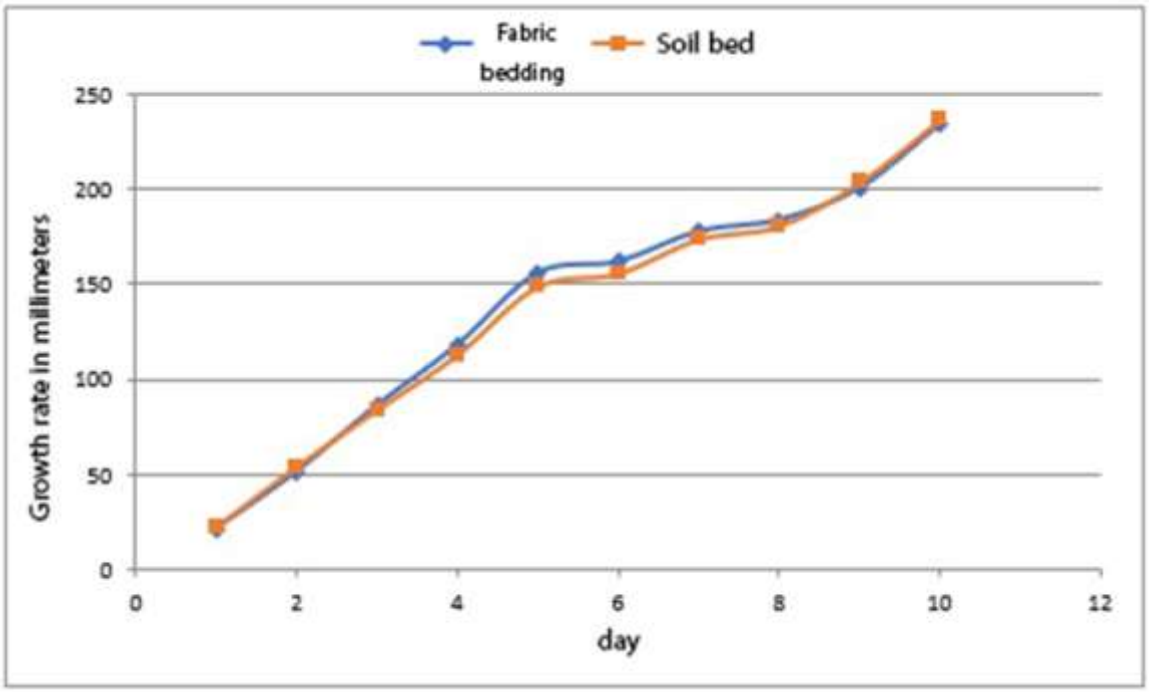

Fig 1 Graph of plant growth rate on two substrates

9. Design Analysis

Each role or design or image in any form, consists of a series of primary visual elements. The designs in Figure 2 can each be used and executed in the design of pots from vertical, horizontal, diagonal and curved lines in line Volumizing the created form and design that each line with its own concept helps us in the appearance and execution of the design, considering the practicality of the volume and creating a pot for the plant to protect the roots and at the same time maintaining the appearance and distinguishing the design Are created with products available in the market. Due to the fact that the soil is not present in the pot, to design the pots, we have tried to make the root compartment smaller and more closed so that the air penetration into the pot is not more than the plant needs, and neglecting this issue causes dryness of the roots. By default, it should be used to protect the roots of the plant from direct light radiation and root rot and rot of the plant due to the presence of high light in the dark spectrum.

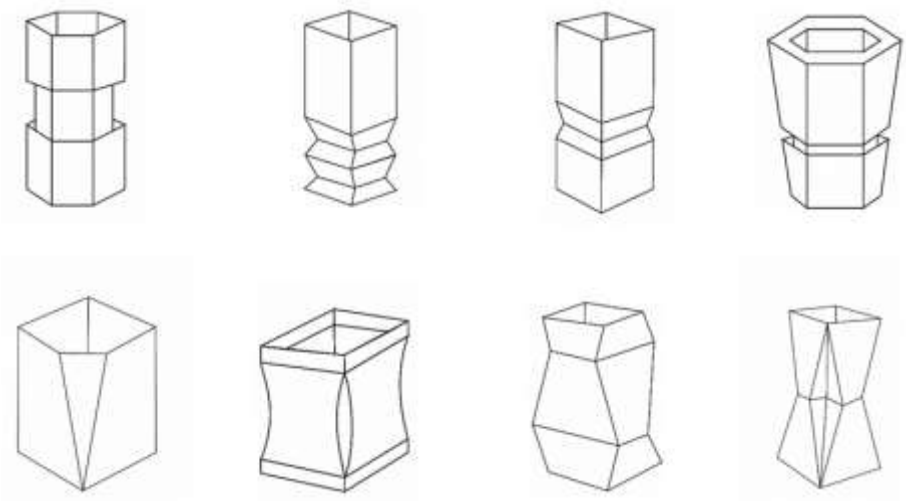

Fig 2 Linear fabric vase designs

Fig 3 Color palette by default

10. Conclusion

In this article, according to the special characteristics that a plant needs for its growth and development, we have tried to design the fabric of pots that can grow in a textile environment by hydroponic method without the need for soil. For this purpose, the fabric was supplemented with ammonium nitrate (which is a plant nutrient) and two substrate samples were prepared for growing wheat seeds (soil, fabric) with the same conditions and parameters. Then seed growth on each substrate was examined for ten consecutive days.

The altitude measured in these ten days showed that the plants had a gradual growth and did not show much deviation compared to the soil bed. In the design discussion, forms and colors with vertical and horizontal lines, diagonal lines and accordion volumes have been used. Dark colors have also been used to prevent root rot that does not transmit light. Finally, eight potted fabric designs were approved and implemented.

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