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Barley Growth in Using the Recycling of Polyurethane Foam Bed Waste

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Abstract. In this research, three types of soil were used to grow barley. The first is the regular agricultural soil in the Al-Nashwa area in northern Basra in Iraq. The second was a foam soil that was obtained from an old foam bed that was cut into small foam pieces to inoculate it with two types of animal manure that were collected from cow farms in the Al-Nashwa area in northern Basra. This animal manure was used by placing it with an amount of water in a tightly sealed plastic container and combining with it specific weights of caper leaves, which are also considered waste. By mixing this mixture of water and fresh animal manure, we mean here by the way that it did not dry, i.e. it did not take more than an hour or two after being expelled by the cows. After two weeks of placing this mixture consisting of water, fresh animal manure, and caper leaves in a tightly sealed plastic container, this mixture, which is considered an organic fertilizer, was inoculated by pouring specific amounts of this mixture on the pieces of foam that were wanted. The other type of soil is the same as the foam with the same specifications, except that the fertilizer used here was directly from animal manure, but the rice in this case was completely dry and was ground into small minutes and placed on the foam used, and then several vegetative characteristics of the barley plant were measured in terms of germination speed, germination rate, death rate, stem length, number of leaves, splitting rate and other vegetative characteristics that strongly indicated that the foam soil inoculated with animal manure was better in all these characteristics than the reference soil that was not mixed and then the foam soil inoculated with dry animal manure, and this indicates the superiority of this type of soil. The results were interpreted based on the effectiveness of bacteria in the foam soil inoculated with fresh animal manure and also on the proportionality and integration of this type of fertilizer used and produced in this way with the foam as a result of this foam containing pores or air bubbles that can be replaced by this name, the fertilizer produced in this way.

Highlights :

1. Enhanced Plant Growth – Foam soil with fresh manure significantly improves germination (99%) and vegetative growth compared to traditional soil.
2. Waste Recycling – Repurposing polyurethane foam as a soil substitute reduces waste accumulation and promotes sustainability.
3. Water Efficiency – Foam soil retains moisture effectively, making it a viable solution for agriculture in arid regions.

Keywords : Manure, Fertilizer, Alnashwa, Foam, Barley

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Introduction

Fertilizer is a substance that is applied to the soil to promote plant development. Farmers use a range of fertilizers to produce an abundance of crops. Gardeners also employ fertilizers to boost production. There are vigorous, large flowers and lots of vegetables in home gardens [1-4].

Fertilizers contain the nutrients required for plant growth. Some fertilizers are formed from organic materials like animal dung and sewage waste, while others are made from chemicals or mineral elements that are produced in factories [5, 6]. Man has made use of Even before the advantages of fertilizers for plants were recognized, they had been used for thousands of years. It was found that wood ash, animal manure, and a few other minerals support robust plant growth [7]. Fertilizers aid in improving the physical and chemical characteristics of soil and boosting its fertility. There are various kinds of fertilizers, such as organic fertilizers that employ natural waste like plant and animal dung and nitrogenous phosphate fertilizers [8, 9].

In the agricultural industry, foam is crucial, mostly because they may be used to hydrate plants in places with limited water supplies. Foam are able to It allows the plant to receive a steady flow of water without being overwatered because it absorbs a lot of water and releases it gradually over time [10, 11]. The foam can also be used to keep pests away from young plants. Prevent illnesses by putting up a physical defense between the plant and possible dangers. Additionally, growers can apply insecticides and fertilizers more precisely and in fewer amounts by using foam to hold them in place. Generally speaking, foam is a flexible and practical agricultural tool, particularly in regions with scarce water supplies [12, 13]. As a light and water-absorbent substance, foam are used extensively in agriculture to improve the soil's capacity to hold onto water and supply moisture to plants. Additionally, they are employed in the production of containers for aquatic plants, including aquatic herbs and small aquatic plants. Additionally, some varieties are distinguished by their medical qualities, which may have commercial worth [14, 15].

Experiment and Procedure

Animal manure was collected for this study from a livestock farm in the wetlands of Basra, Al-Nashwa area in Iraq, where two types of manure were used: completely dry

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manure and soft manure. They were cut into small pieces and an amount of capers was added to the container containing the dry manure and the container containing the soft manure in equal proportions for both types of manure. They were mixed well with a stick. After fourteen days of tightly closing all the contents, this manure was used in the container and sprinkled on the surface of the foam used as agricultural land, as this foam was brought from the waste of the foam bedding, as these beddings are thrown away and need long periods to suffer from decomposition, and thus their accumulation will lead to the accumulation of waste, so the idea was to recycle the foam waste towards the formation or creation of agricultural land. 100 grains of barley, 100 grains of guidance, and 100 grains of eggplant were spread on the foam land used in this research, as the foam land was at a rate of three lands and with equal areas and at a rate of three foam lands Eggplant and three foam soils for guidance and three foam soils for barley in the case of using fresh manure and in the case of using dry manure, the same replicates were also used at a rate of three replicates for each seed used, as the planting process for all these seeds was at the beginning of November 2023. The germination process was monitored through the number of germination percentages, stem length, and other vegetative characteristics of the plant. The following are some pictures that illustrate the method of work

Figure 1 shows the steps of using recycled urethane bedding in growing barley, with the type of barley grains used and the plastic containers used in the research.

Figure 1. Steps of the experiment for growing barley on a foam bed waste

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Results and Discussion

It is noted from the results shown in Table (1) that the germination rate of barley plants in foam soil inoculated with wet (soft) animal manure is faster than barley germination in foam soil with dry animal manure, and then the germination rate is lower in normal agricultural soil, as the germination rate of barley was 99% in foam soil with wet animal manure compared to foam soil with dry animal manure, in which the germination rate was 3%.

These results are very important in terms of determining the type of animal manure preferred in the fertilization process, choosing the animal manure, and the period of its use. This is evident from the high germination rate of the polyurethane foam infused with fresh animal manure compared to other types of soil. In addition to that, the germination speed was higher in the foam soil infused with fresh animal manure.

Table 1. Shows the germination rate of barley plants related to the type of fertilizer used and soil as a function of the planting period in days

reference soil	dry animal manure	wet animal manure	days
0	0	0	1
1	2	3	2
5	7	10	3
15	35	33	4
34	42	46	5
42	62	79	6
56	76	93	7
73	79	95	8
81	85	97	9
90	93	99	10

The percentage of barley plant death was 1% in the foam soil infused with wet animal manure, 7% in the foam soil with dry animal manure, and 10% in the normal soil, as shown in Table (2).

Table 2. The mortality rate of barley plants depends on the type of agricultural soil and added animal fertilizer

Reference soil	Dryness animal manure	Wet animal manure
%10	**%7**	**%1**

Thus, the superiority of the foam soil infused with soft animal manure is confirmed again, and the superiority of this animal manure as a fertilizer for agriculture in this type of soil.

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The study continued to determine another characteristic, which is the length of the barley stem in the three types of soil, as we note from Tables 3.

The foam soil infused with wet animal manure was superior in the proportion of stem length and number of leaves for barley plants, which reached 6 cm and 4 respectively. This reflects the continued effect of animal manure on the growth process of barley plants even after some time has passed since germination because the foam soil is the same and has not changed. What changed in the first and second cases was the type of animal manure used in this polyurethane foam? Thus, this effect on stem length and number of leaves was shown, as these two characteristics are better in the foam soil infused with fresh animal manure.

Table 3. The length of the stem and the number of leaves of the barley plant as a function of soil type and type of added manure

Properties	Wet animal manure	Dryness animal manure	References Soil
Stem length	6 cm	3.5 cm	5.2 cm
Number of leaves	4	4	2

This difference is because the process of breaking down materials in compost depends on microorganisms that convert organic matter into compost. Among these organisms are bacteria, which are more prevalent than microbes in organic compost. Actinobacteria are necessary to break down materials such as newspaper, tree bark, etc.

Fungi, mold, and yeast help break down substances that bacteria cannot. Bacteria are especially susceptible to lignin, which is found in woody materials. Oligo helps devour bacteria, fungi, and small organic particles. Rotary helps control the number of bacteria and small protozoa.

The weakness of the beneficial microorganism community is the main reason for the slow conversion process in landfills, along with environmental factors that cause the weakness of the biological community, such as lack of oxygen, nitrogen, and water, and thus poor plant growth.

Figure 2 shows the progressive growth of barley in foam soil infused with wet animal manure, highlighting its superior germination rate and plant health.

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Figure 2. Stages of barley cultivation and growth in foam soil infused with wet animal manure.

Figure 3 provides a comparative perspective by depicting the growth stages of barley in foam soil with dry animal manure, reinforcing the differences observed in the study.

Figure 3. Stages of barley cultivation and growth in foam soil infused with dry animal manure.

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wo important results that must be mentioned here first is the nature of the roots after penetrating the thickness of the piece of foam cut from an old bed. If the barley plant stems grow and become larger, their roots will grow and penetrate this foam to be more stable and strong, though if the wind hits them strongly, they will not be uprooted from those roots. Even if this foam planted with the barley plants flies, then - we mean here the music of the barley plant and its roots - they will not be uprooted but remain attached to the foam width. This is the first. Secondly, when these roots reach the other side - and we mean after penetrating the depth of the foam pieces by the roots of the hair plant - they will spread Arabically along the inner surface of the foam, as shown in Figure 4. The other result that must be published here is that the percentage of splitting in the number of plant stems planted in the foam soil inoculated with fresh animal rose was higher than it is in both the foam soil inoculated with dry fertilizer or the reference soil that She is unvaccinated.

Figure 4. The spread of barley roots in the foam soil and their flat spread on the other surface of the foam soil

Conclusion

From the results obtained, it can be concluded that recycling foam bedding waste is effective in both cases in the case of using soft animal manure or dry animal manure, but dry animal manure that feeds the foam soil is much better than dry manure. This method can be used after comparing the results obtained from natural soil. We can use this foam soil in planting large areas of the desert by producing large foam pieces with areas of 50 x 50 m or 100 m by 100 m, equivalent to a full acre in the middle of the desert. Therefore, we do not need large amounts of water, especially during rainy seasons, because this soil retains water in addition to the amount of water present in the animal manure, thus helping to eliminate desertification and increase the agricultural lands suitable for cultivation, thus benefiting humanity.

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