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Effect Of Some Treatments On Growth, Flowering, And Bulb Yield In Hyacinth Plant.

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Abstract
The experiment was carried out inside the wooden canopy of the Department of Horticulture and Landscape Design, College of Agriculture and Forestry, University of Mosul, during the period from 1/11/2023 to 1/6/2024, the aim is to study the effect of the best types of natural waste (yeast powder, orange peel powder, potato peel powder, eggshell powder) at two concentrations (5 and 10 g per pot) on the growth and flowering of Hyacinthus orientalis L bulbs, variety (Carnegie) white flower Natural waste was added in powdered form in three batches: the first at planting, the second after bulb emergence, and the third one month after bulb emergence. The experiment was carried out in a completely randomized block design (RCBD) with three replicates, the results showed that yeast powder at a concentration of 5 gm was superior in the characteristics of plant height cm, number of leaves, length of leaves cm, weight of bulb g, and reached 30.133, 6.1000, 23.507, 49.4667 respectively, while yeast powder at a concentration of 10 gm was superior in the characteristics of number of days to flowering, number of bulbs, and reached 77.900, 1.2767, respectively, while eggshell powder at a concentration of 5 gm was superior in the characteristics of flower stalk weight 39.600 gm and orange peel powder at a concentration of 5 gm was superior in the characteristics of bulb volume 58.4667 cm³.
Keywords: *Yeast powder, organic fertilizer, eggshell powder, hyacinth bulbs.*

INTRODUCTION

The scientific name of the hyacinth plant is Hyacinthus orientalis L, which belongs to the Liliaceae family, Hyacinthaceae family, genus Hyacinthus, called spike bulbs and also called hyacinth bulbs or hyacinth, [1] The Mediterranean basin and Central Asia in Iraq, Syria, Asia Minor and Greece are the original home of the plant, in addition to western Central Asia [2] and [3]. The Netherlands is the world's leading country in the production of hyacinth bulbs and flowers, as it contributes 95% of global production, according to recent official statistics, making it the main source of this flower crop worldwide, both in terms of cultivated area and export volume [4]. It is considered one of the true flower bulbs that have been cultivated since ancient times, and the name of the species (orientalis) means eastern or sunrise in Arabic [5]. It is considered one of the coldest and freezing-resistant types of bulbs, but it is affected by high temperatures [7]. The importance of the plant lies in its cultivation in flower pots or in basins in private and public gardens [6]. [7] Hyacinth reproduces vegetatively by bulbs, which can be spherical to oval in shape, and covered with membranes (scales) in different colors such as white, cream, silvery purple, or dark purple, depending on the variety grown. These bulbs, which store water and nutrients, are planted in the fall, usually from late September to November, depending on the location, to bloom the following spring. [8] Hyacinth prefers to grow in light soils, especially sandy or sandy loam, due to their moderate fertility and good drainage, in addition to their acidity (pH) being suitable for the plant's needs. On the other hand, it is recommended to avoid planting hyacinth in heavy or compact soils, or those that retain water for long periods after heavy rains, as this negatively affects the growth of the bulbs and exposes them to rot. [9] They are grown as ornamental plants in parks and gardens, and can be used in single-color or mixed-color groups in flower beds, mixed borders, and mass plantings to achieve maximum visual impact, near building entrance areas and patios. Along walkways, in pots and outdoor planters, as well as cut flowers in bouquets and floral arrangements [10].

Ethanol extracts from hyacinth flowers showed [11] Also, plant-based silver nano particles synthesized using aqueous extracts of petals exhibit antioxidant and antimicrobial activities. [13], [14] have also revealed that bioactive compounds present in plant extracts possess anticancer and immune-stimulating effects. [1] Flowers are also used in the perfume industry to extract essential oils, which have numerous applications in cosmetics and aromatherapy. [15] Organic agriculture has witnessed significant development in recent years due to increased environmental awareness and consumer concern for food safety. [16] [17] Soil management practices have recently led to an increased use of chemical fertilizers to

help increase crop production. The use of these agrochemicals not only degrades arable land but also increases pollution. To overcome this situation, organic agriculture is the only solution that incorporates only natural resources such as organic matter, plant and animal waste, and microbes. [18] The use of organic fertilizers has improved soil fertility and helped combat pest and disease problems. [19] [20] [21] Thus, organic fertilization has become an important part of sustainable, environmentally friendly agriculture.[22] Among the organic materials that have proven useful in agriculture is eggshell waste, which is a rich source of calcium carbonate, up to 95%, and thus a good source of lime, which makes it effective in adjusting soil acidity and improving its physical properties.[23] In a study by [24], eggshell powder treatment showed significant superiority in several traits in potato crops. This treatment outperformed in: plant height, number of leaves, number of nodes, number of branches, leaf area, number of large tubers, and number of medium tubers, while it recorded the lowest number of small tubers in pea crops. The same treatment showed superiority in: plant height, number of leaves, number of branches, number of pods, and number of large pods, and recorded the lowest number of small pods compared to the other treatments. [25] conducted an experiment on peanuts (Arachis hypogaea), in which they used eggshell powder as a source of calcium. The experiment resulted in a significant increase in vegetative growth and yield, confirming the effectiveness of this fertilizer, which is consistent with the results of this study on the trait of flower stalk weight. Among the natural materials that can be used in agricultural production are fruit peels, as fruit peel waste accumulates in large quantities daily, both at the domestic and industrial levels, and people often remove fruit peels and dispose of them as waste. This is a significant environmental issue, particularly in the industrial sector, as it requires proper management to help reduce environmental pollution. Using fruit peels as fertilizers can reduce waste accumulation and utilization. Fruit peels are rich in macro- and micronutrients essential for plant growth. Fruit residues are used as fertilizers to improve soil fertility and promote microbiological activity, as they contain essential minerals for plant growth. Some of the active compounds found in fruit peel seeds also have insecticidal and fungicidal properties, making them effective against certain plant pathogens. Fruit peels can also be used to regulate soil acidity and eliminate insect pests and nematodes. [26] [28] and [27] The results of a study [29] showed that organic fertilization using potato peels had a significantly positive effect on coriander plants, outperforming the chemical treatment (NPK) in most of the studied traits. It contributed to improving leaf production, increasing carbohydrate, protein, and essential oil content, and enhancing the accumulation of active compounds in the oil, such as phenols and flavonoids. It also increased the antioxidant capacity and increased the absorption of important nutrients such as nitrogen, phosphorus, potassium, iron, manganese, zinc, and copper, confirming the effectiveness of potato peels as an alternative organic fertilizer in the production of medicinal and aromatic plants such as coriander. In a study [30], the orange peel treatment alone (T4) outperformed the recommended dose of chemical fertilizer + 1 gram of orange peel powder in root length, recording the second highest value (46.33 cm) in the eighth week after planting, after the T6 treatment, indicating the role of orange peels in promoting root growth in okra. The interaction treatment between orange peels and banana peels (T6) showed significant superiority in a number of traits, including plant height, leaf area, root length, chlorophyll content, root dry weight, number of seeds in fruits, length, diameter, and wet and dry weight of fruits, in addition to the highest plant yield in the four sections, making it one of the most successful treatments in improving the growth and production of okra in sandy soil. [31] showed that the use of potato and orange peels as organic fertilizer led to a significant improvement in the germination rate of tomato seeds, reaching 100%, as a result of improving the soil environment and microorganism activity. This is consistent with the results of this study on the emergence rate characteristic. Yeast (being a fungus) is considered an important biological source for fertilization. Yeast contains many nutrients that are beneficial to plants. [32] It was also explained [33] that yeast is able to produce some plant growth regulators such as auxin and gibberellin, in addition to its ability to produce a group of enzymes that contribute to the conversion of monosaccharides into alcohol and carbon dioxide, a process necessary for photosynthesis in plants. [34] Analysis of the content of dry baker's yeast showed that it contains a high concentration of growth regulators, as it contains free IAA at a concentration of 85.04 $\mu g\ ml^{-1}$ and bound IAA at a concentration of 112.60 $\mu g\ ml^{-1}$ at a wavelength of 280 nm, in addition to free GA_3 at a concentration of 382 $\mu g\ ml^{-1}$ and bound GA_3 at a concentration of 417 $\mu g\ ml^{-1}$ at a wavelength of 254 nm. [35] and [36] As a result of these properties, dry baker's yeast was used. To improve growth and productivity in many crops [42] [41] [38] [37] The results of a study [39] conducted during the spring season of 2013 showed that the use of dry baker's yeast through irrigation near the plant roots, at

concentrations of 0, 4, and 8 grams per liter, had a positive effect on vegetative growth and yield. The 8-gram-liter concentration achieved the best results, as it led to a significant increase in the number of stems, leaf area, fresh and dry weight of the plant, and recorded the highest values in the number of tubers (7.09), average tuber weight (55.39 grams), plant yield (439.7 grams), total tuber yield (17.588 tons per hectare), and marketable yield (13.728 tons per hectare), outperforming the 4-gram-liter concentration and the treatment not treated with yeast.[40] was conducted to determine the effect of four types of plant extracts (licorice, orange peel, pomegranate peel, banana peel powder) at a concentration of (5, 10 g) per plant on vegetative growth and flowering, in addition to the essential oil extract of daffodil (Narcissus daffodil L.). All extracts were added monthly to the soil, and it was observed that the banana peel powder at a concentration of 10 g was superior in all vegetative and floral characteristics of the plant, as the plant height, number of leaves, leaf length, chlorophyll percentage, number and length of flowers reached 40.17 cm, 9.50 leaves per plant, 24.90 cm, 70.53 spadix, 4.18 cm, and 36.37 cm, respectively. As for the essential oil properties, the same treatment (10 g plant^{-1} of banana peel powder) gave the best results in terms of oil percentage, quantity, and specific gravity, 3.880%, 37.12 g kg^{-1}, and 0.836, respectively, while the oil density reached 0.827. [43] conducted an experiment on hibiscus (Hibiscus sabdariffa) to test the effect of yeast extract on some growth traits. The results showed a significant increase in the fresh and dry weight of the plant, as a result of enhancing the absorption of elements and activating vital processes, which is consistent with the results of this study on the bulb weight trait. [44] observed in an experiment on lily plants that fertilization with yeast extract led to a significant increase in the number of bulbs and lateral buds, as a result of stimulating vegetative and reproductive growth, which is consistent with the results of this study on the number of bulbs formed. [45] studied the effect of yeast extract on carnation (Dianthus caryophyllus) plants, and recorded a significant advance in flowering time as a result of stimulating physiological processes. This result supports the findings of the current study on the number of days to flowering trait. [46] conducted a study on eggplant (Solanum melongena), and the results showed that yeast extract contributed to a significant increase in plant height, as a result of its content of growth-stimulating hormones and vitamins, which is consistent with the results of the current study on plant height. [47] showed in their experiment on petunia (Petunia hybrida) that yeast extract and bio-inocula significantly increased the number of leaves, which is consistent with the results of this study on the number of leaves trait. [48] demonstrated in a study on two Hyacinthus orientalis cultivars that the use of yeast led to a significant increase in plant height, leaf length, and panicle weight, which supports the results of this study on leaf length.[44] observed in an experiment on lily plants that fertilization with yeast extract led to a significant increase in the number of bulbs and lateral buds, as a result of stimulating vegetative and reproductive growth, which is consistent with the results of this study on the number of bulbs formed. [45] studied the effect of yeast extract on carnations (Dianthus caryophyllus), and recorded a significant advance in flowering time as a result of stimulating physiological processes. This result supports the findings of the current study on the number of days to flowering. 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to a significant increase in plant height, leaf length and inflorescence weight, which supports the results of this study on the leaf length trait.

This research aims to evaluate the effect of using natural household wastes such as eggshells, orange peels, potato peels, and yeast powder as organic fertilizers in feeding hyacinth bulbs, with the aim of identifying the best type of fertilizers for promoting growth and flowering. The research idea stems from reducing reliance on environmentally harmful chemical fertilizers and replacing them with available and safe natural materials that contribute to supporting clean agriculture and preserving soil fertility and quality. This approach also intersects with several Sustainable Development Goals, including: eliminating hunger by improving agricultural production (Goal 2) Reducing pollution through recycling organic waste (Goal 12), contributing to mitigating the effects of climate change (Goal 13), and preserving land resources and ecosystems (Goal 15).

MATERIALS AND METHODS

Implemented experience inside shade wooden Subordinate For the department gardening And engineering gardens college Agriculture and forests university Mosul, during Duration from October 1 the second 2023 and until June 1 2024, And that With the aim of study better Types waste natural and use it As fertilizers membership And it is (manure powder Yeast, manure powder peels orange, manure powder peels Potatoes, manure powder peels Eggs) and in two concentrations (5 and 10 g Pot) in growth And flowering Bulbs Hyacinthus orientalis L. immersed The eyes before Agriculture with pesticide My device innate and bacterial Beltanol 50% concentration 1 ml liter-^{1} For a period of 10 minutes, then You were planted The eyes same Countries that It varied between 2- 2.5 cm For the class white "Carnegie" flowers White on the date October 1 the second, in anvils capacity (4 kg) filled In soil Mixed Sandy. Done. to prepare Fertilizers peels orange and peels potatoes and peels eggs on road Dry it in oven thermal degree heat (50–60°C) then Grind It in a way powder Smooth. Added. fertilizer on three Payments: First when Agriculture, The second after emergence Bulbs The third after month from emergence Bulbs. Done. mix fertilizer with soil then It was completed irrigation plants after Fertilization. Implemented. experience by design Sectors Randomness Complete (RCBD) with three duplicates, and all redundant It contains on 8 units Experimental, and all loneliness Experimental Includes 4 anvils (any that number anvils kidney =96). Done. analysis Data Using program SAS, And I was tested indication Differences between Transactions By testing Duncan Multi border when level probability 0.05, and it was study Attributes Next: ratio **Percentage of emergence**, **number days necessary For flowering**, **height of plant (cm):** Measured from surface soil until higher a point in The flower inflorescence Using tape measurement flexible, **number leaves (leaves plants):**number leaves kidney on plant One when phase pick flowers, **an average length leaves (cm):**It was calculated Average Collect Lengths leaves in plant And I divided it on Its number **weight The flower inflorescence (gram):** weight when phase Picking Using balance digital sensitive, **weight bulb (gram):**And it was weighed bulb after an end experience Using balance digital, **size bulb (cm^{3}):**It was calculated In a way displacement With water, By putting bulb in cup Amphitheater And measurement size water joke, **number bulbs (bulb plants):**Counted bulbs formed around bulb the mom after an end Experience.

RESULTS AND DISCUSSION

The table shows (1) The effect of eggshell, orange, potato and yeast powder fertilizers on the growth, flowering and bulb yield characteristics of Hyacinthus orientalis L. With regard to the percentage of emergence, it was noted that there was no significant difference between the fertilizer treatments and their concentrations, as the emergence percentage in all treatments was 100%.

As for the number of days required for flowering, the fertilization treatment T4 (10 gm yeast powder) resulted in the lowest number of days to flowering, reaching 77 days, which was significantly superior to most treatments. This is consistent with the results [45] on carnations, where yeast extract contributed to reducing the number of days required for flowering. The reason for reducing the number of days required for flowering when using yeast may be due to its stimulating effect on plant hormones, especially gibberellins, which promote cell division and accelerate growth and development. Some studies indicate that yeast contains compounds capable of stimulating the production of these hormones, which contributes to accelerating the flowering stage of plants [50].

As for the plant height (cm), the fertilizer treatment was successful. T3 (5g yeast powder) gave the highest plant height of 30.133 cm. This treatment did not significantly differ from the T4 fertilization treatment

(10g yeast powder), which reached 28.633 cm. Both treatments differed from the rest of the fertilizer treatments, which is consistent with the results [51] on eggplant, where the yeast extract increased plant height. The reason for the increase in plant height when using yeast is due to enhancing the absorption of essential nutrients such as nitrogen and phosphorus, which supports vegetative growth. Yeast stimulates metabolic activity in the roots and increases the effectiveness of plant tissues in absorbing nutrients, which leads to an increase in plant height [52]. Regarding the number of leaves, the T3 fertilization treatment succeeded in giving the highest number of leaves, which reached 6.1000 leaves, but it did not significantly differ from the rest of the fertilizer treatments.

From the table data for the leaf length trait, we find that the fertilization treatment T3 (5g yeast powder) produced the highest leaf length of 23.507 cm, which significantly outperformed most fertilizer treatments. This is consistent with the results [48] on hyacinth bulbs. This may be due to the fact that yeast contains many nutrients that play an important role in stimulating growth, in addition to the yeast's production of auxin and gibberellin [53]. It is known that the role of auxin is to stimulate cell division and expansion, activate the functions of cell membranes, enzyme performance, and stimulate the formation of organic acids and proteins in cells. 54 Gibberellin stimulates cell division and increases cell wall elasticity, which helps in cell expansion, 55 leading to the activation of vegetative growth, which is evident in the increased length of leaves.

Regarding the weight of the fruit (g), the fertilizer treatment was superior. T1 (5g eggshell powder) gave the highest weight of the shoots (39.600 g), which was significantly superior to some fertilizer treatments. This is consistent with the results [56] on peanuts, where eggshell powder contributed to an increase in the biomass. This may be due to the fact that eggshells consist of about 95% calcium carbonate and contain other minerals such as magnesium and phosphorus, which are important for plant growth. Calcium helps strengthen cell walls and contributes to root growth, thus improving water and nutrient absorption, which is reflected in the growth of the shoots and their weight increase [57].

As for the bulb weight (g), the highest bulb weight was obtained from the fertilizer treatment.T3 (5g yeast powder) reached (49.4667) which significantly outperformed all fertilizer treatments except for treatment T8 (10g orange peel powder) which reached (48.5333g), which is consistent with the results [43] on hibiscus plants, where the use of yeast extract led to an increase in the fresh and dry weight of the vegetative parts, as a result of the role of yeast in enhancing the absorption of elements, stimulating growth, improving plant metabolism and increasing the absorption of important nutrients such as phosphorus and potassium, which contribute to increasing the mass of plant tissues. Moreover, yeast contains compounds that stimulate cellular growth, which leads to the formation of a larger and heavier bulb [58].

As for the bulb size trait, the fertilizer treatment was superior. T7 (orange peel powder 5 g) gave the largest bulb size (58.4667 cm^3) which was significantly superior to all fertilizer treatments. This is consistent with the results [59] on okra plants, where adding fruit peels (including oranges) led to an increase in fruit size as a result of improving soil fertility and plant nutrition. The reason for this may be due to the fruit peels containing growth stimulating factors such as cytokinins, thus increasing cell division and increasing size [60].

As for the number of bulbs formed on the mother bulb, the fertilizer treatment T4 (10 g yeast powder) was the best among the treatments in producing the highest number of bulbs (1.2767 bulbs per plant), which significantly outperformed the other fertilizer treatments. This is consistent with the results [61] on the Lilium plant, where the use of yeast extract increased the number of bulbs and lateral buds. The reason for the increase in the number of bulbs when using yeast may be due to its effect on stimulating the plant's vital activity and increasing the roots' ability to grow and branch. Yeast contains nutrients and minerals that may contribute to improving the soil and providing an ideal environment for root development and spread, which enhances the formation of additional bulbs [62].

Table (1) The effect of transactions on the studied traits:

Transactions	ratio Percentage of emergence	Number of days to flowering day	Plant height cm	Number of leaves plant leaf	Leaf length cm	Weight of the flower inflorescence	Bulb weight gram	Bulb size cm^3	number bulbs plant bulb

T1	eggshell powder 5 g	100.0 a	86,100 ab	20,267 de	5.6667 a	19,667 bc	39,600 a	42.5000 e	57.3333 b	0.3000 b
T2	eggshell powder 10 g	100.0 a	81,300 bc	24,300 cd	5.4667 a	22,167 ab	26,400 bc	45.5667 c	55.8333 d	0.3100 b
T3	yeast powder 5 g	100.0 a	79,000 c	30,133 a	6.1000 a	23,507 a	30,900 ab	49.4667 a	53.7333 f	0.4200 b
T4	yeast powder 10 g	100.0 a	77,900 c	28,633 ab	5.5000 a	20,333 bc	22,933 bc	47.5000 b	52.4333 g	1.2767 a
T5	potato peel powder 5 g	100.0 a	87,667 a	19,667 e	5.6667 a	16,767 d	16,167 c	40.7333 f	54.7667 e	0.3400 b
T6	potato peel powder 10 g	100.0 a	90,667 a	20,667 de	5.5667 a	17,833 cd	27,133 b	43.3333 de	56.4333 c	0.3300 b
T7	orange peel powder 5 g	100.0 a	89,400 a	25,500 bc	5.5000 a	20,033 bc	32,633 ab	44.5333 cd	58.4667 a	0.2100 b
T8	orange peel powder 10 g	100.0 a	88,000 a	24,133 cd	5.8000 a	18,800 cd	29,800 ab	48.5333 ab	57.8333 b	0.5067 b

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