

## Effect of spraying compost tea, sulfur, and DAP fertilizer on the growth characteristics of onion plants *Allium cepa* L.

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### ABSTRACT

A field experiment was conducted at the Baqubah nursery, Directorate of Diyala Agriculture, Iraq, during the seasons 2022–2023 to study the effect of organic fertilizers (compost tea), which included horse, poultry, cow, and vegetative fertilizers, besides chemical fertilizer (DAP) and sulfur, on the growth and yield of onion plants. The results indicated that the treated plants with horse compost tea were significantly superior in onion diameter (4.333 cm), the poultry compost tea and horse compost tea recorded the highest value in onion length reached (8.267 and 7.533 cm, respectively), and spraying sulfur on the plants led to an increase in plant weight (483 g.plant<sup>-1</sup>) and total weight (96.600 ton.hectare<sup>-1</sup>) as compared to the control treatment.

**Keywords:** Onion, compost tea and sulfur

### INTRODUCTION

The onion (*Allium cepa* L.), belonging to the Alliaceae family, is one of the most important vegetable crops in Iraq and the world. It is characterized by its high nutritional, medicinal, and economic values as it contains many vitamins, nutrients, and medicinal compounds such as the anti-oxidant and cancer-fighting quercetin compound and some secondary organic compounds that include sulfur as an essential element in their composition (12, 22). Onions are considered strategic vegetable crops, so many countries have sought to increase the cultivated areas of onions and raise the level of production. The statistics of the Central Statistical Organization for the year 2015 indicate a decrease in the cultivated areas and productivity of this crop compared to previous years, as Iraq's production of green onions for the year 2015 reached 44 thousand tons, a decrease of 76% from the last year. Excessive use of

chemical fertilizers not only reduces the quality of vegetable crops but also pollutes the environment; thus, eco-friendly approaches for improved crop health and yield are required (25). It is essential that academics continue to explore new approaches or methods that could

be utilized to help the changeover from environmentally unfriendly chemical fertilizers to solid or liquid organic fertilizers in order to increase soil fertility and, consequently, enhance production. Many researchers have been interested in studying the effects of organic fertilizers on plant growth and yield, as organic matter is one of the important and effective factors in the availability of plant nutrients because of its properties that affect the soil content of nutrients and make them ready for absorption by the plant and then positively affect the growth and development of the plant (29). The process of incubating compost in water to extract soluble organic matter, microbes, and macro and micronutrients is known as "compost tea" (21). Due to the increased soil biology and fertility, compost tea is becoming more common in organic farming (11, 4). Compost tea provides vital minerals that help restore nutritional efficiency during plant growth, which is one of the most significant advantages (31). One alternate way of extracting compost tea from composted materials involves steeping or brewing the compost in water using a variety of preparation processes (14, 18, 27). Therefore, the main objective of this investigation was to study the effectiveness of several types of organic fertilizers (compost tea), chemical fertilizer (DAP), and sulfur on the growth and yield of onion plants.

#### **MATERIALS AND METHODS**

A field experiment was conducted during the seasons 2022–2023 at the Baqubah nursery, Directorate of Diyala Agriculture, Diyala Province, Iraq. Field land was prepared through plowing, disking, and ridging as experiment units with an area of 6 m<sup>2</sup>

each, and each unit was divided into two lines spaced 25 cm apart. The space between plants was 10 cm, and irrigation water was used through the drip irrigation system. The eight treatments, such as horse compost tea, poultry compost tea, cow compost tea, vegetable compost tea 1, sulfur, DAP compost, vegetable compost tea 2, and control, were arranged according to a complete randomized block design with three replicates. The physical and chemical characteristics of the experimental soil were evaluated using a soil sample taken from a soil layer 0–15 cm deep, as set out in (Table 1). The bulbs of onion (the crystal cultivar) were planted on November 1, 2022.

**Table 1. The field soil properties**

Measurements	Value	Unit of measurement
P	24.03	mg. kg <sup>-1</sup>
K	386	mg. kg <sup>-1</sup>
Clay	22.4	g. kg <sup>-1</sup>
Silt	27.28	g. kg <sup>-1</sup>
Sand	50.32	g. kg <sup>-1</sup>
Texture of soil	Sandy clay loam	-
Organic matter	1.72	%
Ec	1.7	ds Siemens \ m
pH	7.4	-

**Preparation of compost tea**

The compost tea was prepared by weighing 5 kg of each fertilizer and adding 5 liters of water, and covered for a period of 13 days, then diluted with water by 1/4 before being sprayed on the plants. Also, 2.5 g of DAP fertilizer was added to 1 liter of water, while 2.5 cm<sup>3</sup> of liquid sulfur

was added to 1 liter of water before being sprayed on the plants. The compost tea for several types of organic fertilizers was analyzed after being diluted with water at 1/4 in the soil laboratory at the Diyala Agriculture Directorate to find out the PH and EC, as set out in (Table 2).

**Table 2. The PH and EC of the compost tea**

Compost tea	PH	EC
Horses compost tea	8.02	2.01
Poultry compost tea	8.3	3.97
Cow compost tea	7.16	1.06
Vegetable compost tea 1	8.2	1.13
Vegetable compost tea 2	7.4	4.22

The fertilizers were sprayed four times on the dates 29\11\2022, 12\12\2022, 23\1\2023, and 14\2\2023, and the first harvest started on March 6, 2023. The following measurements were recorded such as plant height, number of leaves, onion diameter, onion length, plant weight (g.plant<sup>-1</sup>), and total weight (ton. hectare<sup>-1</sup>), and the vegetable compost tea 2 was sprayed starting from the second date.

The data were analyzed by analysis of variance (ANOVA) (9). **RESULTS**

The treatments, such as horse

compost tea, poultry compost tea, cow compost tea, vegetable compost tea 1, sulfur, and vegetable compost tea 2, showed a significant increase in the vegetative growth characteristics of onion plants as compared with the control (Table 3). The previous treatments were significantly superior and gave the highest average in plant height, amounting to 79.03, 79.60, 76.86, 76.43, 79.66, 77.66, 71.30, and 59.06 cm, respectively, and

number of leaves, amounting to 9.10, 7.73, 9.20, 7.76, 8.33, 8.06, and 4.96, respectively. The treated plants with horse compost tea were significantly superior in onion diameter ( $4.33 \text{ cm.bulb}^{-1}$ ), followed by cow compost tea ( $3.54 \text{ cm.bulb}^{-1}$ ), vegetable compost tea 1 ( $3.24 \text{ cm.bulb}^{-1}$ ), DAP compost ( $2.73 \text{ cm.bulb}^{-1}$ ), sulfur ( $2.67 \text{ cm.bulb}^{-1}$ ), vegetable compost tea 2 ( $2.66 \text{ cm.bulb}^{-1}$ ), and poultry compost tea ( $2.40 \text{ cm.bulb}^{-1}$ ), as compared with the control that recorded the lowest value ( $1.36 \text{ cm.bulb}^{-1}$ ). The poultry compost tea and horse compost tea were significantly superior in onion length, reaching (8.26 and 7.53 cm), respectively, with no significant differences between them, followed by DAP compost (6.40 cm), sulfur (6.36 cm), cow compost tea (6.13 cm), vegetable compost tea 1 (5.80 cm), and vegetable compost tea 2 (5.73 cm), with no significant differences between them, as compared with the control that recorded the lowest value (4.16 cm). The spraying of plants with sulfur led to an increase in plant weight ( $483 \text{ g.plant}^{-1}$ ), followed by cow compost tea ( $462 \text{ g.plant}^{-1}$ ), vegetable compost tea 1 ( $426 \text{ g.plant}^{-1}$ ), DAP compost ( $425 \text{ g.plant}^{-1}$ ), horse compost tea ( $422 \text{ g.plant}^{-1}$ ), poultry compost tea ( $398 \text{ g.plant}^{-1}$ ), and vegetable compost tea 2 ( $321 \text{ g.plant}^{-1}$ ), compared to the control ( $142.5 \text{ g.plant}^{-1}$ ). Also, the spraying of onion plants with sulfur resulted in a significantly increase in total weight ( $96.60 \text{ ton. hectare}^{-1}$ ), followed by cow compost tea ( $92.40 \text{ ton. hectare}^{-1}$ ), vegetable compost tea 1 ( $85.20 \text{ ton. hectare}^{-1}$ ), DAP compost ( $85.00 \text{ ton. hectare}^{-1}$ ), horse compost tea ( $84.40 \text{ ton. hectare}^{-1}$ ), poultry compost tea ( $79.60 \text{ ton. hectare}^{-1}$ ), and vegetable compost tea 2 ( $64.20 \text{ ton. hectare}^{-1}$ ) as compared with the control ( $28.40 \text{ ton. hectare}^{-1}$ ).

## DISCUSSION

Application of several types of organic fertilizers (compost tea), chemical fertilizer (DAP), and sulfur led to an increase in the vegetative growth traits of onion plants compared to the control treatment. (2) showed that the addition of organic nitrogen at a rate of  $9.5 \text{ metric tons.h}^{-1}$  with potassium and phosphorous from natural sources (minerals) led to an increase in plant height, number of leaves, fresh and dry weight of the plant, length, diameter, and weight of the onion, as well as the elements nitrogen, potassium, phosphorus, copper, manganese, zinc, and iron in the plant tissues. (26) noticed an increase in the yield of bulbs, dry matter weight, nitrogen, phosphorous, and potassium elements of the plant when poultry and cow waste were added at a rate of  $18 \text{ metric tons. h}^{-1}$ . According to several research studies, utilizing compost tea in soils can result in excellent onion yields (8, 28). Furthermore, according to (24), compost tea is expected to have a higher level of microbial activity than compost. Compost tea could be an agent for enhancing plant growth in crops grown organically (17). Compost tea's role in improving soil physical and biological properties, such

as water retention, drainage, pH, availability of microorganisms in the soil , and reducing the detrimental effects of chemical-based pesticides and fertilizers on ecosystems (32). (10,13) demonstrated that compost tea prevents the spread of diseases in organic systems and noted that it also increases plant output by promoting root and vegetative growth. The superiority of the bulb neck measurements and average bulb weight after the application of compost tea may be due to the tea's capacity to produce plant hormones and provide beneficial microorganisms that colonize leaf surfaces, mineralize plant nutrients, and fix nitrogen, all of which have an impact on the physical yield properties (6,5). Application of tea waste compost led to increases in fresh and dry biomass, leaf length, root length, and K content (7). Application of sulfur led to an increase in leaf number (20, 15, 30). The increases in bulb diameter were greater when sulfur was used more effectively (1). Sulfur application considerably enhanced onion bulb weight compared to no application. The highest bulb weight was observed when sulfur was applied at a rate of 30 to 60 kg ha<sup>-1</sup>. Some scientists noticed an increase in bulb weight with increasing sulfur levels (16, 20, 15, 19). The onion's productivity was lower when sulfur was not applied. It was also noted that a graded level of sulfur application led to an increase in the yield of onions up to 50 kg ha<sup>-1</sup>, which reaches the bulb yield of 35.5 tons (3).The onion bulb yield responded significantly, from 30 to 75 kg ha<sup>-1</sup> (23).

## CONCLUSION

Based on the findings of the present study, the application of organic

fertilizers for horses, poultry, cows, and vegetables as compost teas besides spraying plants with sulfur and DAP fertilizer led to a significant increase in the vegetative growth traits of onion plants, so it could be concluded that the foliar spraying of compost tea and sulfur are suitable fertilizer supplements to improve the growth, thus reducing the use of chemical fertilizers.

**Table 3.** Effect of several types of organic fertilizers (compost tea), chemical fertilizer (DAP), and sulfur on the growth traits of onion plants

Treatments	Plant height cm	Number of leaves	Onion diameter cm	Onion length cm	Plant weight g.plant <sup>-1</sup>	Total weight ton. hectare <sup>-1</sup>
Horse compost tea	79.03	9.10	4.33	7.53	422	84.40
Poultry compost tea	79.60	7.73	2.40	8.26	398	79.60
Cow compost tea	76.86	9.20	3.54	6.13	462	92.40
Vegetable compost tea 1	76.43	7.76	3.24	5.80	426	85.20
Sulfur	79.66	8.73	2.67	6.36	483	96.60
DAP compost	77.66	8.33	2.73	6.40	425	85.00
Vegetable compost tea 2	71.30	8.06	2.66	5.73	321	64.20
Control	59.06	4.96	1.36	4.16	142.5	28.40
CD (0.05)	8.90	1.68	0.72	1.06	7.50	0.64

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