

Effect of Spraying with Organic Fertilizer and Sorbitol Sugar on Growth and Yield of Cabbage

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Abstract: This study was carried out at the field, Horticulture Dept. Field - College of Agriculture - University of Diyala – during the winter season (2021 - 2022) to study the effect of Spraying Organic Fertilizer and Sorbitol Sugar on the growth, yield produced from Cabbage (Glop Master). A factorial experiment with two factors, Organic Fertilizer concentration (0, 100, 150, 200 mL⁻¹) and Sorbitol Sugar concentration (0, 5, 10 gL⁻¹), was conducted according to randomized complete block design (R.C.B.D) with three replications. Results showed significant superiority of Organic Fertilizer at 200 mL⁻¹ in the head height 24.62cm, stem diameter 2.408 mm⁻¹, number of external leaves 8.774 leaf plant⁻¹, number of roll leaves 21.51 leaf plant⁻¹, dry weight 340.0 gL⁻¹, the total chlorophyll content in leaves 59.57 unit spad, head weight 1.260 kg⁻¹, head diameter 23.21mm⁻¹, Production of one plant 1.578 kg-1 and total yield 52.61ton ha-1, then the lowest values in the control treatment). The result also showed significant increase of Sorbitol Sugar in concentration 10 g L⁻¹ in head height 23.70 cm, stem diameter 2.336 mm⁻¹, number of external leaves 8.931, number of roll leaves 21.49, dry weight 360.0 g⁻¹, the total chlorophyll content in leaves 59.16 unit spad, head weight 1.290 kg⁻¹, head diameter 23.08 mm⁻¹, Production of one plant 1.581 kg⁻¹ and total yield 52.72ton ha⁻¹, then the lowest values in the control treatment). The interaction between the two factors were significant for all the studied traits, Indicated that the response of Cabbage to first variable is related to the second one. Thus, the research has concluded that the Interaction of both variables; Organic fertilizer (200 m L⁻¹) and Sorbitol Sugar 10 gL⁻¹ has great combination to increasing the growth and the yield of Cabbage.

Keywords: Cabbage, Fruits, Organic fertilizer, Sorbitol Sugar, Yield.

1. INTRODUCTION

Cabbage (*Brassica Oleracea var. capitata*. L) belongs to the Cruciferae family (9). It is one major winter leafy vegetable. It is grown naturally in middle east region, Cabbage is well grown in cool humid weather and grown for hand grown row and the end bud. The leaves was used in pickle or cooked (12). Cabbage is a good antioxidant and anti- inflammation and anticancer, anti- constipation and to treat stomach fester and treating skin inflammation and lowering blood sugar (8, 9). It is grown in most parts of Iraq, Cultivation area is reached to 921.5 ha⁻¹ in 2020 with a yield of 8789 ton plant⁻¹. (11) Organic Fertilizer is an important and necessary for the growth and reproduction of plant to complete its life's cycle, It contains

both macro and micro nutrients, the absence of these elements or lack of their availability can make a plant die before the completion of its life's cycle from seed to seed, which has a great role in the physiological processes of the plant. Therefore, it has an impact on physiological processes. Organic fertilizer usually works to, vegetable growth, stimulates root, increase the number of leaves, foliar area, number of branches, increasing the effectiveness of growth regulators, especially Auxin and cytokines. It also has a great role in the formation of organic acid, amino acid and Nucleic acid (RNA, DNA). Energy compound (ATP, NADP) and proteins in the plant. Therefore, the macro and micro elements are necessary to complete the process of elongation and cell division in a plant to grow and complete the life cycle of the plant (4, 3 and 2). Sorbitol Sugar is a carbohydrate ($C_6H_{14}O_6$). It is one of the most important products of the process of photosynthesis. Sugar Sorbitol freely and easily moves inside the plant. It was discovered in 1996 with natural elements and other macro and micro elements inside the phloem (9, 10 and 14). Therefore, this increase in element movement within the phloem leads to an increase in growth and yield. This current study aims to investigate the effect of Organic fertilizer and Sorbitol Sugar, which is a new generation of nutrients that fasten the absorption and nutrient movement from the source to the sink on growth, yield and quantity of the seeds produced from Cabbage plants.

2. MATERIALS AND METHODS

This experiment was carried out in the field of Department-Horticulture- College of Agriculture - University of Diyala. to investigate the influences of different levels of Organic fertilizers spray with Sorbitol Sugar - during 18/9/2021 to 1/2/2022. It aims to study the effect of spraying Organic fertilizer and Sugar Sorbitol on growth, yield of Cabbage cultivar (*Glop Master*) F_1 . The production of used seed is by Origin (USA company .Takii Seed) according to (9), after (90) days of transplantation, with germination rate 90%, off type 1.00% and purity 99.00%, date of production 1/7/2020. Then, the seeds planted in cork dishes on 20/7/2021. The seedlings transferred to the field on 18/9/2021. The practical experiment included two factors, Organic fertilizer with four concentrations (0, 100, 150, and 200 mL^{-1}). Sorbitol Sugar at three concentrations (0, 5, 10 $g L^{-1}$), in addition to the control treatment (spraying with distilled water). Plants were sprayed three times in 3/10/2021, 18/10/2021 and 3/11/2021. The experiment was performed in RCBD with three replications consisted 36 experimental units and each unit contained 10 plants with 6 m in length 0.75 m width and 0.4 m space between plants, At the end season, 5 plants, from each experimental unit, are randomly collected in order to structural features, such as height of head ($cm plant^{-1}$), Stem diameter ($mm plant^{-1}$), Number of external leaves of head ($leaf plant^{-1}$), Number of per leaves of head ($leaf plant^{-1}$) weight of head ($kg plant^{-1}$), Diameter of head ($cm plant^{-1}$) plant yield ($kg plant^{-1}$) and total yield ($ton ha^{-1}$), The SAS system was used (Windows 2010) for statistical analysis, The Duncan calculates the smallest significant between two means (13).

3. RESULT

Vegetative traits: Individual application of spraying Organic fertilizer treatment O_4 caused significant increase in all vegetative growth, characters head height 24.62 cm, stem diameter 2.408 mm^{-1} , number of external leaves 8.774 $leaf plant^{-1}$, number of roll leaves 21.51 $leaf plant^{-1}$, then the lowest values in the control treatment. While, Sorbitol Sugar resulted, spraying on the leaves treatment S_2 caused significant increase in all vegetative, characters

head height 23.70cm, stem diameter 2.336 mm⁻¹, number of external leaves 8.913 leaf plant⁻¹, number of roll leaves 21.49, then the lowest values in the control treatment. The result of interaction as reveals in Table 1 between Organic fertilizer spray and Sorbitol sugar treatment S₂+O₄ were shown caused significant increase in vegetative growth, characters, head height 25.07 stem diameter 2.640 mm⁻¹, number of roll leaves 23.66. As compare to control treatment which gave the lowest values.

Yield traits:

As observed in Table 2 there was significantly, when spraying with Organic fertilizers concentration 200 mL⁻¹, head weight 1.260 kg⁻¹, head diameter 23.21mm⁻¹, Production of one plant 1.578 kg⁻¹ and total yield 52.61ton ha⁻¹, will the control treatment gave the lowest value.

Data in Table 2 Indicates spraying of the Sorbitol Sugar concentration 10 gL⁻¹ has significantly increased of, head weight 1.290 kg⁻¹, head diameter 23.08 mm⁻¹, Production of one plant 1.581 kg⁻¹ and total yield 52.72 ton ha⁻¹, then the lowest values in the control treatment.

Results in Table 2 The results of the interference between Organic fertilizer spray and Sorbitol sugar treatment S₂+O₄ were shown caused significant increase in most fruitage, head weight 1.433 kg⁻¹, head diameter 23.99 mm⁻¹, Production of one plant 1.661 kg⁻¹ and total yield 55.36Tonha⁻¹, then the lowest values in the control treatment.

4. DISCUSSION

This may be due to the role of Organic fertilizer in increasing the availability and concentration of some major and minor nutrients (3,4, and12), Therefore, it works to stimulating vegetative growth by increasing number of leaves, leaves area. Organic fertilizer also increasing chlorophyll content of leaves by formation pigment, which is reflected in increased photosynthesis, Carbohydrates and growth regulators particularly Auxins and Cytokines. Besides, it will help in formation of proteins in the plant through the and nucleic acid, DNA, RNA. They are very important in cell division and elongation (1,8), These results were in agreement with some previous studies (1,5). Thus, Sugar Sorbitol can transport the macro and micro nutrients, elements move freely and easily within the plant, and as we known Sorbitol one of the forms that facilitate the transfer of Organic fertilizer inside the phloem on a complex image dis- (Sorbitol) ester (6, 7, and113). The transfer of the macro and micro elements from the source to the sink may improve physiological and biochemical processes. These elements important in the process of photosynthesis and respiration as they enter the synthesis of RNA and DNA that they are necessary for cell division and elongation. in addition to its role in the manufacture of Hormones (Auxins, Cytokines), that leading to elongation and cell division and thus increasing vegetation traits (6,7).

5. CONCLUSION:

In this study the interaction between the two factors were significant for all the studied traits, Indicated that the response of Cabbage to first variable is related to the second one. Thus, the research has concluded that the Interaction of both variables; Organic fertilizer

(200 mL⁻¹) and Sorbitol 10 g L⁻¹ has great combination to increasing the growth and the yield of Cabbage.

<i>Table. 1 Effect of spraying Organic Fertilizer and Sorbitol and their interaction on Vegetable traits in Cabbage .</i>					
Sorbitol Sugars g- l	Height of head cm plant ⁻¹				Mean B
	Organic Fertilizer mL ⁻¹				
S ₀	19.99 F	22.10 ED	22.42 CED	23.77 ABCD	22.07
S ₁	22.14 ED	22.99 BCED	24.41 ABC	24.99 AB	23.65 A
S ₂	21.49 EF	23.83 ABCD	24.50 AB	25.07 A	23.70 A
Mean	21.13 C	22.97 B	23.76 AB	24.62 A	
Stem diameter mm ⁻¹					
S ₀	1.652 B	1.776 AB	1.740 AB	2.343 AB	1.878 B
S ₁	1.818 AB	2.045 AB	2.349 AB	2.340 AB	2.138 AB
S ₂	1.828 AB	2.328 AB	2.550 AB	2.640 A	2.336 A
Mean	1.765 B	2.018 AB	2.190 AB	2.408 A	
Number of external leaves leaf Plant ⁻¹					
S ₀	6.663 E	7.663 DE	8.106 BCD	8.440 ABCD	7.718 B
S ₁	7.912 CDE	8.415 ABCD	8.747 ABCD	8.830 ABCD	8.476 A
S ₂	7.665 DE	9.330 AB	9.495 A	9.165 ABC	8.913 A
Mean	7.441 B	8.367 A	8.700 A	8.774 A	
Number of leaves per head leaf plant ⁻¹					
S ₀	17.00 D	17.44 D	18.66 CD	20.33 BC	18.35 C
S ₁	18.08 CD	19.83 BC	21.16 B	21.33 B	20.10 B
S ₂	18.50 CD	21.83 B	22.00 AB	23.66 A	21.49 A
Mean	17.81 C	19.47 B	20.51 AB	21.51 A	
<i>Table. 2 Effect of spraying Organic Fertilizer and Sorbitol and their interaction</i>					

<i>on Fruits traits in Cabbage .</i>					
Sorbitol Sugars gL^{-1}	Diameter of head cm plant^{-1}				Mean
	Organic Fertilizer mL^{-1}				
S ₀	18.22 E	20.77 D	21.00 D	22.55 ABC	20.63 C
S ₁	21.08 CD	21.83 BCD	22.74 AB	23.32 AB	22.24 B
S ₂	21.16 CD	22.33 AB	23.83 A	23.99 A	23.08 A
Mean	20.14 C	21.81 B	22.40 B	23.21 A	
Weight of head kg plant^{-1}					
S ₀	0.928 E	1.044 DE	1.055 DE	1.173 CBDE	1.050 B
S ₁	1.102 CDE	1.227 ABCD	1.327 ABC	1.238 ABCD	1.224 A
S ₂	1.133 CDE	1.239 ABCD	1.358 AB	1.433 A	1.290 A
Mean	1.051 B	1.169 AB	1.243 A	1.260 A	
plant yield kg plant^{-1}					
S ₀	1.208 G	1.355 F	1.442 DEF	1.508 BCDE	1.378 C
S ₁	1.404 EF	1.479 CDEF	1.556 ABCD	1.589 ABC	1.507 B
S ₂	1.446 DEF	1.587 ABC	1.633 AB	1.661 A	1.581 A
Mean	1.348 C	1.462 B	1.535 A	1.578 A	
Sorbitol Sugar gL^{-1}	Total yield ton ha^{-1}				Mean
	Organic Fertilizer mL^{-1}				
S ₀	40.55 C	45.17 F	48.79 CDEF	50.27	46.19 C
S ₁	46.82	49.32	51.87	52.98	50.25 B
S ₂	48.20	52.89	54.43	55.36	52.72 A
Mean	45.03 C	48.73 B	51.41 A	52.61 A	

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