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Response of cabbage plants to foliar application of yeast suspension and nitrogen fertilizer

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ABSTRACT

The present study was carried out in Baqubah nursery, Directorate of Diyala agriculture during 2018 to study the effect of foliar spraying of bread yeast suspension with different levels (0, 3, and 6 g/L^{-1}) and Nitrogen fertilizer with different levels (0, 3, and 6 g/L^{-1}) on vegetative growth traits of cabbage plants. Results of this study showed that foliar application with yeast increased significantly the vegetative growth and yield of cabbage, while Nitrogen fertilizer did not cause any significant effect, Meanwhile foliar spraying with active yeast suspension at rates of 3 and 6 g/L^{-1} recorded highest values of plant height, leaf length, leaf width, head diameter, head weight and yield /hectare, which reached (36.4,36.5 cm), (31.0, 32.3 cm), (29.7, 32.5 cm) (19.9, 21.0 cm), (1916.6, 2122.2 g), (82.1, 90.9 ton/hectare) respectively as compared with non-spraying 0 g/L^{-1}, whereas the interfere between yeast suspension and Nitrogen fertilizer was significant, where yeast suspension at 6 g/L^{-1} and Nitrogen fertilizer at 3 g/L^{-1} recorded the highest rate in most of previous traits, also the spraying of yeast suspension and Nitrogen fertilizer at 3 and 6 g/L^{-1} has led to reducing in rate of maturity days, which reached (113.0, 116.0 days), (114.6, 114.4 days) respectively as compared with non-spraying 0 g/L^{-1}.

Key word : *Bread yeast suspension, Nitrogen fertilizer, Cabbage*

Introduction

Application of organic and bio fertilizers is growing gradually in most of the countries to purpose conserve the environment and human health, which became under hazard due to the unbalanced use of chemical fertilizers and pesticides (Agamy *et al.*, 2013). Excessive use of chemical fertilizers not only affects fruit quality, but also causes environmental pollution. (Salim *et al.*, 2016). Farmers in Iraq rely on only chemical fertilizers to maintain crop yield, but few of them are using organic fertilizers and may be no one apply bio fertilizers to support the soil. Biofertilizers with their various kinds are living microorganisms which have a beneficial role in forming a proper region around of roots that promote growth of plants through facilitate uptake of minerals. Biofertilizers are effective, low cost and renewable to supplement chemical fertilizers by plant nutrients (Boraste *et al.,* 2009). Active dry yeast *Saccharomyces cerevisiae* is a natural bio fertilizers that effects on plants due to it contains vitamins, amino acids, major and minor nutrients and growth promoting substances such as cytokinins (Medani and Ragab,

2015). Dry yeastis considered as a natural source of cytokinins and biostimulant that stimulates cell enlargement and division, chlorophyll formation and synthesis of nucleic acid and protein (Wanas, 2002, El- Desouky *et al.*, 1998; and Wanas, 2006). It has a role in producing important substances such as gibberellins, auxins and contain of many nutrient elements (Sarhan and Sharif, 1988). It contains several vitamins, proteins, amino acids and sugars (Mahmoued, 2001). The influence of yeast extract may be attributed to its effect on biological activity, enzyme activity, photosynthetic pigments and metabolism, which enhance vegetative growth (El-Sherbeny *et al.*, 2007 and Wanas, 2002. (It may increase antioxidants, enhance metabolism and water holding capacity (Abbas, 2013). It also releases CO_2 which leads to improving of photosynthesis (Kurtzman and Fell, 2005). Tartoura (2001) found that the bread yeast suspensionwas contained carbohydrates, protein, plant growth regulators GA, IAA and the necessary elements for plant growth at different proportions such as N 1.2%, P 0.13%, K 0.03%, Br 0.016%, Zn 0.05% Na 0.01%, Mg 0.07%,Fe 0.13%, Ca 0. 02%. The present study was designed to disclose the impact of different levels of active yeast suspension and Nitrogen fertilizer on vegetative traits of cabbage.

Materials and Methods

The present investigation was carried out during the season 2018 in the Directorate of Diyala agriculture, Baqubah nursery, Iraq to study the effect of foliar application of different levels of active yeast suspension and Nitrogen on vegetative traits of cabbage. Seedlings of cabbage cv. Rock were sown directly in soil on 3/9/2018 in rows with distances between them 60 cm and between plants were 50 cm which arranged in a factorial experiment design with two factors, the first of which includes three levels of active yeast suspension (0.3,6 g/ liter distilled water), the second factor also includes three levels of Nitrogen 0,3,6 g/liter distilled water through using of urea (46% N) with three replicates for each treatment where each replicate contain 6 plants, the land was prepared for cultivation by plowing, disking and ridging, then taking soil samples representing the depth of plowing (0 - 0.15 m) in order to record the physical and chemical properties of the soil, as set out in (Table 1). The active yeast suspension was sprayed on the plants at two times on 16/10/2018 and 18/11/2018, also Nitrogen at 17/10/2018 and 19/11/2018. High phosphorus fertilizer and NPK fertilizer were applied at a rate of 80 and 40 kg/ha respectively, after 30 days of planting by the drip irrigation system, the water irrigation was pumped through the drip irrigation system.The following measurements were recorded such as plant length, stem length, leaf length, leaf width, fruit head diameter, head weight/g, yield/hectare, Maturity/days.

Table 1. The physical and chemical properties of the soil before planting

Measurements	Value	Unit of measure-
Clay	328.1	g / kg soil
Silt	280.1	g / kg soil
Sand	391.8	g / kg soil
Texture of soil	Mixed clay	-
CaCO3	276.13	g / kg soil
Organic matter	1.4	%
N	34.89	mg / kg soil
P	8.13	mg / kg soil
K	347.30	mg / kg soil
Ca	17.45	millmole/ liter
Mg	16.05	millmole/ liter
Na	2.36	millmole/ liter
HCO3	7.9	millmole/ liter
Cl	14.5	millmole/ liter
So_4	20.85	millmole/ liter
Co_3	0.0	millmole/ liter
Ec	5.93	ds Siemens \ m
PH	7.82	-

Preparation of yeast suspension

Dry yeast suspension was prepared by dissolving 3 and 6 g of yeast in a liter of distilled water at a room temperature, then adding 2 g sucrose to activate of yeast and left it for two hours before using (Chalutz *et al.*, 1977).

Statistical analysis

The data was analyzed by one way Analysis of Variance (ANOVA) (Fisher and Yates, 1968).

Results

Table (2) showed that the addition of active yeast suspension at 3 and 6 g/L has led to a significant increase in rate of plant height, leaf length and leaf width, which reached (36.4,36.5 cm), (31.0, 32.3 cm), (29.7,32.5 cm) respectively, superior over non addition 0 g/L^{-1}, also the addition of Nitrogen fertilizer

Table 2. Effect of active yeast suspension and Nitrogen fertilizer on plant length, leaf length and leaf width

Plant length B Nitrogen conc.	A Yeast conc.			
	0	3	6	Rate
0	30.2	36.1	36.6	34.3
3	35.7	36.2	38.0	36.6
6	33.5	37.0	34.9	35.2
Rate	33.1	36.4	36.5	
CD 0.05	A= 1.8, B= 1.8 , A x B= 3.1			
Leaf length B Nitrogen conc.	A Yeast conc.			
	0	3	6	Rate
0	25.6	31.8	33.2	30.2
3	30.2	29.4	32.2	30.6
6	30.0	31.9	31.5	31.1
Rate	28.6	31.0	32.3	
CD 0.05	A= 1.4, B= 1.4, A x B= 2.5			
Leaf width B Nitrogen conc.	A Yeast conc.			
	0	3	6	Rate
0	23.2	30.8	33.7	29.2
3	28.3	27.1	32.9	29.4
6	28.2	31.3	31.0	30.1
Rate	26.5	29.7	32.5	
CD 0.05	A= 1.6, B=1.6, A x B= 2.8			

at 3 g / L^{-1} has led to a significant increase in rate of plant height which reached (36.6 cm) as compared withnon-addition 0 g/L^{-1}, as for the impact of interfere between treatments presented in Table 2 show that the highest value of plant height was recorded in yeast suspension at 6 g/L^{-1} and Nitrogen fertilizer at 3 g/L^{-1}, which reached (38.0 cm), while the highest values of leaf length and leaf width were recorded in yeast suspension at 6 g/L^{-1} and Nitrogen fertilizer at 0 g/L^{-1} reached (33.2,33.7 cm) respectively.

The results presented in the Table 3 clearly revealed that, foliar spraying of yeast at 3 and 6 g/L^{-1} significantly had an influence on all growth characters (head diameter, head weight and yield /hectare as compared with non-spraying 0 g/L^{-1}, which reached (19.9, 21.0 cm), (1916.6, 2122.2 g), (82.1, 90.9 ton /hectare) respectively, no significant differences between Nitrogen concentrations rates, while the combine between active yeast suspension and Nitrogen fertilizer was significant, where yeast suspension at 6 g/L^{-1} and Nitrogen fertilizer at 3 g/L^{-1}

Table 3. Effect of active yeast suspension and Nitrogen fertilizer on fruit head diameter, head weight/ g, yield /hectare , Maturity/days

Head diameter cm B Nitrogen conc.	A Yeast conc.			
	0	3	6	Rate
0	15.5	20.7	21.5	19.2
3	18.4	17.8	21.7	19.3
6	18.8	21.2	19.9	20.0
Rate	17.5	19.9	21.0	
CD 0.05	A= 1.2, B=1.2, A x B = 2.197			
Head weight/ g B Nitrogen conc.	A Yeast conc.			
	0	3	6	Rate
0	1124.9	2077.7	2238.8	1813.8
3	1666.6	1488.8	2294.4	1816.6
6	1727.7	2183.3	1833.3	1914.7
Rate	1506.4	1916.6	2122.2	
CD 0.05	A= 222.8, B= 222.8, A x B= 386.0			
Yield ton/hectare B Nitrogen conc.	A Yeast conc.			
	0	3	6	Rate
0	48.2	89.0	95.9	77.7
3	71.4	63.8	98.3	77.8
6	74.0	93.5	78.5	82.0
Rate	64.5	82.1	90.9	
CD 0.05	A= 9.5, B = 9.5, A x B = 16.5			
Maturity/days B Nitrogen conc.	A Yeast conc.			
	0	3	6	Rate
0	128.0	113.0	113.0	118.0
3	113.0	113.0	118.0	114.6
6	113.0	113.0	117.3	114.4
Rate	118.0	113.0	116.1	
CD 0.05	A= 1.9, B= 1.9, A x B= 3.4			

recorded the highest rate of previous traits reached (21.7 cm, 2294.4 g, 98.3 ton /hectare) respectively, also the spraying of yeast suspension and Nitrogen fertilizer at 3 and 6 g / L^{-1} has led to reducing in rate of maturity days,which reached (113.0,116.0 days) , (114.6, 114.4 days)respectively as compared with non-spraying 0 g/L^{-1} , whereas the yeast suspension at 0 g/L^{-1} and Nitrogen fertilizer at 0 g/L^{-1} recorded the highest rate of maturity days,which reached 128.0 days.

Discussion

Previous results showed that applying of active

yeast suspension positively affected all of studied growth characteristics of cabbage. Dry yeast is used in the bio and organic fertilization system as an alternative source of growth substances (Ezz El-Din and Hendawy, 2010). Foliar application of yeast led to increase quality and yield of many vegetable crops (Fawzy, 2007; Kabeel *et al*., 2005 and Abou El-Nasr *et al*., 2001). Application of the active yeast extract led to improving growth and productivity of vegetable crops such as (Taha and Omar, 2010; Ahmed *et al*., 2011) on potato plants (El-Ghamriny *et al.,* 1999; Fathy *et al*., 2000) on tomatoes, (Tartoura, 2001; El-Desuki and El-Greadly, 2006) on pea. (Amer, 2004; El- Tohamy and El-Greadly, 2007) on beans (Hewedy *et al.,* 1996; El-Tohamy *et al*., 2008) on eggplant. Heikal, (2005) demonstrated that applying of yeast enhanced essential oil yield, plant nutrition and growth of thyme plants. Sarhan (2008) noticed a significant increase in the physical and chemical characteristics of the potato and some vegetative growth parameters and yield traits when spraying plants with yeast suspension. Yazdani *et al,* (2009) confirmed that the spraying of yeast suspension on corn led to an increase in the content of the seeds from the mineral elements. Hussein and Kalaf, (2008) reported that spraying of potato plants with different concentrations of dry bread yeast enhanced number of branches, plant height , number of tubers per plant, dry matter in the shoot and the rate of tuber weight and plant yield. Using of dry bread yeast led to improving productivity in some vegetable crops (Fathy and farid 1996; Fathy *et al.* 2000; Mohammed *et al*., 1999; Omar, 2003; Sarhan 2008). Sarhan *et al*. (2011) found that the spraying of dry bread yeast at 6 g/L^{-1}concentration on cucumber plants led to a significant increase in, number of fruits per plant, average weight of the fruit, plant height, plant yield, early yield and total yield. Salim *et al.* (2018) reported that the productivity of cabbage significantly increased in response to the biofertilizer (*Pseudomonas fluorescens* and *Azotobacter chroococcum*) which played an important role in enhancing of plant nutrient status and increasing the growth of cabbage plant.

Conclusion

The results of the present investigation indicated that, foliar application of yeast suspension as stimulated dose was superior effect of vegetative growth characteristics of cabbage. It could be concluded that, yeast more effective as a bio-stimulant for yield and quality of cabbage plants under the field conditions.

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