

## Efficacy of Bio-Fertilizers *Pseudomonas fluorescens* and *Azotobacter chroococcum* on Yield of Cabbage (*Brassica fleracea* L. Var. *Capitata*)

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### Original Research Article

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**Abstract:** This study was conducted to investigate the effect of biofertilizer (*Pseudomonas fluorescens* and *Azotobacter chroococcum*) on growth of cabbage (*Brassica oleracea* L. var. *capitata*), the experiment was carried out at the experimental farm of soil laboratory belong to Directorate of Diyala Agriculture, Iraq during 2017, the experiment included three levels of bio fertilizers 0.08, 0.14 and 0.28 g/plant, it was laid out in randomized complete block design having four treatments with four replications. The results showed a significant increase in cabbage yield in treatments that inoculated with biofertilizer. The highest increase in yield of cabbage (plant weight, head weight, total plant weight (ton\acre) and total head weight (ton\acre)) was achieved in Biofertilizer 0.14 g/plant was reached 1262.375 g, 810.025 g, 14.026 ton\acre and 9.000 ton\acre respectively followed by Biofertilizer 0.28 g/plant, 1113.125 g, 757.875 g, 12.367 ton\acre and 8.421 ton\acre respectively and Biofertilizer 0.08 g/plant, 1000 g, 700 g, 11.111 ton\acre and 7.777 ton\acre respectively as compared with control 731 g, 363g, 8.122 ton\acre and 3.883 ton\acre respectively .

**Keywords:** cabbage (*Brassica oleracea* L. var. *capitata*), *Pseudomonas fluorescens*, *Azotobacter chroococcum*.

### INTRODUCTION

Cabbage (*Brassica oleracea* var. *capitata* L.) is popular as a winter season vegetable belongs to family Brassicaceae, short duration crop gives more yields per unit area, They are highly nutritious and protective and contain more of vitamins and minerals as compared to other cereal crops [1].

The Food and Agriculture Organization [2] has identified cabbage as one of the top twenty vegetables and an important source of food globally. The massive application of inorganic fertilizers, fungicides and insecticides have increased the toxicity and polluted the total ecosystem of the rhizosphere [3]. Use of Bio-fertilizer can promote plant growth by increasing the supply or availability of macro and micronutrients through the natural processes [4]. Bio-organic fertilizers plays a key role in plant growth as a source of all necessary nutrients in available forms through improving the biological, chemical and physical properties of soils as well as mineralization [5]. *Azotobacter chroococcum* fixes extra nitrogen through roots from the atmosphere, *Pseudomonas* soluble the extra phosphorus and both of the bacteria increase potassium content [3]. The main objective of this research was to investigate the effects of inoculation of *Azotobacter chroococcum* and *Pseudomonas fluorescens* bacteria on cabbage yield under field conditions.

### MATERIALS AND METHODS

The trial was conducted at soil laboratory farm, Directorate of Diyala Agriculture, Iraq during 2017. The seedlings of Cabbage were obtained from nursery of Diyala Agriculture and transplanted in the soil with Ec 0.81 dsm and PH 7.13 at 19\9\2017. Bio fertilizer (*Pseudomonas fluorescens* & *Azotobacter chroococcum*) as commercial formulation was obtained from a ministry of science and technology. Bio fertilizers were added to each plant by drill the soil close the plant and deep 5 cm at 18/10/2017, the experiment included three levels of bio fertilizers 0.08, 0.14 and 0.28 g/plant with a treatment of control without adding with four replications, whereas DAP fertilizer (Diammonium phosphate) at the rate of 100 kg\ hectare was added at 29/9/2017, the distance between row to row was kept as 40 cm and plant to plant was kept as 20 cm and watered as needed, ten plants of each replicate were taken randomly for recording plant weight , head weight, Total weight ton\acre and head weight ton\acre. The experimental

design was Randomized Complete Block and the data was analyzed by one way analysis of variance (ANOVA) [6]

**RESULTS AND DISCUSSION**

Data from Table-1 revealed that the differences with respect to the Plant weight (g), Head weight (g), Total plant weight (ton\acre) and Total head weight (ton\acre) were significant among different treatments. The maximum of Plant weight was superior in the treatment of Biofertilizer, 0.14 (1262.375 g) followed by Biofertilizer 0.28 (1113.125 g) and Biofertilizer 0.08 (1000 g) as compared with control (731 g), Biofertilizer, 0.14 was recorded highest significantly different in Head weight of cabbage (810.025 g) followed by Biofertilizer 0.28 (757.875 g) and Biofertilizer 0.08 (700 g) with significant differences from control (363 g), also treatment of

Biofertilizer, 0.14 was superior in Total plant weight and Total head weight reached (14.026 ,9.000 , ton\acre) followed by Biofertilizer 0.28 (12.367, 8.421 ton\acre) and Biofertilizer 0.08 (11.111, 7.777 ton\acre) as compared with control (8.122, 3.883 ton\acre) respectively .

These findings are supported by Shukla *et al.*, [5] and Akhtar *et al.*, [7], they reported that the application of biofertilizers *Pseudomonas fluorescens* with organic substances increased plant yield and improved the cabbage yield and soil fertility. Similar finding agreed with [8] reported that the maximum head weight and yield were obtained by treatment of *Azotobacter* that significantly superior over all the treatments and minimum head weight and yield were observed under the control.

**Table-1: Effects of bio fertilizers on some characteristics of Cabbage**

Treatments	Plant weight (g)	Head weight(g)	Total plant weight (ton\acre)	Total head weight (ton\acre)
Biofertilizer 0.08 g/plant	1000 c	700 c	11.111 c	7.777 c
Biofertilizer 0.14 g/plant	1262.375 a	810.025 a	14.026 a	9.000 a
Biofertilizer 0.28 g/plant	1113.125 b	757.875 b	12.367 b	8.421 b
Control	731 d	363 d	8.122 d	3.883 d
CD 0.05	59.6	35.9	0.66	0.42

**CONCLUSION**

Data in table-1 showed that, the productivity of cabbage significantly increased in response to the tested biofertilizer (*Pseudomonas fluorescens* and *Azotobacter chroococcum*) compared to control. From obtained results it was concluded that using of biofertilizers has the perspective to enhanced plant nutrient status, and boost cabbage plant growth, also may be considered a substitute for chemical fertilizer if added in sufficient quantities.

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