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ORIGINAL ARTICLE

Effect of Trichoderma, Humic acid Bacteria growth on some Agronomic traits in wheat

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ABSTRACT
Wheat (Triticum sativum L.) is regarded as one of the most important of crop productions. In order to evaluate the effect of Plant Growth Promoting Rhizobacteria (PGPR), Trichoderma and Humic acid *on the yield and physiological characteristics of wheat an experiment was done in factorial form, based on randomized complete block design with three replications in a field located in Taher Abad, Kashan in the year of 2012-2013. The experimental treatments were included of Plant Growth Promoting Rhizobacteria in two levels (use and nonuse), Trichoderma with two levels (use and nonuse) and* Humic acid *with two levels (use and nonuse).The results of the analysis of variance showed a significant effect of treatments on most of the traits you 5 levels of one percent. the use of growth-promoting bacteria, leading to an increase in length (3. 24cm), number of grains per spike (8.67), seed weight (4.52 g), weight of straw (8346 kg/ha) compared with the control treatment. Trichoderma consumption increases significantly in mean spike length (2.61cm), number of grains per spike (3.17), seed weight (3.3 g), straw weight (3870.4 kg/ha) in the control treatment. In addition, the maximum length of spikes (3.41cm), number of grains per spike (3.33), 1000 seed weight (18.1 g), straw weight (2793.75 kg/ha) in the treatment* Humic acid *consumption was observed. Examine the interaction effects showed that the combined use of experimental treatments yielded most good results.*

Keywords: Wheat, Plant Growth Promoting Rhizobacteria, Trichoderma, Humic Acid, yield

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INTRODUCTION

Human wheat as a staple food across the world is very important currently under cultivation and total production rate than other grains (rice, barley and maize) in the first place is running [1]. Usefulness of terrestrial organisms as bio-fertilizers as the most natural and most desirable way having resolved to keep alive and vital systems, soil, are discussed. Supply of organic matter to the soil, due to the urgent need to address it, the biggest advantage of such application. In addition, the provision of a fully tailored nutrition natural plant nutrients to aid biodiversity intensification of vital activities, quality improvement and protection of health and the environment in general, conservation of national assets (soil, water, non-renewable energy sources) are the benefits of Bio-fertilizers [1].

The excessive use of chemical fertilizers to produce more crops has caused despite the high costs, fertilizer production continues. As far as nitrogen and phosphate fertilizers in late 1360 and a growth of over 10 percent is [3] and in recent decades 4x consumption of phosphate fertilizers and nitrogen fertilizers is to 9 times as. As a result, the use of chemical inputs in agricultural land caused numerous environmental problems, including pollution of water resources environment, food quality crops and soil fertility decline has been [4]. This requirement necessitates the revision of new ways to increase productivity. Principles of sustainable agriculture and appropriate solution to solve this fundamental problem by using more of the inputs are within the field of Bio-fertilizers [4, 5, 6, 7].

The types of organic fertilizers and bio-accumulation can fungi, micro-organisms dissolved phosphate, Humic acid and vermicompost noted that today many applications in sustainable agricultural systems in order to achieve the quality and consistency of their performance and horticultural crops. Although the use of agricultural biological age is great, but the use of organic fertilizers and biological factors in the past few decades has reduced but today, due to the problems created by the indiscriminate use of chemical fertilizers has been reintroduced to their use in agriculture?
The research reported in this regard to investigate the effects stimulating bacterial growth and acid Hiumic Trichoderma was carried out on a number of agronomic traits in wheat.

MATERIALS AND METHODS

Profile of the test site

Research in crop year 2012 - 2013 was carried out on a private farm located in the city Taherabad. factorial experiment in a randomized complete block design with three replications and eight treatments were conducted in 24 experimental plots. In this experiment, the bacteria first factor driving growth in the consumer and not consumption (*Azotobacter karkokom* , *Azospirillium brasilense, Lipoferum putida*), the second factor consisted of two levels of Trichoderma and lack of the third factor consisted of two levels Humic acid intake was no intended use. Bacteria were used in this study belong to three genera Azotobacter, Pseudomonas and Azospirillum bacteria that this plant are known as a PGPR. Liquid inoculants, bacteria Azotobacter Kerkukum + Azospirillium brasilense lipoferum + Pseudomonas putida that indigenous soil bacteria and soil biology research by the Research Institute for Soil and Water isolated and purified, and inoculums of each millimeter of It has a lively 107 bacteria from each of the genera of bacteria .In this study, attributes such as length, number of grains per spike, 1000 seed weight and straw weight size and straw were measured. Period of growth after removal of the first half meter of each plot, five plants with scissors shoot on location and the size of the palm crown sent to the laboratory for measuring the hormonal change A.

Statistical Analysis

Aanalysis of variance for a factorial experiment in a randomized complete block design was conducted using the software SAS9.1. Duncan's test to compare the means Multiple range 5% was used drawing diagrams using the software Excel 2007 program has done.

RESULTS AND DISCUSSION

Spike length

ANOVA results indicated a significant effect for this trait (P <0.01) levels of growth promoting bacteria, Trichoderma and Humic acid on the traits (Table 1). Also according to this table, the interaction of PGPR and Trichoderma interaction between PGPR and Trichoderma interaction and Humic acid and the acid is significant at the one percent level. According to table 2, which shows the effect of PGPR on the length of treatment, the effect of PGPR significantly increased length (P <0.01), compared to control (no consumption) indicates that the amount equal to 24.3 cm. Humic acid sequence of Trichoderma and 2.61 and 3.41 cm increase in length compared to the control treatment (no consumption) showed (table 3 and 4). According to the study on the interaction of Trichoderma showed that treatment of PGPR + control (a1b1) and consume less PGPR and Trichoderma (a2b2) length had the highest rate. Also investigated the interaction of bacteria and Humic acid showed growth in the control treatment (a1c1) lowest consumption of bacteria growth + Hiumic acid intake (a2c2) had the highest rate of head length. The interaction of Trichoderma and Humic acid length indicated that the control treatments (b1c1) and the use of Trichoderma + Humic acid (b2c2) had the lowest and the highest spike length. In interpreting these results, it can be said bacteria with a variety of direct and indirect mechanisms; especially Fitohurmon production plant can be effective in increasing plant growth [8].

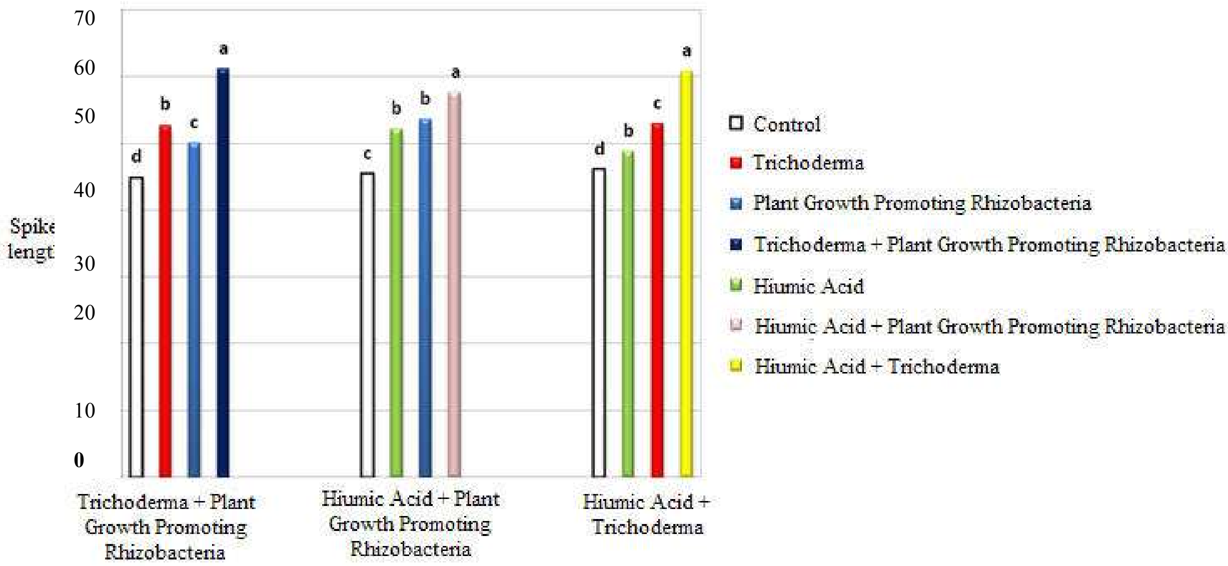

Figure 1 Comparison of Average the growth of bacteria and Trichoderma, Trichoderma acid bacteria Humic stimulating growth and acid Humic length shows.

Number of grains per spike

ANOVA results indicated a significant effect for this trait (P <0.01) levels of growth promoting bacteria, Trichoderma and Humic acid on the traits (Table 1). Also according to this table, the interaction of PGPR and Humic acid interaction % probability level and the interaction of multiple factors in experimental Trichoderma and Humic acid are significant at the 5% level. According to Table 2, which shows the effect of PGPR treatment on the number of grains per spike, the effect of PGPR significantly increased the number of grains per spike (P <0.01), compared to control (no consumption) indicates which is equal to the amount of 8.67, respectively. Trichoderma and Humic acid sequence 3.17 and 3.33increase in the number of grains per spike, compared to control (non consumption) showed (Table 3 and 4). Interaction effects showed that the Humic acid bacteria growth and control (a1c1) lowest consumption of bacteria growth + Humic acid intake (a2c2) had the highest rates of grains per spike. The interaction of Trichoderma and Humic acid on seed number indicates that the control treatment (b1c1) minimum consumption of Trichoderma + Humic acid (b2c2) grains per spike had the highest rate (Figure 2). The results of the comparison showed that the average effects of multiple largest number of kernels per treatment a2b2c2 (PGPR consumption + use + of Trichoderma humic acid), which is equal to 51.67 this amount compared to the control 15.67 increased. The least number of kernels per treatment a1b1c1, that is equal to 36 (see Figure 3). Similar results were also significant increase in wheat yield in the presence of Azotobacter following have been reported by researchers [9-11].

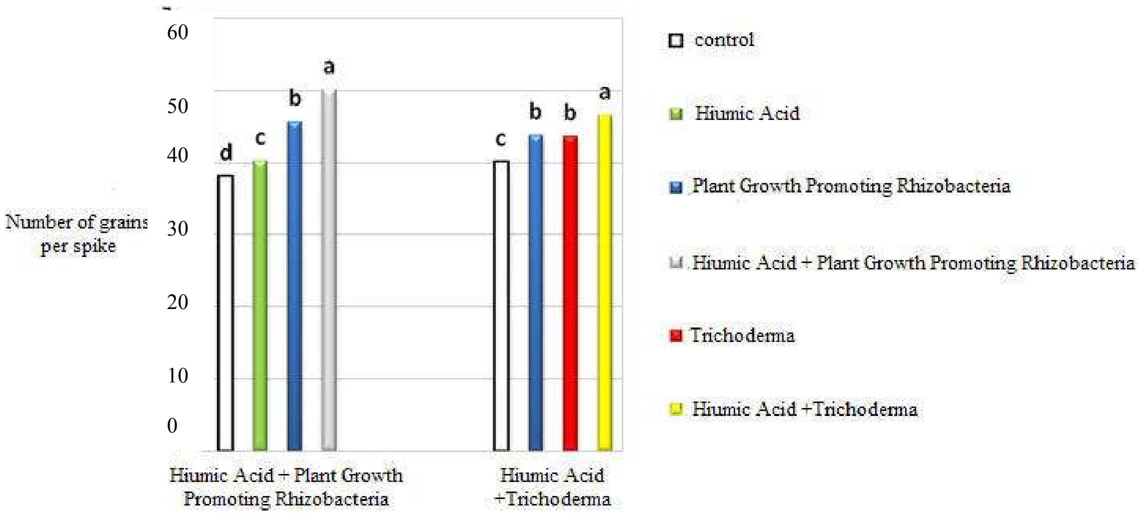

Figure 2- Comparison of Average of bacterial growth and acid Humic, Trichoderma and Humic acid on number of grains per spike

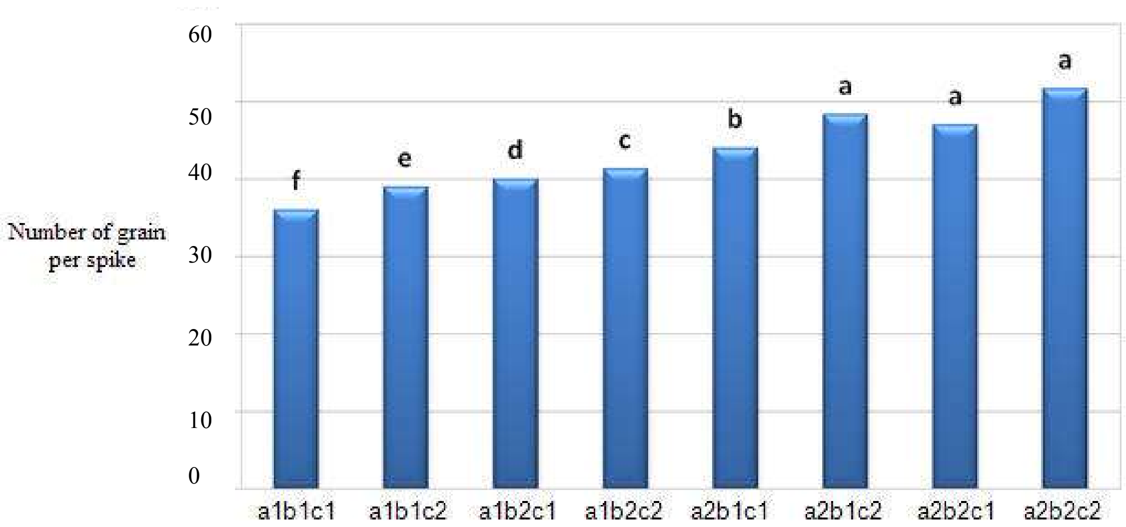

Figure 3- Comparison of the average impact growth of bacteria, Trichoderma and Humic acid on the number of grains per spike

1000 seed weight

ANOVA results indicated a significant effect for this trait (0.01>P) levels of growth promoting bacteria, Trichoderma and Humic acid on the traits (Table 1). Also according to this table PGPR and Trichoderma interaction and interaction Humic acid bacteria growth and is significant at the one percent level. According to Table 2, which represents the effect of PGPR on 1000 seed weight, 1000 seed weight significantly increased the effect of PGPR (0.01>P), compared to control (no consumption) indicates that This amount equals 52.4g. Humic acid sequence of Trichoderma and 3.3 and 18.1 gram increase in 1000 seed weight relative to the control (no consumption) showed (Table 3 and 4).

Straw weight

ANOVA results indicated a significant effect for this trait (P <0.01) levels of growth promoting bacteria, Trichoderma and Humic acid on the traits (Table 1). Also according to this table, the interaction of PGPR and Trichoderma interaction and Humic acid bacteria growth and interactions of multiple factors test is significant at the one percent level. According to table 2, which shows the effect of the weight of the straw is treated with PGPR, PGPR use of straw weight increased significantly (P <0.01), compared to control (no consumption) indicates that this amount was equal to 8346 kg per hectare. Trichoderma and Humic acid sequence 3870.4 and 2793.75 kg per hectare increase in straw weight relative to the control (no consumption) showed (Table 3 and 4). Figure 4 Comparison of average growth stimulating effects + Trichoderma bacteria, the bacteria will drive + Humic acid shows the weight of straw. Compared between treatment a1b1 (control) and lowest a2b2 (PGPR use of Trichoderma +) had the highest rates of straw weight. The study on the interaction between PGPR and Humic acid showed treatments a1c1 (control) and lowest a2c2 (use of growth-promoting bacteria + Humic acid intake) had the highest rates of straw weight. The results of the comparison showed that the highest average weight of triple effects of treated straw a2b2c2 (PGPR consumption + use + of Trichoderma humic acid), which was equal to 27,895 kg per hectare compared to the amount of 13490 kg ha increased control. The minimum weight of the treated straw a1b1c1 (control), which is equal to 14 405 kg ha (Figure 5).

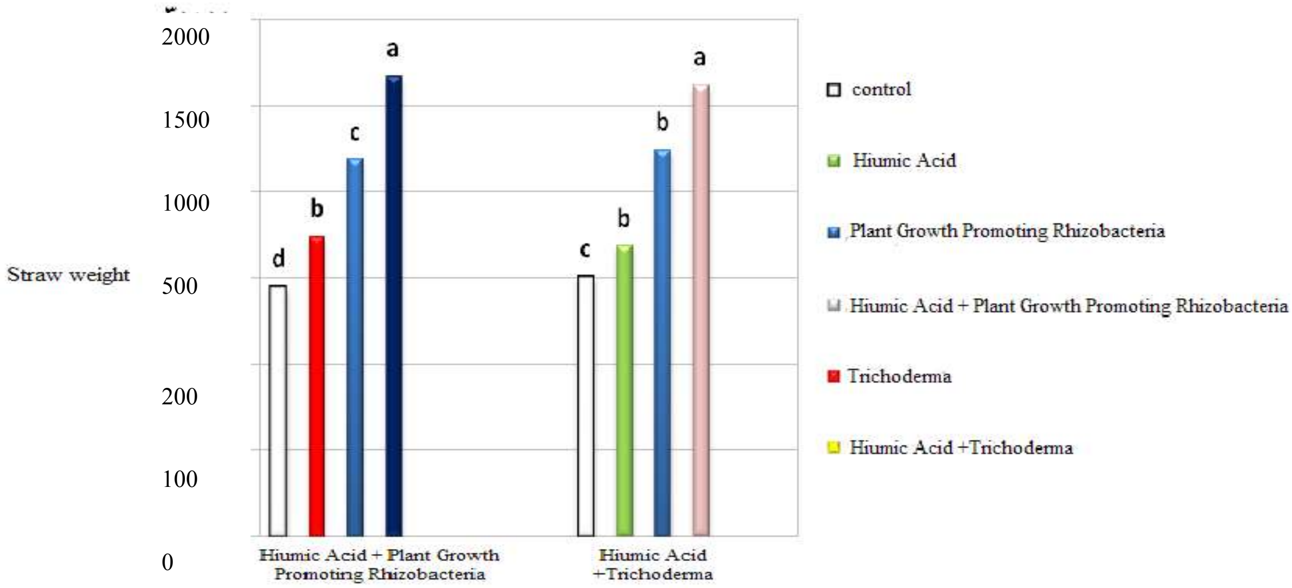

Figure 4 Comparison of average growth stimulating effects + Trichoderma bacteria, the bacteria will drive + Humic acid shows the weight of straw

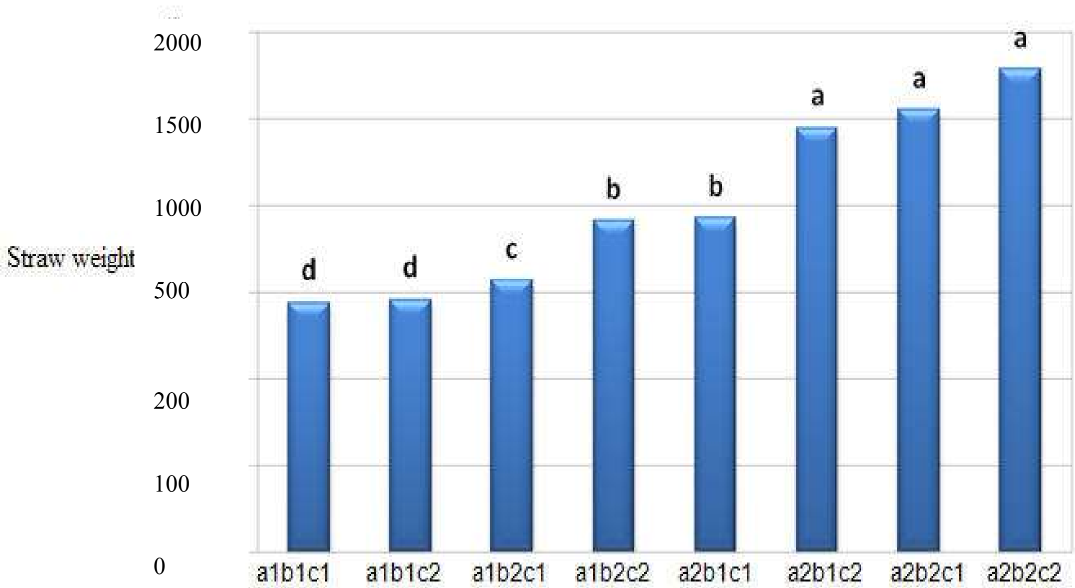

Figure 5- Comparison of the average impact growth of bacteria, Trichoderma and Humic acid on weight of straw

Results obtained on the application of straw weight gain of bacterial growth were in line with the results of other researchers. Over a two-year experiment on wheat and cotton researchers, found that selected strains of bacteria Azotobacter, significantly increased the yield and growth parameters such as plant dry weight and plant height were compared with the controls.

The results of inoculation with Azotobacter in cotton and wheat plants, led to the best growth of plants were grown under conditions [10].

Table1. Analysis of variance of plant traits in wheat

S.O.V	df	Mean of Square			
		Spike length	Number of grains per spike	1000 seed weight	Straw weight
Rep	2	0.004ns	6.292**	0.186ns	2616ns
Plant Growth Promoting Rhizobacteria (A)	1	11.16**	450.6**	122.7**	16718373**
Trichoderma (B)	1	21.41**	60.1**	65.4**	3595230**
Humic acid (C)	1	68.1**	6.666*	8.3**	1873209**
(A*B)	1	0.61**	0.008ns	2.6**	219842**

(A*C)	1	0.45**	8.16**	1.91**	240200**
(B*C)	1	1.59**	0.667*	0.096ns	2301ns
(A*B*C)	1	0.03ns	1.5**	0.313ns	554800**
(Error)	14	0.012	0.1	0.077	939.1
C.V.%		1.07%	0.73%	2.78%	3.46%
** and * respectively show a significant relationship in 1% and 5% probable level					

Table2. The mean levels for Plant Growth Promoting Rhizobacteria

Plant Growth Promoting Rhizobacteria	Mean of Square			
	Spike length	Number of grains per spike	1000 seed weight	Straw weight
No consumption	9.80b	39b	38.5b	21500b
Consumption	11.35a	48a	42.8a	24900a

Table3. The mean levels for Plant Growth Promoting Rhizobacteria

Trichoderma levels	Mean of Square			
	Spike length	Number of grains per spike	1000 seed weight	Straw weight
No consumption	9.5b	41.9b	39.1b	18000b
Consumption	11.4a	45.1a	42.2a	21000a

Table4. The mean levels for Plant Growth Promoting Rhizobacteria

Humic acid levels	Mean of Square			
	Spike length	Number of grains per spike	1000 seed weight	Straw weight
No consumption	9.8b	41.8b	40.2b	18950b
Consumption	10.9a	45a	41.4a	2150a

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