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The effect of vermicompost biological fertilizer on corn yield

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Abstract
Today, with the development of environmental pollution and health that is obtained from the use of chemical fertilizers, production and use of biological fertilizers (Biofertilizer) is considered as an important approach in the field of biotechnology, soil and agriculture in the world's interest to investors. In order to reduce the use of nitrogen fertilizer in agriculture of corn, a research by using randomized complete block design with split plot with three replications was conducted in 2013. The amount of nitrogen fertilizer at four levels, including the recommendation based on soil test (control), and 25, 50 and 75 percent of the recommended intake of bio-fertilizer as the main factor and vermicompost contains no biological fertilizer vermicompost (control) and consume 5, 7 and 9 tons per hectare bio-fertilizer were considered as sub plots. The results showed that application of different treatments has significant impact on corn yield, as 9 tons per hectare with a yield of 7.11 tons per hectare bio-fertilizer produced the highest grain yield. Effect of nitrogen fertilizer on yield was significant and the highest yield in the treatments of nitrogen based on soil test (control) was obtained with a yield of 5.11 tons per hectare.

Keywords: maize, yield, bio-fertilizer, vermicompost

1. Introduction
One of the most important cereals in human food production, almost 55% of the protein, 15 percent fat and 70 percent Glosid and 55-50 percent of calories consumed by humans in general in the world are financed by cereal [1].
Corn is strongest and largest crop and absorbing and releasing energy stored in the earth and energetically is very favorable for livestock forage and as a high-energy food is very important and provide main dish of large group of people either directly or indirectly through livestock products and plant accounts and the highest value compared to other grains. Hence its title is king of grains [1]. In our country, due to the limited expansion of the area under cultivation in soil and water resources and economic, self-sufficiency should be looking to increase yield per unit area, therefore, recognizing factors affecting yield seems necessary.
Nitrogen is the most important element in producing quality and quantity of crops, especially corn vital plant plays an important role. On the other hand economic and environmental problems caused by the indiscriminate use of chemical fertilizers nitrogen and attention to the innate potentials very interesting and varied soil organisms, especially microorganisms. One of the most important and most functional areas of research in the scientific studies, is trying to bio-fertilizers. In recent decades with the

increasing use of chemical fertilizers has serious environmental problems and economic burden on the society. In this regard, extensive efforts to find appropriate solutions to improve the soil, crops, and removing pollutants is started.
If sufficient nitrogen is available to plants, growth, it will be rapid and positive impact on the accumulation of protein in the grain [16]. Nitrogen fertilizers cause to increase forage yield and quality [11]. The dynamic of nitrogen in the soil caused by time and its application and bio-fertilizers is very important for success in seed yield [3]. Therefore, to achieve this objective by applying appropriate methods of nitrogen fertilizer during the growth period is possible [12]. Gillick et al (2001) announced the best time for application of nitrogen fertilizer at planting and 25 days after planting.
One of the solutions optimal production of the product and protect the health of the environment, providing the necessary conditions and the need for greater use of bio-fertilizers is the soil microorganisms. The use of soil microorganisms and biological fertilizers with different biological processes involved in plant growth and nutrient cycle are increasingly enhanced [14;15].
Nitrogen deficiency in the early stages of growth (height 30 to 20 cm) on the number of rows of kernels negative has effect. (In case of a severe shortage of maize not be formed) nitrogen at a later stage cannot compensate for the negative effect in the early stages [8].
Biological fertilizer, vermicompost using different systems such as biological nitrogen fixation, production of growth hormone (auxin) and secretion of antibiotics leads to the development of root systems of corn, which can increase the yield. This method can be used in addition to economic considerations (reducing fertilizer nitrogen) is also important for the environment [5].
Applicable PGPR bacteria and as Yield Increasing Bacteria in China started in 1979. Today these bacteria in more than thirty states and for 55 different product applications and economic benefits and its use is estimated to be at least 59.4 million dollars per year [10].
These beneficial soil fertilizer biomasses to produce optimal products that this goal by improving soil quality and environmental safety and hygiene, the use of biotechnology is funded. Production and use of biological fertilizers is one of the basic elements in the soil and consequently Biotechnology is the integrated management of plant nutrition.
In general, biological fertilizer, the high concentration of beneficial soil organisms or substances with one or more metabolic type is available with a maintenance material is merely to provide nutrients for plants, the production of [2;7;9]. In general, biological fertilizer, the high concentration of beneficial soil organisms or substances with one or more metabolic type is available with a maintenance material is merely to provide nutrients for plants and the production [2;7;9]..

2. Materials and methods

This experiment using a split plot in a randomized complete block design with three replications. The size of each sub-plot of 18 square meters consisting of four lines of planting distance of 75 cm and a length of 6 meters.
The main factor was the amount of nitrogen fertilizer based on soil test recommended dose (control), 50, 75 and 25 percent consume the recommended amount and sub-plots included the use of biological fertilizer biological fertilizer vermicompost (control) and consume 5, 7 and 9 ha was biological fertilizer vermicompost.
Last year's wheat crop after harvesting, plowing straw collected and two perpendiculars to each other and perpendicular to the disc stirred and in late May by the Farrow and ground test plan and then put to bed by seeding machine, Ditcher, the main streams to irrigate and create ready plots were planted. After preparing the ground for implantation, biological fertilizer vermicompost has been distributed at the farm level by nitrogen-fixing tuber formation of nitrogen can meet your requirements.
After physiological maturity, after removal of the center line half a meter from the top and bottom of each plot, grain yield and harvest area of 7 square meters and measured traits. The final harvest of the seeds from the pods separated and dried, 10 samples of 100 seeds dry by the scale determined after

applying the 14% moisture as grain weight were recorded. Number of kernel rows per ear, number of kernels per row, biological yield and grain weight data obtained from measurements taken and analyzed by software MSTATC analyzed by Duncan's comparison of all kinds.

3. Results and discussion

Analysis of variance showed that the effect of nitrogen fertilizer and bio-fertilizer vermicompost on all parameters measured include the number of kernels per row, grain weight and grain yield were significant. In one treatment biological fertilizer vermicompost highest number of kernels per row (number 33.18), KTW (269.7 g), grain yield (11.7 ha), biological treatment of vermi-compost fertilizer 9 tons per hectare and the lowest number of kernels per row (number 25.64), thousand grain weight (253.8 g), yield (9.2 tons per hectare) related to treatment control (no biological fertilizer vermicompost), respectively. Nitrogen is a macro elements necessary elements needed for plant growth and development that lack of it for any reason, reduced growth and yield components, and seed yield is the result. Through biological nitrogen fertilizer plant vermicompost [2;4;14;9;5] of compensate deficiency this element to crops and with the growth and development of corn and assimilate the vegetative reproductive organs (increased harvest index) improved yield. The results of the project can be concluded that the advantages of bio-fertilizers (vermicomposting) to reduce nitrogen can stabilize production and increase production, increase farmers' income and reduce the cost of procurement and use of nitrogen fertilizers is mentioned.

3.1. The number of grain per row

Effects of seed inoculation with bacteria and the effect of nitrogen in the number of kernels per row were significant at the 5% level. The results indicated that the three groups were statistically different levels of nitrogen so that nitrogen treatment based on soil test (N1) with a mean maximum number 32.34 and 25% nitrogen fertilization treatments based on soil test (N4) with a mean of 25.76 minimum number of grain per row, respectively (Figure 1).

The vermicompost fertilizer tested at three groups were analyzed in terms of vermi-compost and fertilizer 9ton/ ha (B4) with a mean maximum number 33/18 and vermicompost fertilizer treatments (B1) with a mean produced the lowest number of grains per row 25/64 (Figure 2).

Due to the increased number of grains per row active nitrogen uptake and growth in reproductive and vegetative and flowering stages, and the increase of corn and the effect of vermicompost fertilizer consumption increased microbial activity and genetic changes and increased the reduction in the effects of too much nitrogen treatments increased vegetative growth and increased competition means more competition for assimilates is strongly abortion of flowers.

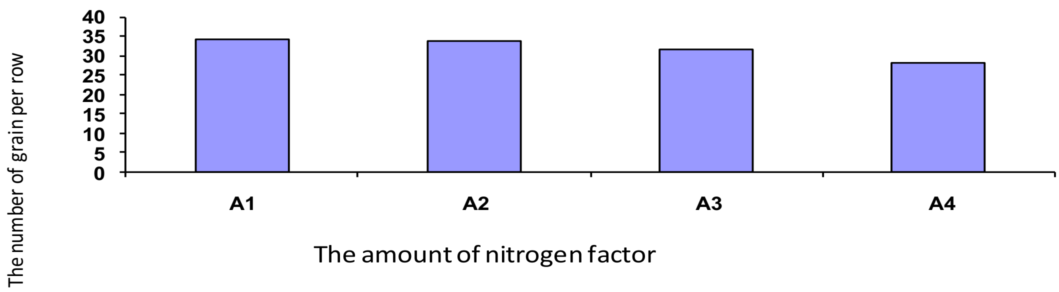

Figure 1. Effect of nitrogen fertilizer on the number of grains per row

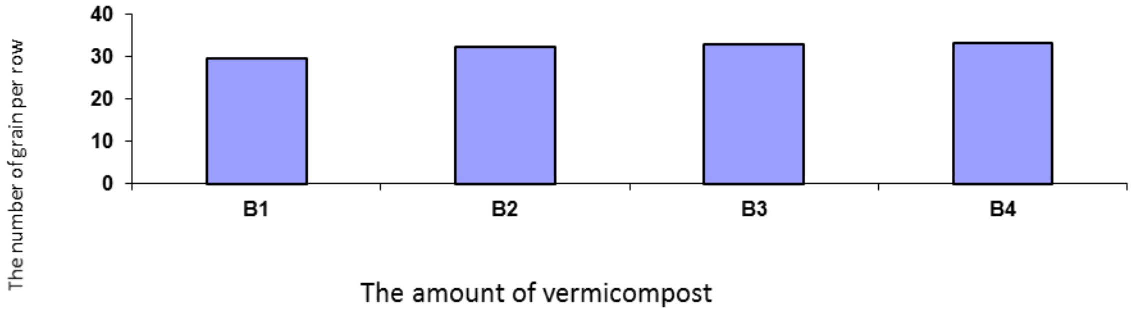

Figure 2. Effect of vermicompost fertilizer on the number of grains per row

3.2. The weight of one thousand seeds

Effects of nitrogen and vermicompost fertilizer, seed weight were significant at the 5% level.

The results indicated that the levels of nitrogen in the three groups were statistically so that the treatment of nitrogen fertilizer based on soil test (N1) with the average of the highest and treatments 4/258 25% nitrogen soil test (N4) with a mean hot 229/3 lowest seed weight, respectively (Figure 3).

The vermi-compost fertilizer tested at three groups were analyzed in terms of vermi-compost and fertilizer 9ton/ ha (B4) with a mean of the highest and the treatment without fertilizer vermi-compost 269/7 (B1) with hot 253/8 lowest average seed weight were produced (Figure 4).

Because of the weight of seeds of nitrogen nutrition treatments is application of vermi-compost fertilizer applied because the amount of nitrogen applied is not able to supply a massive deficit of nitrogen and increasing weight gain due to seed treatments provide proper nutrition and lack of competition to gain due to its abundance of treatments to increase the thousand grain weight which is one of the important parameters of grain yield.

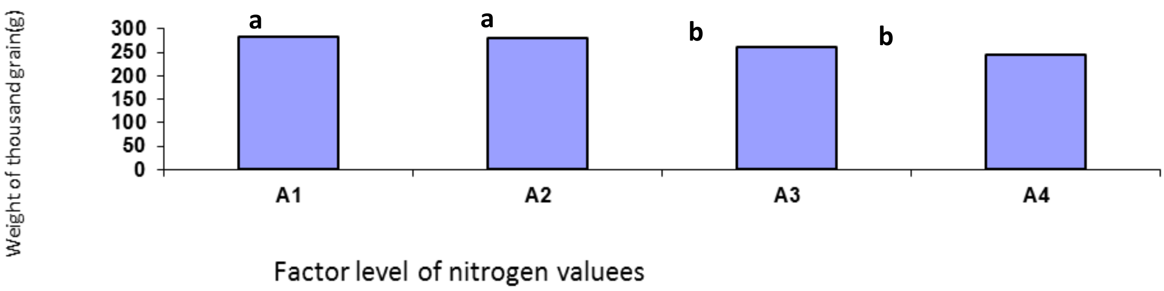

Figure 3. The effect of nitrogen fertilizer on grain weight

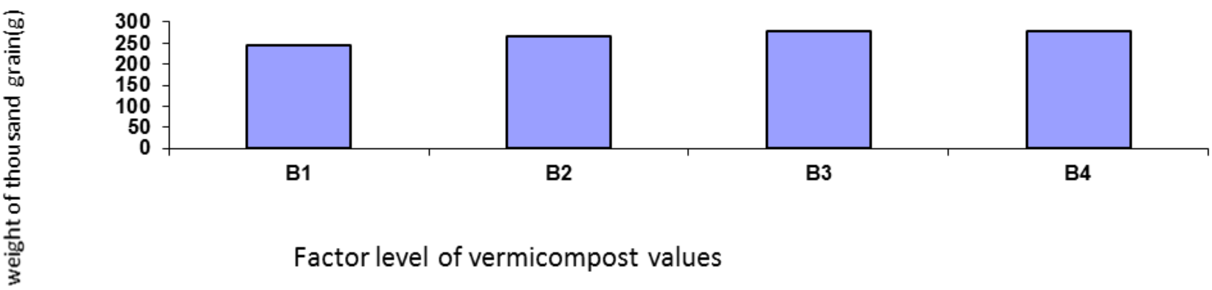

Figure 4. Effect of vermicompost fertilizer on thousand grain weight

3.3. Grain Yield

The effects of seed inoculation with bacteria and the effect of nitrogen fertilizer in yield were significant at the 5% level, the results indicated that the three groups were statistically different levels of nitrogen so that nitrogen treatment based on soil test (N1) with a mean of 11/500 ton /ha and the highest consumption of 25% nitrogen fertilization treatments based on test soil (N4) with a mean of 6/400 ton/ha produced the lowest yield. Figure (5) In vermicompost fertilizer tested at three groups were analyzed in terms of vermi-compost and fertilizer 9ton/ ha (B4) with a mean of 11 / 700ton / ha maximum and no fertilizer vermicompost (control) (B1) with a mean of 9 / 200ton / ha produced the lowest yield (Figure 6). Due to the increased grain yield was vermicompost fertilizer for growth and increased dry matter and nitrogen dilution and absorption of nitrogen and other substances. The above reported results are according to Mansk et al (2000) corresponds.

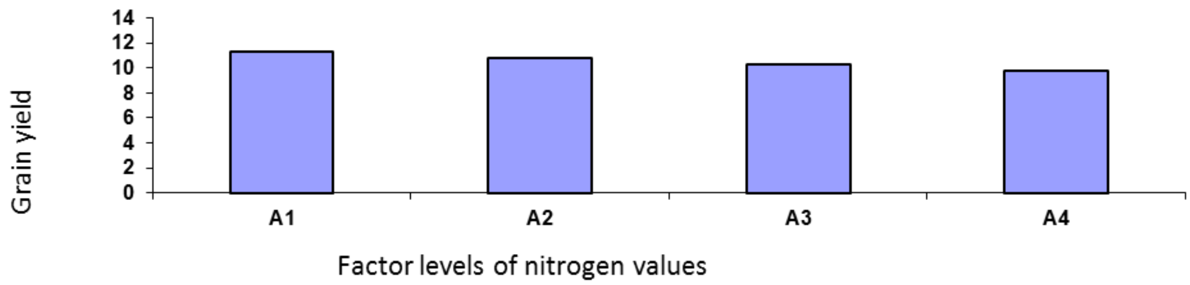

Figure 5. Effect of nitrogen fertilizer on grain yield

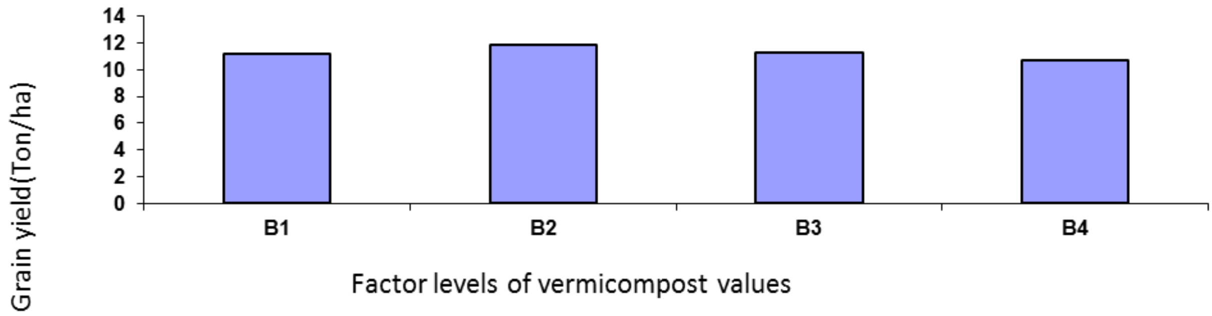

Figure 6. Effect of vermicompost fertilizer on grain yield.

Conclusions

Among major advantages of using biological fertilizer "Vermicompost" for reducing consumption of nitrogen fertilizers, one could point to stability of production, increased production, and increased revenue of farmers as well as reducing costs of supplying and consuming nitrogen fertilizers. Considering the results obtained during 1 year of conducting the test, it was observed that proper management could contribute to quality and quantity of corn grains through reducing the use of nitrogen fertilizers and added application of biological fertilizer "Vermicompost". The biological fertilizer "Vermicompost" increases grain yield of maize in the area of Elshter City so that maximum grain yield of 11.700 tons per hectare was obtained through using 9 tons per hectare of Vermicompost. In addition, the least grain yield with 9.200 tons per hectare belonged to control treatment (i.e. no Vermicompost used). The best and lowest grain yield were respectively observed for control treatment (i.e. 11.500 tons per hectare) and using 25% of recommended values of nitrogen fertilizers (6.400 tons per hectare).

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