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Effect of using growth-promoting bacteria on yield and growth parameters of Progress Cultivar Sunflower in Arak weather conditions

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***Abstract*—**InApplication of biologic fertilizers especially plant growth-promoting bacteria in combined form using chemical fertilizers is important strategy of plant fusion feed for the sustainable management of ecologically sustainable agricultural system with sufficient input. In order to investigate the influence of bacterial inoculants application of AzotobacterCrococum, Azospirillumlipoferumand Pseudomonas on application and application of sunflower components (Progress Cultivar) an experiment was performed at the Agricultural Research Station in Arak Azad University in 2009. Seed inoculation with pairwise mixed bacteria or a combination of three bacteria and non-inoculation bacterial seed (control) the chemical at the presence of 350 kg urea fertilizer per hectare and the absence of urea fertilizer as treatments were considered. Grain function features, total dry weight, leaf area index and crop growth rate (CGR), net assimilation rate were measured. The results showed that all of the studied features were affected by experimental treatments, so that the interaction of urea fertilizer and combination of three bacteria of Azotobacter, Pseudomonas and Azospirillum for grain function was significant at level 1%. The results showed that grain function of treatments that consumed three bacteria of Azotobacter, Pseudomonas and Azospirillum was 3.96 96/3 tons per ha.

Keywords:sunflower,PGPR,yeild,growth parameter

INTRODUCTION

Using bio-fertilizers in sustainable agriculture ecological systems has particular importance in promoting production and maintaining sustainable soil fertility. [8]The term of bio-fertilizers is not applied only to organic materials derived solely from animal manures, crop residue, and green manure, but bacterial microorganisms, particularly bacteria promoting plant growth and substances produced by their activities are considered among the most important bio-fertilizers [5].This group of bacteria in addition to increasing the availability of

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soil mineral components through nitrogen biological fixation, soluble phosphorus and potassium and preventing pathogens, affect crop function by production of hormones that regulate plant growth can [9]. Also according to increasing impact on the growth of plants, these bacteria are commonly called the stimulus bacteria [10].The use of bio- fertilizers, particularly plant growth promoting bacteria is important strategy for mixed management of plant nutrition for sustainable agricultural systems with sufficientinputs in form of mixing chemical fertilizers consumption with application of mentioned bacteria. [8] inputs in form of mixing chemical fertilizers consumption with application of mentioned bacteria. [8] . Bacteria of Azotobacter, Pseudomonas and Azospirillum are important plant growth-promoting bacteria that in addition to nitrogen biological fixation and soil phosphorus solution and production of significant amounts of hormones that stimulate the growth specially auxin, gibberellin and cytokinin affect the growth and yield of crops [11] Kaplink et al study (1982) showed increased plant height, wet and dry weight plant leaves under the effect of seed inoculation by Azospirillum bacteria. [5] In order to study the effects of Azospirillum on wheat plant and experiment was done that results indicate the increased number of tillers, increased number of ears per inoculated plant with Azospirillum compared with control. In order to success in agriculture Azospirillum should be used as adjuvant bacterium with other microorganisms. In this regard, Azospirillum help the better performance of other microorganisms and contribute directly to the positive effects on plant growth [1]. Inoculating plants' seeds with Pseudomonas bacteria increase plants growth or decrease the population of harmful microorganisms in greenhouse and field trials. Tilak et al studies (1982) also showed increased plant dry weight of corn seeds that it was inoculated with Azotobacter and Azospirillum bacteria [9]. The purpose of this study was to investigate the influence of bacterial bio-fertilizer application through sunflower seed inoculation with Azotobacter and Azospirillum, Azotobacter and Pseudomonas, Azospirillum and Pseudomonas binary combination and ternary combination of bacteria with and without nitrogen fertilizer on Sunflower function.

I. Materials and Methods

This experiment was carried out at crop research station of Islamic Azad University of Arak with latitude of 34 degrees 3 minutes north latitude and 49 degrees 48 minutes east longitude that had 1757 m above sea level, in 2009. The area has mild- hot summers and cool winters. Temperature changes are high. Cold starts usually from November and continues until May. Treatments include a variety of plant growth promoting bacteria (A) at five levels as follows

a1: without bacteria (control)

a2: AzotobacterCrococum + Azospirillumlipoferum

a3: AzotobacterCrococum + Pseudomonas

a4: Azospirillumlipoferum + Pseudomonas

a5:AzotobacterCrococum+Azospirillumlipoferum+ Pseudomonas

And treatment (B) chemical fertilizer at two levels:

b1: no urea

b2: 350 kg per hectare urea was used.

After sampling and filed soil test it was determined that the clay soil context with saturated extract electrical conductivity was 7.1 and acidity was 7.7. The amount of food components and required fertilizer based on soil analysis, enough superphosphate 250 kg per ha was used. The plan was conducted factorial in form of complete randomized blocks in 4 iterations. Each plot consisted of 5 rows of 6 m length and 60 cm space and spacing between plants was 20 cm The obtained results variance was analyzed using the software (MSTAT-C) and mean comparison was done by Duncan method. The whole field prune is typically implemented during the developmental period and irrigation plots and blocks was carried out separately avoid mixing bacteria. Thinning stage and setting the required density was done in 4-leaf stage. The amount of 350 kg nitrogen fertilizer as urea per ha was added to soil after thinning in two equal portions at planting. Sunflower seeds were prepared from oilseeds research part of Seed and Plant Improvement Institute of Karaj. In order to avoid the adverse effects of pesticides and herbicides on the survival and activity of microorganisms, no herbicide was used in this experiment. However, when the rate

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of herbicides was increased fighting grass weeds was done by hand weeding and to measure yield components and some features randomly, 5 plants per three midfield plot randomly were harvested and marginal effects that were half a meter from the beginning and end of each line, and transported to the laboratory for measurement. Measurements included total plant dry weight, leaf area index and crop growth rate (CGR), relative growth rateand net assimilation rate. In order to measure the final performance after attainment of physiological maturity of cultivars, area equivalent to 2 square meters per plot by was harvested removing the margins and manually and grain yield was measured. The obtained results variance was analyzed using the software (MSTAT-C) and mean comparison was done by Duncan method.

II. Results and Discussion

Analysis of variance showed that grain yield was significantly affected by treatments . Biological yield were affected by fertilizer levels and was statistically significant at 1% .Azotobacter and Pseudomonas Azospirilium treated with the highest value of 3/99 tons per acre and the lowest of the control treatment having 3/16 tons per hectare. Treatments a2, a3, a4 , also in comparison with control increased. Azotobacter treatment compared with control V Azospirilium lipoferum has higher performance and conclude with the Khosravi observation in 1376 that combines wheat seed inoculated with bacteria and have corresponded . [1] because these bacterias have caused the synthesis of growth hormone in addition of nitrogen-fixing.

Azotobacter crococom and Pseudomonas treatment compared with the control group has a higher yield .

Kunda observed that with combination of rice with Azospirilium and Pseudomonas has led to increase of food consumtion which end up with increase of yield.[6] Fages and Arsac in 1991 stated that Azospirilium and Pseudomonas significantly increases sunflower growth[3]. Lipoferum and Pseudomonas Azospirilium treatment yield with non- urea fertilizers according to the comparison table (1-1) 3.55 tons per hectare was highest in the absence of urea. Without urea fertilizer control treatment yield 2/81 t/h showed that the combined use of inoculant Pseudomonas Azospirilium than other inoculants has led to higher performance . Jagnow and teammates in 1991 reached the conclusion with carry out experiment on wheet& hordeum that inoculation of Azospirilium and Azotobacter would increase grain yeild up to 40 percent,the researcher also declared that increase of yeild might be due to secretion of Indol acetic acid gibberellin and cytokinin which is produced by stimulated bacteria.[4] the inoculation with Azotobacter especially manure , especially a positive impact on corn yield . [8] Total dry weight : Total dry weight is the important indicators of growth that reflects the amount of dry matter per unit area of whole plant and in fact shows the weight of the total photosynthesis and respiration tissue . During the experiment after 389 growing degree days , fast growth of plant began and continued up to about 1887 degree days, afterwards proved , however, is not zero .the behavior of dry matter raising is shown in figure 1-1.at begining of growth dry matter has been raising in all treatment,but Azotobacter Azospirilium Pseudomonas lipoferum treatment has shown more value.In figure 1-2 has shown the effect of urea diffrent areas per TDW. the amount of raising of TD in begining of growth in treatment which has had urea consumption of 350 KG was more than the one with no chemical fertilliser usage

Leaf Area index

Most of the leaf area is for Azotobacter Azospirilium Pseudomonas lipoferum and this suggests that this treatment increases the growth of sunflower a5 which is in comparison with control and other treatments . Because nitrogen -fixing bacteria , especially Azotobacter corococom bacteria the time of maximum plant growth will be helpful to plant

as figure 1-4 illustrates LAI changing rate in b2 treatment has the max.effect and b1 min.which reduces when reaches to maximumGDD.

crop growth rate:

Maximum crop growth rate is total amount of dry matter produced per unit of field area per unit of time indicated as g/m2 in GDD. figure 1-5 illustrate CGR changing rate for diffrent treatment.the max CGR is for Azotobacter corococom Azospirilium lipoferum Pseudomonas treatment and shows that bacterial effect of Azotobacter , Pseudomonas and Azospirilium cause increase in crop growth rate ratio and is superior to the control treatment Figure 1-6 indicates Changes rate in the treatment area , consuming 350 kg of urea fertilizer and chemical fertilizer shows that treatment with urea chemical fertilizer is the most effective, resulting in higher performance , and treatment without the use of fertilizer had the least impact . And the process is reduced to 1887 GDD

Relative growth rate :

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Relative growth rate , the increase in dry weight relative to the initial weight per unit of time is based on the increase in dry weight of the plant unit time is expressed as units , where g in GDD is. , In Figure 1-7 the RGR for biological fertilizer treatment is shown . Can be seen in the relative growth rate in the first quarter of positive growth , but the proportional growth has declined over time and the end of the growing season reaches negative values . the reason of the higher relative growth rate in the treatment of Azotobacter , Zvspyrvlyvm lipoferum Vsvdvmvnas relative to the control treatment could point to positive impact on microbial fertilizers already mentioned.Figure 1-8 indicates Relative growth rate in nitrogen levels b1 and b2 .in this diagram relative growth rate at treatment with 350 kg urea chemical fertiliser is more than the one with out chemical fertiliser since from begining of growth appropriate amount of fertiliser has been used.

Mean square(m.s)							(S.O.V)
cv	error	Effect between biofertilizer and nitrogen	Nitrogen fertilizer	biofertilizer	Rep	df	treatment
6/51	0/057	0/575**	9/49**	0/863**	3/786 n.s	3	Grain yeild

Net assimilation rate :
diagram 1-10 indicates NAR changes in the two levels of fertilizer b1, b2. Max. NAR is for
B2 treatment.
with study of inoculation treatment mean change rate,it reveals that in seed inoculation with three bacteria has the most stimulating effect and then combination of, Azospirilium ,Pseudomonas, Azotobacter Pseudomonas, Azospirilium , Azotobacter.So it seems that adding the bacteria has caused seed bacterial inoculum on sunflower seed yeild. Hence, the most effective combination of bacteria under research has been Pseudomonas fluorescens bacterium.This result can also show a synergistic relationship of mentioned bacterial combination with each other for increasing sunflower yield. Therefore we can come to conclusion that due to bacterial inoculation of seed, positive relationships between bacteria and sunflower plant is increased which has led to raising of grain performance. field measurements during growth time revealed that use of biological fertilizer increases the total dry weight , leaf area index , crop growth rate (CGR), net assimilation rate . with refer to research performed shows that stimulus bacteria for plant growth effects growth of plants by mechanism of producing stimulating hormones, particularly auxin , cytokinins and gibberellin. Thus, it seems likely that the bacteria used in this study,bacteria used effected seed yeild and traits by plant growth stimulating hormones.
In this assumtion because gibberellin causes longitudinal growth of cells espeicially stem nodes and auxin causes cellulardivisions,with refer to results obtained from research ,usage of bacteria under experiment can cause increase of sunflower speiceis seed progress yeild.

Tabale1-Mean squares and significant levels of characters under examination

Table2-- mean comparision of growth characteristic

Grain yeild Ton/ha	Treatment
	Biofertilizer
3/164 d	a1
3/589 c	a2
3/711 bc	a3
3/930 ab	a4
3/958 a	a5
	Chemical fertilizer
3/186 b	b1
4/166 a	b2
	interaction
2/810 e	a1b1
3/517c	a1b2
3/20 cd	a2b1
3/997 b	a2b2
3/370cd	a3b1
4/052 b	a3b2
3/533c	a4b1
4/327b	a4b2
3/017 de	a5b1
4/953 a	a5b2

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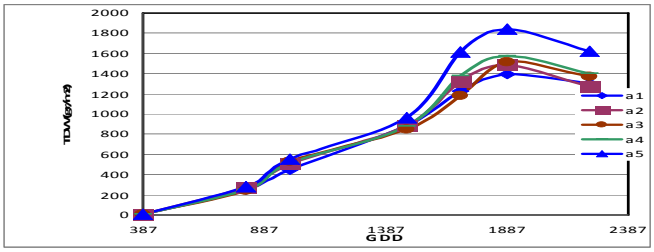

Fig1-1-The effect of biofertilizer on total dry matter

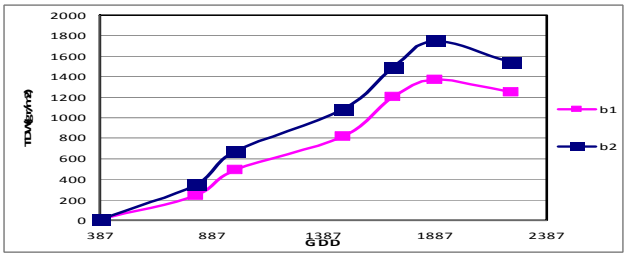

Fig1-2effect of chemical nitrogen fertilizer on total dry matter

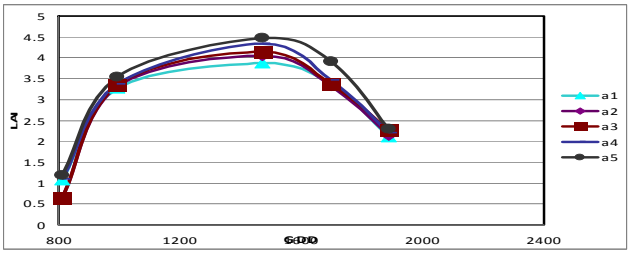

Fig1-3effect of bio fertilizer on leaf area index(LAI)

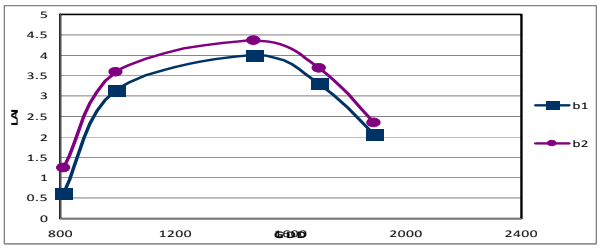

Fig1-4-effect of chemical nitrogen fertilizer on leaf area index(LAI)

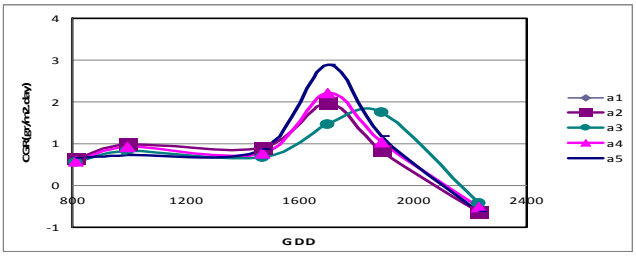

Fig1-5-Effect of bio fertilizer on crop growth rate(CGR)

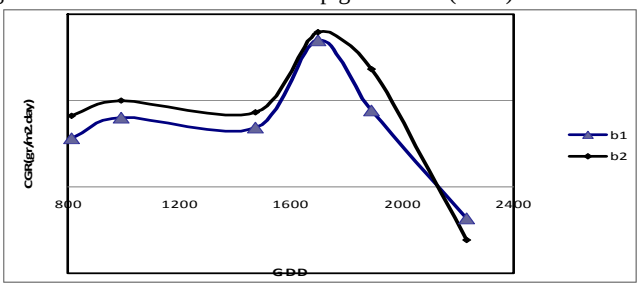

Fig1-6Effect of nitrogen fertilizer on crop growth rate(CGR)

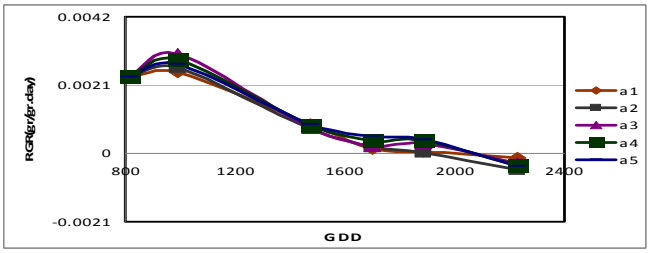

Fig1-7Effect of biologic fertilizer on (RGR)

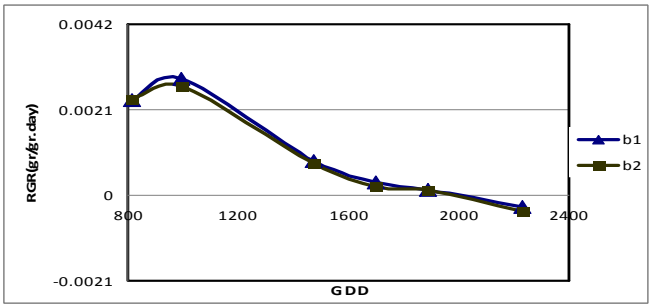

Fig1-8Effect of nitrogen fertilizer on (RGR)

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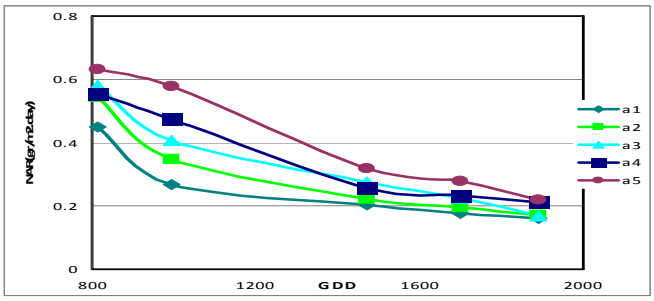
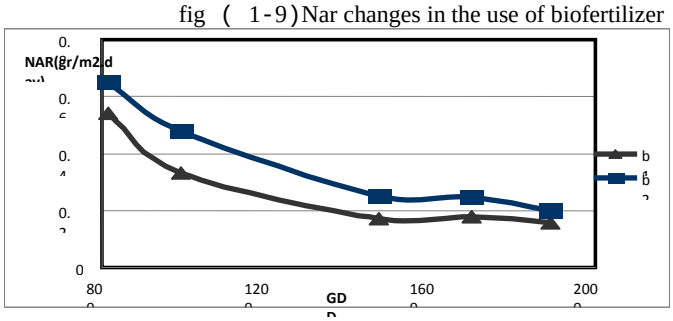


fig (1-9)Nar changes in the use of biofertilizer



Fig(1-10-)nar changes at two level nitrogen fertilizer

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REFERENCES

1-BASHAN, Y. AND DUBRROVSKY , J., G. 1996 . AZOSPIRILLUM SPP. PARTICIPATION DRY MATTER PARTITIONING IN GRASSES AT THE WHOLE PLANT LEVELBIOLOGY AND FERTILITY OF SOILS

2-Bashan, Y. And Dubrrovsky , J., G. 1996 . Azospirillum spp. Participation dry matter partitioning in grasses at the whole plant levelBiology and fertility of soils , 23:435-440.

3-Fages, A. Arsac, D.1991.Effect of bio fertilizers on sunflower . J.of the Indian Soc. Of soil Sic.45:292-296

4-Jagnow, G ,. Ghoeflich and K.H. Hoffman.1991 .Inclution of non-symbiotic rhizospher bacteria : possibilities of incracing and stablizing yield Agnew .Botanic 65:97-126

5-kapulink, Y.,Sarig, S.,Nur, A., Okan, Y. and Henis, Y.1982; The effect of Azospirillium inoculation on growth and yield of corn. Trends Biotecnology , 7: 39-44

6-Kundu,A K.1984. Biofertilizers for sustainable agriculture .Agrobios, India

7-Manaffee,W .F.and Kloepper, J. W.1994 ; Applications of plant growth promoting rhizobacteria in sustainable farming systems, Pankburst,C.E ,Doube,B.M,Gupta,V.V.S.R.,eds. Pp:23-31 CSIRO, Pub.East Melbourne, Australia.Plant .Sci :75:321-327

8-Martin, P, Glatzle, A ., Kolb, W ., Omay, H . And Schmidt, W.1989. N2-fixing bacteria ir the rhizosphere:Quantification and hormonal effects on root development. Zeitschriffur Pflanzenernahrung and Bodenkunde, 152:237-245.

9-Tilak, K. V. B.R., Singh, C.S Roy V.k. and Rao , N.s.s. 1982. Azospirillum brasilense and Azotobacter chroococcum inoculum: effect on yield of maize (Zea mays L.) and sorghum (Sorghum bicolor) Soil Biology and Biochemistry, 14:417-418

10-Sharma, A.k .2003;biofertilizers for sustainable agriculture. Agbios, India.

11-Sturz, A.V and Christie , B.R .2003;Beneficial microbial ollelopathies in the root zone : The management of Soil quality and plant disease whit rhizobacteria. Soil and Tillage Research**,** 107-123**.**

12-Vessey , J.K .2003; plant growth promoting rhizobacteria as biofertilizer.Plant and Soil ,:271-586

13-Zahir, A.Z., Arshad, M. and Frankenberger (Jr.) W.F. 2004. Plant growth promoting rhizobacteria* applications and perspectives in agriculture. Advances in Agronomy 81:96-168.

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