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Original Article

Effect of Different Biofertilizers and Irrigation Closed Time on Some Agronomic Characteristics of Sugar Beet (*Beta Vulgaris* L.)

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ABSTRACT

Objective: A field experiment was conducted at Dorud region, Iran, during 2013. The aim of this research was study on effect of different biofertilizers and irrigation closed time on some agronomic characteristics of sugar beet (*Beta vulgaris* L.). **Methods:** The experimental design was factorial based on RCBD with three replications. Treatments were three irrigation closed time [Oct-6 (A_1), Oct-13 (A_2) and Oct -21 (A_3)] and three nitrogen biofrtilizers [Nitroksin (B_1), Nitrokara (B_2), Biozar (B_3) and control (B_4)]. After treatments 3m^2 in each plot harvested for leaf and root yield measurement. K%, Na% and N% were determined by Betalizer machine in Isfahan sugar beet factory. **Results:** Results showed that, the effect of all treatments on root yield was significant but all treatments were not significant on fresh leaf yield. Effect of different biofertilizers were significant on K% and N% and other treatment were not significant on them. The effect of any treatment was not significant on Na%. Among the nitrogen biofertilizers, Nitroksin and Biozar treatments has the highest K% and Nitrokara treatment has the lowest K% and Nitroksin treatment has the highest N% and Nitrokara treatment has the lowest N% and the differences of them were significant. In final we reviled that application of different biofertilizers and different irrigation closed time reviled that among the all treatment highest root yield was belonged at application of Biozar in Oct-13 irrigation closed time and minimum root yield was belonged at application of Nitrokara in Oct-21 irrigation closed time.

1.INTRODUCTION

Sugar beet (*Beta vulgaris* L.) is an industrial crop is cultivated in many countries in the world. Countries that produce the most are the Commonwealth of Independent States, the united countries of Europe, the United States of America, and China (Kandil et al, 2004). Improving sugar beet yield and quality are the main goals of the governmental policy to increase sugar production in order to gradually cover gap between sugar consumption and production. The aim of all investigators was to decrease the gap between production and consumption of sugar (Nemeat-Alla et al, 2009). Fertilization is limiting factor for sugar beet production (Nemeat-Alla et al, 2009). Thus, its favorable to choose the optimum rate and times of application from macro and micro nutrients

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to gave the maximum yield and quality for sugar beet crop (Nemeat-Alla et al, 2009). Ismail and Ghait (2005) and Nemeat Alla et al. (2007) reported that root dimensions significantly affected by nitrogen levels and gave maximum root dimensions with high dose of N. Biofertilizer is a natural product carrying living microorganisms derived from the root or cultivated soil (Ramakrishnan, and Selvakumar, 2012). So they don't have any ill effect on soil health and environment. Besides their role in atmospheric nitrogen fixation and phosphorous solubilisation, these also help in stimulating the plant growth hormones providing better nutrient uptake and increased tolerance towards drought and moisture stress (Ramakrishnan, and Selvakumar, 2012). A small dose of biofertilizer is sufficient to produce desirable results because each gram of carrier of biofertilizers contains at least 10 million viable cells of a specific strain (Anandaraj and Delapierre, 2010). In recent years, utilizing biological fertilizer and nitrogen through bacteria had considerable attention. Application of biological fertilizers (growth stimulator bacteria) in sugar beets could be a recommended alternative too (Jafarian et al, 2013). The impact of injection had a profound improvement in growth in the above process. This growth might be due to nitrogen settlement which was caused by bacteria. Nitro bacteria presence caused an improvement in the efficiency of sugar beet product and it raised gross sugar percentage between7 to 24 and pure sugar percentage between 2.5 to 5.39. Ibiene et al (2012) showed that the ability to solubilize phosphate was exhibited by Nitrobacter species and Nitrosomonas species while Azotobacter species produce indole acetic acid (IAA) and siderphore. Abo-El-Goud (2000) reported that using biological fertilizer had a positive impact on the weight of the fresh and dry root and the weight of the fresh and dry stem, as well as leaf surface indicator in wheat. Nitrobacteria presented in the soil environment of inoculated sugar beet seeds showed a significant effect on the secretion of additive growth substances such as Gibberellins (Mrkovacki et al., 2001).

Water is one of the most important requirements for plant. Due to the shortage of water over the world, providing strategies such as proper irrigation methods, irrigation management, while offering ways to reduce and control the negative effects of water stress in plants and varieties more resistant to water etc., to save water in agriculture is critical and should be a priority research (Sadeghi-Shoae et al, 2013). Intermittent or alternate irrigation has been widely used in U.S.A. since 1962 and in the cultivation of potatoes, corn, sorghum, sugarbeet and cotton have had good results. Samadi and sepaskhah (1984) studied three irrigation methods (constant intermittent, variable intermittent, and normal furrow Irrigation method) on dry bean. Results showed that water consumption was lower under constant and variable intermittent furrow irrigation compared to conventional irrigation (a decrease by 20 % and 27 %, respectively). Therefore the aim of this experiment is study on effect of different biofertilizers and different irrigation closed on some agronomic characteristics of Sugar Beet (*Beta vulgaris* L.) in Dorud vregion of Iran.

2. MATERIALS AND METHODS

In order to study effect of different biofertilizers and irrigation closed time on some agronomic characteristics of Sugar Beet (*Beta vulgaris* L.) an experiments was conducted under temperate condition in station of agricultural farm in Deh-Haji village, Dorud city, Lorestan provience, Iran during 20013. The soil type was a silty loam, pH of 7.6 and EC = 0.65 d s m^{-1}. In the soil of this farm available P= 8.6 ppm, organic carbon= 84%, available K= 235 ppm. The Dorud region has a continental semi-arid climate with annual precipitation of 224 mm. The experimental design was factorial based on RCBD with three replications. Treatments were three irrigation closed time [Oct-6 (A_1), Oct-13 (A_2) and Oct -21 (A_3)] and three nitrogen biofrtilizers [Nitroksin (B_1), Nitrokara (B_2), Biozar (B_3) and control (B_4)].

After treatments $3m^2$ in each plot harvested for leaf and root yield measurement. K%, Na% and N% were determined by Betalizer machine in Isfahan sugar beet factory. Data were analyzed with Proc GLM procedure, SAS (SAS Inst., 1994) statistical software.

3. RESULTS AND DISCUSSIONS

The effect of all treatments on root yield was significant but all treatments were not significant on fresh leaf yield (Table 1). Effect of different biofertilizers were significant on K% and N% and other treatment were not significant on them. The effect of any treatment was not significant on Na% (Table 1).

Table1.

Analysis of variance (mean squares) for some agronomic characteristics of sugar beet under application of different biofertilizers and different irrigation closed time

S.O.V	df	leaf fresh yield	root yield	K	Na	N
R	2	1.3	117	0.36	1.5	1.6
irrigation closed (A)	2	13.1	105**	0.13	0.15	0.009
Biofertilizer (B)	3	2.7	236**	0.41*	0.38	0.41*
A*B	6	4.8	270**	0.25	0.24	0.14
Error	22	10	15.6	0.17	0.38	0.15
CV%		30	8.9	13.1	27	29

* and **: Significant at 5% and 1% probability levels, respectively

The simple comparison of the mean values of the leaf yield showed that among the irrigation closed time treatments, the highest leaf yield (11.5 ton/ha) was belonged at Oct-6 treatment and the lowest fresh leaf yield (9.5 ton/ha) was belonged at Oct-13 treat and the differences were not significant (Table 2). Among the nitrogen biofertilizers, Nitrokara treatment has the highest (10.6 ton/ha) fresh leaf yield and Biozar treatment has the lowest leaf yield (9.5 ton/ha) but the differences were not significant (Table 2). Water stress condition have been found to disrupt several physiological processes leading to reduction in growth Bloch and Hoffmann (2005), restrict growth and alter the chemical composition of beet. Under drought conditions, with holding irrigation reduced leaf and taproot growth (Abdallah and Yassen, 2008).

Table 2.

Mean comparisons for some agronomic characteristics of sugar beet under application of different biofertilizers and different irrigation closed time

treatments	leaf fresh yield (ton/ha)	root yield (ton/ha)	K(%)	Na(%)	N(%)
irrigation closed (A)					
Oct-6 (A_1)	11.5	46.1[a]	3.1	2.4	1.3
Oct-13 (A_2)	9.5	48[a]	3	2.2	1.3
Oct -21 (A3)	9.9	42[b]	3.2	2.2	1.32
LSD	2.6	3.34	0.3	0.52	0.32
Biofertilizers					
Nitroksin (B_1)	10.4	41[b]	3.3[a]	2.2	1.41[a]
Nitrokara (B_2)	10.6	40[b]	2.8[b]	2.6	1.03[b]
Biozar (B3)	9.5	50[a]	3.3[a]	2.2	1.3[b]
Control (B4)	10.6	48[a]	3[ab]	2.1	1.4[a]
LSD	3	3.8	0.4	0.6	0.38

Means by the uncommon letter in each column are significantly different ($p<0.05$)

For root yield the results showed that Among the irrigation closed time treatments, the highest root yield (48 ton/ha) was belonged at Oct-13 treatment and the lowest root yield (42 ton/ha) was belonged at Oct-21 treat and the differences were significant (Table 2). Among the nitrogen biofertilizers, Biozar treatment has the highest (50 ton/ha) root yield and Nitrokara treatment has the lowest root yield (40 ton/ha) and the differences were significant (Table 2). The biofertilizers could replace 50% of chemical fertilizers recommended to the plant growth promoting substance produced by biofertilizers in addition to the reasonable quality of atmospheric nitrogen fixed (Gomaa, 1999). For gave to highest yield in agriculture addition of nitrogen fertilizer is very important (Beyranvand et al, 2013 , Kiani et al, 2013 and Shaban, 2013a,b). Interaction effect of treats for root yield of sugar beet under application of different biofertilizers and different irrigation closed time showed that, in Oct-6 irrigation closed time the maximum root yield belonged at control treatment and application of any biofertilizer was not significant for root yield of sugar beet (figure 1). In this treatment minimum root yield was belonged at application of Nitroksin biofertilizer treatment. After control treatment application of Nitrokara was useful rather than other biofertilizer in Oct-6 irrigation closed time.

For Oct-13 irrigation closed time the minimum root yield was belonged at control treatment and application of biofertilizer was significant for root yield of sugar beet. In this treatment maximum root yield was belonged at application of Biozar biofertilizer treatment. After Biozar treatment application of Nitrokara was useful rather than Nitroksin in Oct-13 irrigation closed time (Figure 1). At Oct-21 irrigation closed time the maximum root yield belonged at control treatment and application of any biofertilizer was not significant for root yield of sugar beet. In this treatment minimum root yield was belonged at application of Nitrokara biofertilizer treatment. After control treatment application of Biozar was useful rather than Nitroksin in Oct-21 irrigation closed time (Figure 1). Explained the vital roles of water supply at adequate amount for different physiological processes such as photosynthesis respiration, transpiration translocation, enzyme reaction and cells turgidity. Reduction of plant size and growth under water stress my be attributed to a decrease in the activity of meristemic tissues responsible for elongation. As well as the inhibition photosynthetic efficiency under insufficient water condition Siddique et al (1999).

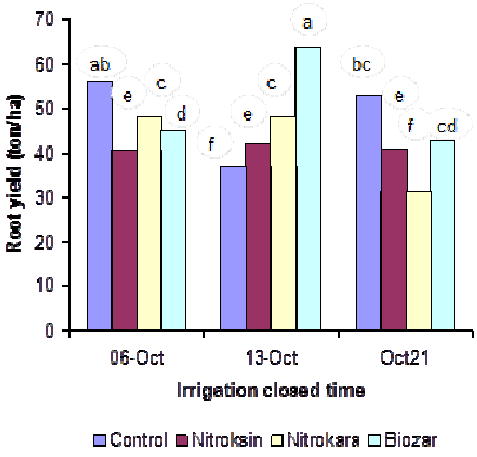

Figure 1. Interaction effect of treats for root yield of Sugar Beet under application of different biofertilizers and different irrigation closed time. Means by the uncommon letter in each column are significantly different ($p<0.05$)

In final Interaction effect of treats for root yield of sugar beet under application of different biofertilizers and different irrigation closed time reviled that among the all treatment highest root yield (64 ton/ha)was belonged at application of Biozar in Oct-13 irrigation closed time and minimum root yield (32 ton/ha) was belonged at application of Nitrokara in Oct-21 irrigation closed time. In application of Nitrokara in Oct-21 irrigation closed time treatment root yield was equal of 1/2 root yield in application of Biozar with Oct-13 irrigation closed time treatment that this differences was very significant and important (figure 1). According to above mentioned results Abdallah and Yassen, (2008), El– Monayeri et al (1983) , Azzay (1998) and Mona et al (2000). The simple comparison of the mean values of the K% showed that among the irrigation closed time treatments, the highest K (3.2%) was belonged at Oct-21 treatment and the lowest K (3%) was belonged at Oct-13 treat and the differences were not significant (Table 2). Among the nitrogen biofertilizers, Nitroksin and Biozar treatments has the highest (3.3%) K and Nitrokara treatment has the lowest K (2.8%) and the differences were significant (Table 2). Abdallah and Yassen, (2008) showed that the interaction between fertilizer and irrigation data showed that application 40kgN/ fed + bio gave the highest values in K content and uptake in shoot and roots as compared with the other treatments. Results of this study for Na% showed that among the irrigation closed time treatments, the highest Na (2.4%) was belonged at Oct-6 treatment and the lowest K (2.2%) was belonged at Oct-13 and Oct-21 treats and the differences were not significant (Table 2). Among the nitrogen biofertilizers, Nitrokara

treatment has the highest (2.6%) Na and control treatment has the lowest Na (2.1%) and the differences were not significant (Table 2).

High tension exerts a physiological effect on the root, elongation, turgidity and number of root hairs decrease with increasing tension, the decrease nutrients uptake by water stress also has been supported by Nelson 1982. For N% the results showed that among the irrigation closed time treatments, the highest N (1.32%) was belonged at Oct-21 treatment and the lowest N (1.3%) was belonged at Oct-6 and Oct-13 treats and the differences were not significant (Table 2). This might be attributed to the increase in the root surface per unit of soil volume and the rate of nutrients uptake or may be due to the high capacity of the plans supplied with N fertilizer in building metabolites, which might contribute much to the increase of the dry matter. (Kalane et al 1998). Among the nitrogen biofertilizers, Nitroksin treatment has the highest (1.41%) N and Nitrokara treatment has the lowest N (1.03%) and the differences were significant (Table 2).

CONCLUSION

In scientific world long term field studies showed a significant contribution of biofertilizers for the yield increase of the field crops, which vary in range from 8–30% of control value depending on crop and soil fertility.In the present study, significant differences were observed among nitrogen biofertilizers and irrigation closed time treatments regarding the average root yield was more affected. Application of supernitroplas with phosphate barvar2 biofertilizers in the same time on its own increased seed yield of barley significantly. In final Interaction effect of treats for root yield of sugar beet under application of different biofertilizers and different irrigation closed time reviled that among the all treatment highest root yield was belonged at application of Biozar in Oct-13 irrigation closed time and minimum root yield was belonged at application of Nitrokara in Oct-21 irrigation closed time.

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