Effect of Nitrogen Fertilizer on Growth, Yield and Sucrose Concentrationof Sugar Beet (*Beta vulgaris* L.) Under Saline Soil in El Kadaro, Sudan

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Abstract: Field experiments were conducted on two consecutive seasons (2014/2015 and2015/2016) at the Agricultural Farm of Bahri University in Elkadaro (Sudan), where is the soil classified as slightly saline at surface and saline sodic at subsurface soil. Seed of sugar beet Ballede variety was obtained from the Agricultural Research Station in Wad Madani.The objectives of the experiments were studied the effect of mineral nitrogen fertilizer on growth, root yield and juice quality of sugar beet under saline soil. The nitrogen fertilizer was applied as urea at the rate of 0Kg N/ha, 40Kg N/ha, 60 Kg N/ha, and 80 Kg N/ha.The experiments were laid out in randomized complete block design with four replicates. The results showed that 80 Kg N/ha treatment was highly significant ($P< 0.01$) increased leaves number, leaf area index, leaves fresh weight, shoot fresh weight, root fresh weight and root diameter per plant over all other treatments and the control. However treatment 60KgN/ha significantly ($P< 0.05$) produced more leaves number, shoot fresh weight, root fresh weight and root diameter per plant. Each of nitrogen treatments significantly ($P< 0.05$) increased root yield per plant over the control. The increases in root yield compared to control were 13% 33% and 46% for the 40 Kg N/ha, 60 Kg N/ha, and 80 Kg N/ha respectively. Each level of nitrogen fertilizer significantly ($P< 0.05$) reduced Sugar percentage, (Pol %), Brix percentage, and Purity percentage. However, treatments

60KgN/ha and 80KgN/ha significantly ($P<0.05$) increased moisture percentage over the other treatments.

Key words: Nitrogen fertilizer; saline sodic soil; sugar beet; ELkadaro (Sudan)

1. INTRODUCTION

Sugar beet (*Beta vulgaris* L.) is a member of the family Chenopodiaceous. It is mainly a crop of temperate regions where it is grown as a spring or early summer crop. It ranks second to sugarcane as a source of sucrose in the world. Sudan has no experience in beet production although scientific research on the crop was started in1930s where it was investigated among other crops as a substitute for cotton in the Gezira Scheme (El-Karouri, and El-Rayah 2006). Sugar beet is a useful crop for farmers, particularly when incorporated into a rotational scheme. The stem of sugarcane supplies about 60% of the world's sugar, while the other 40% comes from the roots of sugar beet; sugarcane and sugar beet have long been considered as a main source of sugar (Ali, 2004). Sugar beet is among the salt tolerant crops, but is reported to be less tolerant during germination and emergence (Kaffka, and Hembree 2004).

Sugar beets need phosphorus for energy transfer in the plant (ATP) and to support cell walls(phospholipids). Nitrogen (N) is the most limiting nutrient in sugar beet crop, determining white sugar production by affecting both root yield and internal root quality (sucrose, K, Na, α-amino N concentrations). Excessive N promotes shoot growth at the expense of root growth and sucrose accumulation (Draycott, Christenson 2003).The nitrogen content of sugar beet was significantly positive correlated with nitrogen amount used (Baiyan, and Jingping 2014).The variability of N uses efficiency, due to environmental effects (De Koeijer *et al*,2003). In England on inorganic soils proposed an amount of 100-110 kg N ha^{-1} as a rate equilibrating between fertilizer prices and beet values (Jaggard *et al*, 2009). But amount is within the range of 100-125 kg N/ha as adequate for maximum sugar beet yield in Germany (Märländer *et al,* 2003). However, in Sudan that the nitrogen application at the rates of 86 and 129 N/ha significantly affected sugar beet crop yield and the weight of the root per plant but sucrose content decreased at the 129 kgN/ha (Osman, 2011). In Egypt, increasing nitrogen fertilizer as soil application up to 90 kg N/fad significantly increased root diameter, root yield and sugar yield (Nemeat Alla *et al*, 2002). The reverse was true with respect to sucrose % and purity % (Nemeat Alla, *et a,l* 2002). Similar results were obtained by Shalaby *et al*, (2003) in Egypt, reported that applying nitrogen fertilizer at the rate of 80 and100 kg N/fad produced the highest values of the chemical constituents of fresh sugar beet roots. They also showed that increasing nitrogen up to 120 kg N/fad could be significantly increased root, top and sugar yields/fad. On the other hand, sucrose %, and juice purity decreased with increasing nitrogen fertilizer rate up to 120 kg N/fad. The nitrogen applications tend to increase in leaves numbers, leaf area index, shoot and root dry weigh (Mustafa, 2007). Increased nitrogen rate resulted in increased leaf number, leaf area index and the rate of complete canopy expansion (Hosseinpour *et al*,2013).Increasing nitrogen application as soil fertilizer significantly increased length, diameter and weight of roots as well as sugar yield (El-Harriri, and Mirvat 2001)and (Nawar, and Saleh 2003). Increased nitrogen rate resulted in increased leaf number, leaf area index and the rate of complete canopy expansion (Hosseinpour *et al*,2013).

Currently, at least 20 % of the world's irrigated land is salt-affected soils. Among those affected by salt, about 60 % are sodic (Qadir *et al*, 2006). However, salinity is also increasing in dry land agriculture in many parts of the world (Rengasamy, 2006). Saline soils are often referred to as "white alkali" because of the white salt crust that forms on the soil surface. Saline soils are characterized by the following: EC more than 4, Exchangeable Sodium Percentage (ESP) less than 15, and pH less than 8.5. As for saline sodic soils are characterized by the following: EC > 4, ESP > 15, and pH < 8.5 (USDA, 2010). However, under semi-arid conditions, large amounts of Na are accumulated in plant tissues even under non-saline conditions (Wang *et al*, 2004) and (Tsialtas, and Maslaris2006). Excessive Na affects negatively leaf morphology, physiology, yield and quality of sugar beets being the major root impurity under the semi-arid conditions (Wakeel *et al*, 2009).The irrigation with fresh water (0.5dSm^{-1}) produced the highest sugar beet yield 27.03 t/fed (64.8 t/ha) and the highest sugar percent, 18.2%, respectively, Irrigation with saline water (3.8dSm^{-1}) significantly reduced the beet root yield by about 21. 4 to/fed (51.25 t/ha). In addition, water salinity 3.8dSm^{-1} until sugar beet significantly reduced beetroot yield quality (Eid, and Ibrahim 2010). Sucrose, total soluble solids and purity of sugar beet juice decreased with salinity stress (Khalil *et al*, 2001). Leaves from plants exposed to lower level of salinity showed little change in photosynthesis, whereas those treated by high levels of salinity had up to 91.5% inhibition in photosynthetic rates and an increase in CO_2 compensation point (Dadkhah, 2011).

The objective of the present research was to study the effect of mineral nitrogen fertilizer on growth, root yield and juice quality of sugar beet under saline soil.

MATERIALS AND METHODS

Field experiments were conducted on sugar beet under winter season for two consecutive seasons (2014/2015 and2015/2016) at the Agricultural Farm of the Bahri University in Elkadaro area. Seed of sugar beet (*Beta vulgaris*.L) variety Ballede was obtained from the Agricultural Research Station in Wad Madani. Sugar beet was chosen because it is a salt tolerant plant and in this respect may be a suitable crop for Northern Sudan. Being an easy rotational crop which farmers can grow in the winter season, the inclusion of sugar beet in the rotation facilitates crop diversification and could lead to spread of small factories for sugar extraction at the village level. The soil at the site has 37% clay content at soil surface (0-30 cm depth), and high clay content (> 45) at subsurface soil (30-60 cm depth) low water permeability. It is saline soil at surface and saline sodic at subsurface horizons, has about 0.02% nitrogen, 0.3% organic carbon and low amount of available phosphorus (4 mg Kg^{-1} soil).Some physical and chemical properties of the experimental soil were determined according to Kim (1996) and presented in Table (1). Experiments were irrigated with underground water. The electrical conductivity of the water is 912 micro moh SAR is 2, sulphate is 0.5 meq/l, bicarbonate is 6.0meq/l, and water pH is 7.2. According to U.S. Salinity Laboratory Classification, the irrigation water is classified as (C_3S_1) high salinity and low sodium water. .

The land was ploughed by using deep disc tillage, harrowed and leveled. It was then divided into 6×3.5 m subplots five ridges per plot were prepared in north-south direction with 60 cm between ridges. Nitrogen was added in the form of urea at the rate of (0,40, 60, and 80 kgN/ha) respectively and phosphorus as a basal does in the form of diammonuim phosphate dehydrate (DAP) at the rate of 20kg P_2O_5/ha. The treatments were control, 40kg N/ha, 60kg N/ha and 80kg N/ha. The phosphorus fertilizer was applied on one side of the ridge at sowing. The half doses of nitrogen fertilizer was applied at 4WAS (week after sowing), and the second was applied at the 8WAS on one side of the ridge. The irrigations were given every 7 to 10depending on weather condition.

In both seasons, the seeds were sown by hand in holes on the middle of the ride at a depth of 2 cm and 15 cm between holes, thinning to one plant per hole was carried out after the 4WAS. The sowing date was the first week of September. Four hand-weeding were carried out during the growing season. Treatments were replicated four times in a completely randomized block design. Soil augur samples were taken at 0-15 cm, 15-30cm, 30-45cm and 45-60cm soil depth before sowing. Soil and water samples were taken to Sudan University of Science and Technology laboratory for the chemical and physical analysis. Three plant samples were taken from the outer two ridges in each plot at 7, 10, 13 and 16WAS. Each sample was put in a labeled paper bag and taken to the laboratory.

The following parameters were measured; soil pH determined on a Soil Suspensions 1:5 where the electrodes were placed in the supernatant liquid. EC determined on the extraction of saturated soil paste. Soluble calcium and magnesium were determined by EDTA (USDA, 1954). Soluble sodium was measured by Flame photometer. The procedure followed in obtaining the cation exchange capacity (CEC) was essentially that reported in (Dewis, and Freitas 1976). Exchangeable cations were extracted from the soil by 1.0 N ammonium acetate pH 7 (McGinnus, 1971), and measured by Flame photometer. Then SAR and ESP were calculated. The parameters measured were number of leaves/plant determined by counting all the leaves of the sampled plants and then obtaining the mean number of leaves per plant. Leaf area index, was determined using Watson Method (1953). Root diameter by using Verna. Shoot and leave fresh and dry weights per plant. Root fresh weight. At harvest, root yield t/ha was calculated. Roots harvested from each plot were taken to Guneid Cane Research Center laboratory for the chemical analysis. The chemical analysis were sugar content (Pol %) Insoluble Solids (Brix %), moisture% were determined by using McGinnus methods 1971. Purity and was obtained by dividing Pol % by Brix %.

The data were subjected to analysis of variance, using the SAS statistical package (SAS, 2010). Differences among treatments were evaluated by the least significance difference (LSD) at 5% level.

III. RESULTS

Number of leaves and leaf area index per plant

The effect of nitrogen fertilizer on number of leaves and leaf area index per plant was shown in table2. The data obtained for both first and second seasons indicated that at 7WAS, through the 16thWAS,80 Kg N/ha treatment significantly ($P \leq 0.05$) increased leaves number per sugar beet plant over all other treatments and the control. Treatment60KgN/ha, significantly ($P \leq 0.05$) produced more leaves number per plant over the control. As for the leaf, area index for the first and second seasons the data showed that at 7WAS, through the 16thWAS, 80 Kg N/ha, treatment significantly ($P \leq 0.05$) increased leaves number per plant over all other treatments and the control except for second season at 10WAS and 16WAS. Treatments 40KgN/ha and 60KgN/ha, significantly ($P< 0.05$) increased leaf area index per plat over the control for both season, except 40KgN/ha treatment at 7WAS for first season.

Leaves fresh weight and shoot fresh weight (g plant^{-1})

The effect of nitrogen fertilizer on leaves fresh weight and shoot fresh weight was shown in table3. Treatment 80KgN/ha, significantly ($P \leq 0.05$) produced more leaves fresh weight per plant over all other treatments except for 60KgN/ha treatment at 10WAS for the first season. However, for the second season treatment 80KgN/ha, significantly ($P< 0.01$) produced more leaves fresh weight per plant over all treatments except for 60KgN/ha treatment at 16WAS. For both seasons at 7WAS, through the 16thWAS, 60 Kg N/ha treatment significantly ($P \leq 0.05$)increased leaves fresh weight per plant over the control. Similar results were obtained for both first and second seasons, at 7WAS, through the 16thWAS, for shoot fresh weight per plant.

Root fresh weight(g plant^{-1}) and root diameter (cm)

The effect of nitrogen fertilizer on root fresh weight and root diameter was shown in table4. The data obtained for both seasons showed that at 7WAS, through the 16thWAS, all the treatments significantly ($P \leq 0.05$) increased root fresh weight over the control. The best treatments were 60 KN/ha and80 KN/ha. As for root diameter, for both seasons at 7WAS, through the 16thWAS, treatments 80Kg N/ha and 60Kg N/ha significantly ($P \leq 0.05$) increased root diameter per plant over the control. However, treatment 40KgN/ha significantly ($P< 0.01$) produced more root diameter per plant over the control except for second season at 7WAS.

Root and sugar yields (t/ha) and juice quality

The effect of nitrogen fertilizer on root yield, sugar yield (t/ha) and juice quality was shown in table5.The data obtained for both seasons showed that the nitrogen fertilizer at rate 80KgN/ha and 60KgN/ha treatments significantly ($P < 0.05$) produced more sugar beet root yield and sugar yield (t/ha) over the control. As for juice quality, the data indicated that for both seasons each of nitrogen fertilizer none significantly effect on juice quality sugar pol%, brix% and purity%.

Table1. Average values of some physical and chemical properties of soil under consideration

Soil depth	Particle size distribution			Soil texture	EC	SAR	ESP
Cm	Sand	Silt	Clay	%	dSm^{-1}		%
0-15	55	12	33	Sandy clay loam	4.8	09	04
15 -30	49	10	41	Sandy clay	6.1	12	11
30- 45	42	12	46	clay	9.3	22	28
45- 60	39	12	49	clay	10.9	37	34

EC = electrical conductivity; SAR = sodium adsorption ration; ESP= exchangeable sodium percentage.

Table2. Effect of mineral nitrogen fertilizer on number of leaves and leaf area index $plant^{-1}$

Treatments	F S				Ss			
	7WAS	10WAS	13 WAS	16WAS	7WAS	10WAS	13WAS	16WAS
Number of leaves per plant								
0Kg N/ha	14.9 b	23.3 c	27.7 c	25.5 c	20.3b	23.2 d	24.9 c	23.2 c
40KgN/ha	14.2 b	24.5 b	30.4 b	24.7 c	21.3 b	28.5 c	27.4 b	28.5 b
60Kg N/ha	14.4 b	24.5 b	31.6 b	29.0 b	20.1 b	33.1 b	28.8 b	31.1 b
80KgN/ha	18.1 a	25.8 a	37.7 a	31.8 a	25.6 a	36.4a	33.6 a	36.3 a
SE	**0.7**	**0.44**	**1.3**	**1.03**	**0.38**	**2.01**	**1.4**	**3.5**
CV	**14.6**	**5.04**	**9.9**	**6.2**	**6.7**	**16.1**	**15.3**	**16.1**

Leaf area index								
0Kg N/ha	1.52 c	4.0 c	5.0 c	3.1 c	4.3 c	5.7 c	5.9 d	3.2 c
40KgN/ha	1.42 c	4.95 b	6.3 b	3.9 b	5.1 b	6.2 b	6.7 c	6.1 b
60Kg N/ha	2.07 b	4.97 b	5.9 b	4.1 b	4.8 b	7.2 a	7.4 b	8.4 a
80KgN/ha	2.62 a	5.89a	6.7 a	5.4 a	5.2 a	7.7 a	8.9 a	8.2 a
SE	**0.20**	**0.40**	**0.40**	**0.38**	**0.3**	**0.5**	**0.52**	**0.45**
CV	**18.7**	**19.5**	**19.1**	**18.8**	**10.3**	**9.8**	**21.9**	**10.8**

Means followed by the same letter (s) in column are not significantly at $P \leq 0.05$, according to LSD Test.; FS = first season 2014/2015; Ss = second season 2015/2016; WAS= weeks after sowing

Table3. Effect of mineral nitrogen fertilizer on leaves fresh weight and shoots fresh weight (g plant^{-1}) for first and second seasons

Treatments	**F S**				**Ss**			
	7WAS	10WAS	13 WAS	16WAS	7WAS	10WAS	13WAS	16WAS
Leaves fresh weight per plant								
0Kg N/ha	153.4 c	353.3 c	440 c	263 c	141.4c	440.8 d	516.2 d	551.2b
40KgN/ha	143.4c	481.9 b	457 bc	359 b	147.6bc	517.4 b	604.7 c	576.8 b
60Kg N/ha	175.8b	519.8 a	480 b	380 b	149.8b	465.1 c	655.1 b	736.7 a
80KgN/ha	232.4 a	520.0 a	635 a	511 a	157.7a	555.4 a	799.5 a	796.2 a
SE	**11.9**	**25.3**	**35.3**	**39.0**	**7.2**	**32.8**	**46.1**	**33.1**
CV	**11.8**	**15.9**	**10.4**	**13.7**	**21.2**	**28.1**	**19.3**	**16.7**
Shoot fresh weight(g plant^{-1})								
0Kg N/ha	166.3 c	368 c	478 c	295 c	150.9 b	457.6 c	600.6 b	687.8 b

40KgN/ha	157.6c	502 b	498 bc	396 b	152.4 b	472.7 c	645.4bc	69.7 b
60Kg N/ha	182.5b	543 a	527 b	428 b	152.1 b	490.3 b	665.3 b	821.3 a
80KgN/ha	238.6 a	528 ab	697 a	573 a	162.2 a	679.1 a	782.1a	861.0 a
SE	**12.1**	**26.5**	**41.7**	**45.2**	**7.5**	**32.7**	**46.1**	**84.7**
CV	**16.5**	**15.8**	**21.2**	**18.7**	**21.5**	**14.8**	**20.7**	**20.3**

Means followed by the same letter (s) in column are not significantly at P ≤ 0.05, according to LSD Test.; Fs = first season 2014/2015; Ss = second season 2015/2016; WAS= weeks after sowing

Table4. Effect of mineral nitrogen fertilizer on root fresh weight (g plant^{-1}) and root diameter (cm) for first and second seasons

Treatments	**F S**				**Ss**			
	7WAS	10WAS	13 WAS	16WAS	7WAS	10WAS	13WAS	16WAS
Root fresh weight(g plant^{-1})								
0Kg N/ha	56.1 c	216 c	427 c	591 c	39.2 c	183.6 c	516.2 d	587.8 c
40KgN/ha	58.1 b	241 b	489 b	659 b	45.4 b	244.5 b	604.7 c	696.7 b
60Kg N/ha	60.3 b	280 a	561 b	715 b	54.7 a	276.8 a	655.1 b	821.3a
80KgN/ha	65.9 a	299 a	638 a	818 a	51.8 a	275.4 a	799.5a	861.0 a
SE	**2.3**	**19.8**	**33.2**	**54.8**	**4.5**	**17.2**	**46.9**	**54.7**
CV	**15.0**	**18.3**	**17.4**	**19.5**	**18.5**	**23.7**	**23.1**	**21.1**
Root diameter (cm)								
0Kg N/ha	2.56 c	6.11 c	7.7 c	9.1c	2.65 b	4.65 c	6.7 c	8.9 d
40KgN/ha	3.14b	6.53 b	8.2 b	9.5 b	2.55 b	5.78 b	7.2 b	9.6 c
60Kg N/ha	3.45 a	6.89 a	8.3 b	9.7 b	2.94 a	5.75 b	7.5 b	10.3 b
80KgN/ha	3.50 a	6.87 a	9.1a	10.1 a	3.04 a	6.04 a	8.8 a	11.2 a

SE	**0.11**	**0.20**	**0.22**	**0.25**	**0.12**	**0.23**	**0.29**	**0.34**
CV	**9.8**	**10.5**	**13.4**	**10.8**	**16.2**	**11.5**	**9.8**	**10.7**

Means followed by the same letter (s) in column are not significantly at P ≤ 0.05, according to LSD Test.; FS = first season 2014/2015; Ss = second season 2015/2016; WAS= weeks after sowing

Table5. Effect of mineral nitrogen fertilizer on root yield (t/ha) and juice quality of sugar beet for first and second seasons

Treatments	**Root yield (tha^{-1})**	**Sugar yield (tha^{-1})**	**Sugar% (Pol %)**	**Brix (%)**	**Purity (%)**	**Moisture (%)**
			First season			
0Kg N/ha	41.24 d	10.27 c	23.6 a	24.97 a	92.6 a	73.4 c
40KgN/ha	46.57 c	11.17 b	21.8 b	24.00 b	90.3 b	74.3 b
60Kg N/ha	54.81 b	11.46 b	19.5 c	21.23 b	93.7 a	75.3 a
80KgN/ha	60.38 a	12.30 a	19.1 c	20.43 b	88.2 c	75.9 a
SE	**3.15**	**0.54**	**0.12**	**0.88**	**1.2**	**0.6**
CV	**12.9**	**15.7**	**4.4**	**11.4**	**4.9**	**2.5**
			Second season			
0Kg N/ha	40.0 c	8.37 b	18.6 a	20.8 a	89.7 a	77.4 a
40KgN/ha	39.5 c	8.41 b	17.8 b	21.4 a	83.0 b	75.0 b
60Kg N/ha	54.3 b	11.02 a	16.6 c	20.2 b	82.4 b	76.1b
80KgN/ha	59.9 a	11.46 a	17.1 a	19.5 b	89.0 a	76.0 b
SE	**3.0**	**0.59**	**0.51**	**0.67**	**1.9**	**0.60**
CV	**12.7**	**18.2**	**10.5**	**13.7**	**8.2**	**3.2**

Means followed by the same letter (s) in column are not significantly at P ≤ 0.05, according to LSD Test.

IV. DISCUSSION

The data obtained for both first and second seasons showed that at 7WAS, through the 16thWAS, 80 Kg N/ha treatment significantly increased leaves number and leaf area index per sugar beet plant over all other treatments and the control. Treatment 60KgN/ha, significantly produced more leaves number and leaf area index per plant over the control. These results are in conformity with that of Mustafa 2007. Who showed that; nitrogen applications tend to increase in leaves numbers, leaf area index of sugar beet. Also, Hosseinpour *et al*, 2013 reported that increased nitrogen rate resulted in increased leaf number, leaf area index and the rate of complete canopy expansion.

Treatment 80KgN/ha and 60KgN/ha significantly produced more leaves and shoot fresh weights per plant over all other treatments for both seasons at 7WAS, through the 16thWAS. Similar finding was reported by Draycott, Christenson 2003. Who found that Excessive N promotes shoot growth at the expense of root growth and sucrose accumulation. Similar results was obtained by Osman 2011, who reported that the nitrogen application at the rates of 86 N/ha significantly affected sugar beet crop yield and the weight of the root per plant. Also, Jaggard et al, 209 who indicated that nitrogen applications tend to increase in leaves numbers, leaf area index, shoot and root fresh and dry weighs.

The data obtained for both seasons at 7WAS, through the 16thWAS, each of nitrogen treatment significantly increased root fresh weight and root diameter over the control. This result was in agreement with El-Harriri, and Mirvat 2001, and Nawar, and Saleh, 2003. Who found that increasing nitrogen application as soil fertilizer significantly increased root diameter and weight of roots. Also, Nemeat Alla, 2002 in Egypt, reported that increasing nitrogen fertilizer as soil application up to 90 kg N/fad significantly increased root diameter, root fresh weight, and sugar yield.

Nitrogen fertilizer at rate 80KgN/ha and 60KgN/ha treatments significantly produced more sugar beet root yield and sugar yield (t/ha) over the control. As for juice quality, the data indicated that for both seasons each of nitrogen fertilizer had not significantly effect on juice quality sugar pol%, brix% and purity%. These results are compatible with that of Osman, 2011who reported that the nitrogen application at the rate of 86 N/ha significantly affected sugar beet crop yield and the weight of the root per plant but sucrose content decreased at the 129 kgN/ha. Khalil *et al*, 2001 found that sucrose, total soluble solids and purity of sugar beet juice decreased with salinity stress. In Egypt, reported that increasing nitrogen fertilizer as soil application up to 90 kg N/fad significantly increased sugar yield Nemeat Alla *et al* 2002. Also, Eid, and Ibrahim, 2010 observed that irrigation with fresh water ($0.5 dSm^{-1}$) produced the highest sugar beet yield 27.03 t/fed (64.8 t/ha) and the highest sugar percent, 18.2%, respectively when irrigation with saline water ($3.8 dSm^{-1}$) significantly reduced the beet root yield by about 21. 4 to/fed (51.25 t/ha).In the current study the mean of sugar root yield of both season is 60.14 t/ha for 80 kg N/ha treatment. The increasing of sugar beet root yield compared with control is 48.1% for two seasons.

V. CONCLUSION

Sugar beet plant is tolerant to salt saline soil and suites the Northern Sudan in arid region under saline condition. Application of mineral nitrogen at rate 80 KgN/ha affect positively on growth behavior of sugar beet that is finally significantly increased leaves number, leaf area index, leaves fresh weight, shoot fresh weight, root fresh weight root diameter per plant and sugar content.

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