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Effect Of Nitrogen and phosphorus Fertilizer on Juice Quality of Posoda and Dorota Sugar beet (*Beta Vulgaris.L*) Cultivars

Marwa Elngrashi Mustafa Mohammed[1] Abdel Aziz Hamid[2] Fadlalla Elbashier Rabih[3]
[1] Ministry of A agriculture ,White Nile State Sudan
[2] Faculty of Agriculture, Technology and Fishing Sciences, Alnileen University, Khartoum, Sudan.
[3] Faculty of Agriculture and Natural resources, University of Bakht Alruda Sudan.

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Abstract

The study was conducted to evaluate the effect of nitrogen and phosphorus application on yield of each part of two sugar beet (*Beta vulgaris* L.) cultivars, such as brix percentage, purity percentage, fiber percentage, moisture percentage The experiment was carried out in season (2011/12). at the Experimental Farm of the White Nile Sugar Company (W.N.S.C). The experiment was laid out in Factorial Randomized Complete Block Design with four replicates. Treatments were nitrogen (0 and 100kg N/ha) designated as (N_0 and N_1), phosphorus (0 and 50 kg P_2O_5/ha) designated as (P_0 and P_1) and two sugar beet cultivars were Posoda and Dorota designated as V_1 and V_2 respectively, The addition nitrogen and phosphorus application had no significant effect on brix percentage, purity percentage, fiber percentage, moisture percentage. The results of the study recommended the addition of the nitrogen and phosphorus application in sugar beet to obtain hight sugar content with using highly responsive sugar beet cultivars.

Keywords: Nitrogen, Phosphorus Fertilizer, Juice Quality, Dorota Sugar, Posoda Sugar.

Introduction

Sugar beet (*Beta vulgaris* L.*)* is a member of the family Chenopodiaceae. It is a temperate region crop grown as a summer crop but proved to be successful in sub-tropical areas as a winter crop. It ranks second to sugarcane as the second most important sugar crop in the world according to FAO production year book (1995). Total world production of sugar beet is 266 million tons from a production area of 7.8 million /ha. In the Arab world the area under sugar beet is 123000 hectares with a total production of 5 – 6 million tons. The leading beet producing Arab country is Morocco which produces about 49% of total production of all Arab countries. In Egypt, the crop was introduced on commercial scale very recently. Its cultivation is expanding rapidly, being more efficient water user. The government policy now is discouraging further cane area expansion (Afifiy 1996). Sudan has no experience in

beet production although scientific research on the crop had started nearly seventy years ago. The first trials recorded were carried out at Gazeira Research Farm during the depression of the 1930s when a substitute for cotton was being actively sought. It was considered a possible source of sugar during the war at that time. Sugar beet, like most of the members of the family Chenopodiaceae, 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. Thus besides providing self-sufficiency in sugar commodity, it will generate an extra income to small farmers. Moreover the by-products of beet culture and remanufacturing industry are a good feed for animals. Despite concerns about effect on human health and increasing competition from other sugars e.g iso glucose from cereals or high fructose corn syrup from maize and from artificial sweeteners (e.g saccharin, aspartame and cyclamate) the public's demand for sucrose continues.The initial success of the beet sugar industry in many countries was based on or sustained by political events. However, the ever–increasing demand for sugar, and the ability of sugar beet crop to satisfy that demand effectively and profitably, ensured that national sugar industries, once established, jealously guarded. As result, the majority of the world’s sugar is now produced and sold within the protection of preferential international agriculture the trade agreement. Scott, *et al* (1974).Sugar beet profits are based on three key factors: beet yield, sucrose content and sucrose recovery efficiency. Optimizing beet sugar yields can be challenge. Research on sugar beet nutrition has a high priority wherever the crop is introduced and grown and there are several reasons for this. Firstly, the correct addition of nutrients to soil has the greatest effect on crop performance, which is within the grower's control. Secondly, fertilizers have historically been the most expensive item in growing the crop on nearly all soil types, although currently insecticides and herbicides often top the bill. Thirdly much attention is paid to the correct nutrition of the crop, and concern about straw burning and nitrate in underground water stimulated research into nutritional strategies which minimize adverse effects on the environment. The efficiency of utilization of nutrients from fertilizers applied depended upon the soil conditions, biological characteristics of the crop, crop productivity and the fertilizer rate (Hosseinpour et al, 2013). It is common that

phosphorus and nitrogen fertilizers are the most important major nutrient for plant. phosphorus can be major limiting nutrient in many soils (Mustafa, 2007). however the continuous use of fertilizer containing this element has meant that many arable soils now contain large reserves of phosphorus and fresh applications give little or no increase in sugar beet yield. Consequently research directed towards nitrogen requirement rather than phosphorus Cooke and Scott, (1993). Nitrogen is in short supply in nearly all arable soils and is the most important element applied to sugar beet wherever the crop is grown and when virgin soils are brought into intensive farming. Phosphorus is usually the first element needed; however the continuous use of fertilizer containing this element has meant that many arable soils now contain large reserves of phosphorus and fresh applications give little or no increase in sugar beet yield. Consequently, in the past 20 years most of the research effort has been directed towards understanding nitrogen requirement whereas research on phosphorus has declined. Scott, et al (1974).Research on sugar beet in Sudan is scarce, but recently some preliminary research on the crop has been conducted.

Materials and Methods

Experimental site

A field experiment was conducted during season (2012/ 2013) at the Experimental Farm of the White Nile Sugar Company (W.N.S.C). The farm extends along the Khartoum-Rabak Asphalt Highway. The study area is subtended by latitudes 14°20' N, and 13°45' N and longitudes 32°15' E and 32°40' E . The total area is about 154,920 feddans (65066.4 ha).

Treatments and design

The two sugar beet cultivars studied Posada and Dorotea designated as V_1 and V_2 respectively. The fertilizer treatments were two nitrogen levels (0 and 100 Kg N/ ha) designated as N_o and N_1 and two phosphorus levels (0 and 50 Kg P_2O_5 /ha) designated as P_o and P_1 respectively. The experiment was laid out in a randomized complete block design with four replications. The experimental unit is a plot (4.65 m^2) in area, consisting of (3) ridges at (155 cm) length. The seeds of sugar beet cultivars were obtained from the White Nile Sugar Company (W-N-S-C).The crop was shown on the 1^{th} week of December, 2012 in at the rate of 3 seeds/hole and spacing of 20 cm between holes. Thinned to one plants per hole .Thinning was carried out after the fourth irrigation when the plants were 6 weeks old. Urea (46% Nitrogen) was used as

a source of Nitrogen and triple superphosphate (48% (P_2O_5) was used as source of phosphorus. Phosphours was applied at crop side, the crop was irrigated immediately after sowing; using White Nile water. Irrigation water was applied at10 days intervals. Six manual weeding operations were carried out during the growing season.

Chemical analysis

Roots harvested from each plot were crushed and blended to be used for chemical analysis.

Sugar content (Pol %)

The blended sample of each plot was strained by filter paper. A sample of 25 ml of juice was taken from each sample and used for determination of sugar content (Pol %) using polarimeter (Mathur 1990).

Sugar yield:

It was obtained by multiplying root yield per plot by Pol %

$$\frac{\text{root yield per plot X Pol}}{100}$$

Insoluble Solids (Brix %):

It was determined by Meade and Chen (1975). A sample of 1000 g of root material from each treatment was used for this purpose.

Fiber %:

The fiber percentage was determined by the A.O.A.C (1984) method . A sample of 20 g from each treatment was used.

Purity:

It was obtained by dividing Pol % by Brix %:

$$\text{Purity} = \frac{\text{Pol \%}}{\text{Brix \%}}$$

Moisture %:

It was measured by John (1968) method.

Statistical analysis:

Analysis of variances (ANOVA) was used on the data for each season separately and mean separation was carried out using the Duncan's Multiple Range Test (DMRT) according to Gomez and Gomez (1984).

Results and Discussion

Juice quality

Analysis of variances in table 1 showed that the application of N and P fertilizers and the two sugar beet cultivars Posoda and Dorota had no significant effect on all juice traits studied in this experiment which comprises sugar content (Pol%), sugar yield (Kg/ha), Brix percentage, Purity percentage, Fibre percentage and moisture content Neither nitrogen nor phosphorus fertilizer was found to affect juice quality attributes in this study . This result was in agreement with the finding of VanBurg et al (1983) who found that the over use of nitrogen decreased both sugar percentage and juice quality nitrogen level generally led to increase shoot growth and thus late maturity and increase of amino acids and thus led to decrease sugar content and purity percentage (El Shaier et al , 1993)and he also conducted that nitrogen decreases sugar content and increases root yield and sugar yield impurities .These finding was confirmed by many Scientists such as Carter and Traviller (1981) ,Lee et al (1987) , Brava et al (1989),Winter (1990), Shraifi and Orazi Zadeh (1992), Mohammed Khani (1994), Hosseinpour (1993), Ebrahimian (1994) and Gohari (1994) . In spite that nitrogen is a key factor in sucrose utilization and sugar concentration .Armstrong and Milford(1985) reported that application of nitrogen more than 200kgN/ha lead to concentration of nitrogenous impurities , particularly the amids and amino acids rises rapidly to a point where they impair the crystallization of sugar in factory process.

Table. 1 Effect of nitrogen and phosphorus application on juice quality of two sugar beet

Treatments	Brix%	Purity%	Fiber%	Moisture%
V1N0P0	17.9 a	72.2 a	4.3 a	79.0 a
V1N0P1	19.1 a	68.7 a	4.6 a	78.1 a
V1N1P0	18.9 a	71.3 a	3.6 a	79.0 a
V1N1P1	19.6 a	70.4 a	4.2 a	77.8 a
V2N0P0	18.8 a	71.8 a	3.7 a	78.4 a
V2N0P1	18.7 a	72.3 a	4.2 a	78.3 a
V2N1P0	18.7 a	70.2 a	4.0 a	78.3 a
V2N1P1	18.3 a	71.7 a	4.2 a	78.8 a
grand mean	18.8	71.1	4.1	78.5
C.V	**2%**	**4%**	**3%**	**1%**

Means followed by the same letter(s) are not significantly different at (0.05) level of probability according to (DMRT).

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