THE RELATIONSHIP BETWEEN WATER REQUIRMENTS And NITROGEN FERTILIZERS SOURCE APPLICATED WITH DIFFERENT RATES And ITS EFFECT ON SUGAR BEET YIELD AS WILL AS SOIL And PLANT POLLUTION

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A Thesis Submitted in Partial Fulfillment
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ABSTRACT

Two field experiments were carried out to study the effect of irrigation quantity i.e. 2000- 2500- 3000$m^{3/}$fed., nitrogen fertilizer sources i.e. anhydrous ammonia, urea, ammonium sulfate and ammonium nitrate at rates i.e. 70, 80 and 90kg N/fed. on growth, juice quality, yield and its component as well as plant content of sugar beet plants under Kafr El-Sheikh Governorate conditions during 2010/2011 and 2011/2012 seasons.

Results reveal the following findings:

Decreasing amount of irrigation water caused reduction in crop growth rate, root volume, root fresh weight per plant, alpha amino nitrogen%, top yield/fed., root yield/fed., sugar yield/fed., water requirement, nitrite and nitrate, percentage in leaves, potassium percentage in roots as well as nitrite, and nitrate, and ammonium and available N in soil, in both seasons. On the other hand, reduction of irrigation water amount increased root length, sucrose%, purity%, sodium percentage, nitrogen percentage in leaves and water use efficiency, in both seasons. Relative growth rate and net assimilation rate were not significantly affected by irrigation water quantity in both seasons.

All studied traits were significantly affected by nitrogen fertilizer sources in both seasons. Sugar beet plant received anhydrous ammonia gave the highest values of root length and volume, root fresh weight, K%, purity%, sucrose%, root and sugar yield/fed., water use efficiency. Also increased crop growth rates nitrite, nitrate, ammonium and available N in soil, but anhydrous ammonia gave the lowest values of alpha amino nitrogen, Na%, water requirement, nitrite and nitrate in leaves and relative growth rate. Ammonium nitrate gave the highest values of alpha amino nitrogen, Na% and nitrate in leaves. Ammonium sulfate gave the highest values of water

requirements and N% in leaves. Applied urea gave highest values in top yield, relative growth rate and net assimilation rate.

Sugar beet plants fertilized at the rate of 90kg N/fed. gave the highest values of root length and volume and fresh weight and yield, K%, alpha amino nitrogen, root and sugar yield/fed., nitrite and nitrate and ammonium and available nitrogen in soil, and/or N% in leaves at harvest top yield and water use efficiency while, using the rate of 70kg N/fed. gave the highest values of Na%, purity%, water requirements and sucrose%.

The interaction effects between irrigation water quantities, nitrogen sources and nitrogen rates were found to be significant using $2000m^3$ water/fed. and anhydrous ammonia at 90kg N fed. gave the highest values of root length, water requirement, water use efficiency and N% in leaves in both seasons While, using $2000m^3$ water/fed and anhydrous ammonia at 70kg N/fed. gave the highest values of Na%, purity% and sucrose% in both seasons. Using $2000m^3$ water/fed. with ammonium sulphate at the rate of 90kg N/fed. gave highest value of N% in leaves. On the other hand, using $3000m^3$ water/fed with anhydrous ammonia at 90kg N/fed. produced the highest values of root fresh weight yield, K%, sugar yield, top yield as well as nitrite, nitrate, ammonium and available N in soil in both seasons While, using $3000m^3$ water/fed with ammonium nitrate gave the highest alpha amino nitrogen in both seasons.

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INTRODUCTION

Sugar beet (***Beta vulgaris,* L**.) ranks the second important sugar crop after sugar cane, producing annually 45% of sugar production all over the world. Recently, sugar beet has an important position in Egyptian crop rotation as a winter crop not only in the fertile soils, but also in poor or saline or alkaline or calcareous soils. The great importance of sugar beet crop is not only from its ability to grow in the newly reclaimed areas as economic crop, but also for production higher of sugar under these conditions as compared with sugar cane. Moreover, sugar beet is specialized as a short duration crop, where it grows in a period of about half that of sugar cane. Furthermore, sugar beet requires less water requirement. Also, its productivity makes it a good cash crop at this situation. The Egyptian Government encourages sugar beet growers to increase the cultivated area for decreasing the gap between sugar production and consumption. This increase is likely to be obtained by growing sugar beet crop in newly reclaimed soils. Most of these areas face some stress problems, i.e. shortage of irrigation water, salinity and unbalance nutrient elements. Attempts are made for increasing sugar beet productivity in newly reclaimed soils.

Nowadays, Egypt face a problem in amount of irrigation water. The shortage of irrigation water is the most important factor constraining agricultural production in Egypt. Thus, the first important step of Egyptian strategy is increasing productivity from unit area with the lowest irrigation water quantity and saving the irrigation water.

Nitrogen is a major nutrient element and it's needed in large amount for high yield of sugar beet and it considered the most factor affecting the growth and productivity of sugar beet. Application the optimum rate from nitrogen fertilizer plays a fundamental role in plant growth and yield as well as yield quality.

Source of nitrogen application is important management tools in this respect because maximum nitrogen efficiency is obtained when nitrogen is applied in the form which is available for uptake by plant needed.

Anhydrous ammonia represents a cheaper N-source than the famous solid sources. The cost of transportation and handling is relatively low for anhydrous ammonia owing to its 82% N composition. Being a liquid when pressurized allows anhydrous ammonia to be transported and handled in more convenient and less expensive ways and with less labor that dry materials. These advantages carry over to the farmer in a very effective, less expensive N fertilizer and a source that requires less labor and handling to apply it in the field. When N was absorbed as NH^{+}_{4} , action uptake exceeded anion uptake and H^{+} were released to balance the charge, conversely. When N was absorbed as No^{-}_{3} anion uptake was changed and OH^{-} or HCO^{-}_{3} ions were released to balance the excess anion absorption. The major advantages of anhydrous ammonia as a direct application fertilizer are its high N analysis and low cost. Recently, a great attention has been devoted to develop practices of application and technologies, which are offered by fertilizer producers, engineers, distributes, traders, policy makers and scientific communities.

The studies on fertilization sugar beet with new nitrogen source such as anhydrous ammonia under limited irrigation quantity are rare. Therefore the aim of the present investigation is to study the effect of irrigation quantity, nitrogen sources and rates on sugar beet growth, juice quality, yield and it's components under Kafr El-Sheikh Governorate conditions.

REVIEW OF LITERATURE

The literature of this study could be divided as follows:

A.1-Effect of irrigation on growth of sugar beet:

Carter *et al.* (1980) showed that reducing the irrigation level increased sucrose percentage. The reduction in water may increase percentage but may also reduce plant growth, root and sugar yield.

El-Hennaway and El-Hawary (1995) found that values of root length, root diameter and root fresh weight of sugar beet were significantly decreased as water depletion level increased.

Abd El-Wahab *et al.* (1996) studied the effect of different amounts of irrigation water (I_1=2625, I_2=2100 and I_3=1575 m^3/fed.), they found that root length was significantly increased as water amount decreased and decreased root diameter (cm).

Emara (1996) found that the highest increase for root length resulted from the irrigation volume of 1500m^3/fed. values were 29.54cm, while the maximum irrigation water 2500m^3/fed. resulted in the highest values of root diameter, root fresh weight and foliage weight of sugar beet.

Mohamed *et al.* (2000) showed the highest root length and root fresh weight/plant of sugar beet when irrigation was applied at 65% of the field capacity (F.C.).

Abd El-Wahab *et al.* (2002) found that root diameter was increased significantly as water amount increased. Root length was increased significantly as water amounts decreased.

Fadi *et al.* (2002) showed that the growth of sugar beet was much lower in soils irrigated at 60% field capacity than in soil irrigation at 100% field capacity. The rate of underground to aboveground dry matter increased