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BIOCHEMICAL STUDIES ON SOME SUGAR CROPS

BY

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Thesis

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LIST OF ABBREVIATIONS

%	=	Percent
μ	=	micro ($1x10^{-6}$)
α Amino N	=	Alpha amino nitrogen
CV	=	Cultivar
DM	=	Dry matter
EC	=	Electrical conductivity
ESP	=	Exchangeable sodium percentage
Fed	=	Feddan
GR	=	Growth regulator
ha	=	Hectare
IAA	=	Indole acetic acid
K	=	Potassium
K_2O	=	Potassium oxide
KCl	=	Potassium chloride
Kg	=	Kilogram
mel^{-1}	=	milliequivalent / liter
mg	=	milli gram ($1x10^{-3}$ gram)
Mins	=	Minutes
mM	=	milli molar
N	=	Nitrogen
Na	=	Sodium
P	=	Phosphorus
P_2O_5	=	Phosphorus oxide
ppm	=	Part per million
t	=	Ton
t/ha	=	Ton/hectare
Zn	=	Zinc
Zn SO_4	=	Zinc sulphate

1. INTRODUCTION

Sugar beet is a specialized type of ***Beta vulagris***, L. grown for sugar production.

The total sugar production produced in Egypt during 1998 from both can and beet 1167000 tons (934 and 233) thousands tons from cane and beet, respectively). This amount covers about 71.8 % of our total consumption.

Some many factors are limiting the enhancement of sugar production from sugar cane. In the contrary several advantages favouring sugar beet as a suitable source for increasing local sugar production to reduce the gap between the production and consumption.

It is well known that the wild ancestors of beet evolved on sea coasts, which may be the underlaying reason for the crop ability to survive salinity better than most other field crops, this may be due to its deep root system and high capacity for osmotic adjustment (osmotic adjustment could be due to the large amount of K, Na, $\propto$ Amino N and other salts accumulate in the leaves and root sap).

Therefore, Egyptian strategy during the present and future days planned to expand beet cultivation in the newly reclaimed soils.

Potassium is considered one of the most essential mineral elements for sugar beet production. it has a great influence on various biochemical processes and enzyme systems. Moreover, plant growth regulators are increasely used in modern agriculture due to their unique role in regulating and intensifying the action of some agronomical practices for achieving both qualitative and quantitative improvement in beet production.

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Name of Candidate Samia Hassan Ashmaye Degree Ph. D

Title of Thesis "Biochemical Studies on Some Sugar Beet"

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ABSTRACT

Pot experiment was carried out during season 1996/1997 in Giza Agricultural Research Centere (ARC) to study the effect of potassium fertilizer (24 and 48 kg K_2O/ fed.) sodium (non saline soil 1.8 mmhos/cm.) and (saline soil 5.2 mmhos/cm.), IAA (10^{-6} M) and their interactions on growth characters, biochemical constituents, quality and productivity of sugar beet (Beta Vulgaris, L.). The results revealed that potassium fertilizer at the rate of 24 kg K_2O/fed. or IAA exhibited the highest fresh and dry root weight and quality especially at harvest in both non saline and saline soil. These results revealed that potassium fertilizer at the rate of 24 kg K_2O/fed. or IAA exhibited the highest/root weight and quality especially at harvest in both non saline and saline soil.

These results are recognized due to the appreciable and positive effect of K elements on agrobiochemical constituents of beet root and leaves, quality parameters (sucrose % , sugar extractable %, extractability and purity and (RNA and DNA contents) Meantime, decreasedthe levels of sodium and Amino N as main juice impurites, sugar lost to molasses and reducing sugars, on the contrary K fertilizer increased the activity of invertase enzyme.

Moreover, K fertilizer inhibited greatly polysaccharide formation due to urgent increase in the ratio of total soluble sugars to total carbohydrates Growing beet under saline soil conditions (5.2 mmhos cm)has adiversed effect on most studies traits excep sucrose percentage (pol.%) of extracted Juice. Addition K fertilizer and/or IAA greatly decrease the deleterious effect of salinity where additive

Use Other Side if Necessary

A.M. Nagib

(Cairo Univ. Press. 1524-1984-5000 ex.)

CONTENTS

The effect of varying potassium fertilizer rates and Indole Acetic Acid under normal (non-saline and saline soil on sugar beet with special emphasis on the biochemical changes, root weight and quality proved to be of vital importance.

The aim of this study was to:

1. Search for suitable K rate to beet grown under non and saline soil conditions that insure optimum average root weight and high quality.
2. To study the effect of K, salinity, IAA and their interactions on various physio-biochemical processes such as nuclic acid, soluble carbohydrate fractions, some macro elements and invertase activity.
3. To get some information about the relationship between K and salinity individually or together on beet productivity.

2. REVIEW OF LITERATURE

Sugar beet is classified as plant that need a high potassium requirement and more potassium is absorped by sugar beet than any other mineral nutrient element. The specific role or action mechanism of many nutrient element is known in great deal. Despite the fact, however, that potassium is recognized as being absolutly indispensable and that it is present in high concentrations in plants. Most physiology textbooks state simply that the precise function of potassium is unknown. The metabolic role of potassium has never the less been inference from growth disorders or malfunctions that occur when potassium is present in limiting quantities. **Nason and Mc Elary (1963)** and **Evans and Sorger (1966)** stated that potassium deficiency causes many changes in the vital processes of plants. Some of these changes are summarized as follows:

Changes in carbohydrate metabolism:

- Initial increase in soluble carbohydrates.
- Ultimate decrease in soluble carbohydrates.
- Decrease translocation of carbohydrates

Change in nitrogen metabolism:

- **Decreased protein synthesis.**
- **Increased soluble nitrogen compounds-amino acid, amids**
- **Decreased photosynthesis.**
- **Decreased chlorophyll fraction.**
- **Increased respiration.**

All the listed processes are catalyzed by plant enzymes. Potassium is thus readily implicated in enzymatic reaction. In fact, potassium is frequently referred to as an enzyme activator. Research specifically directed towards the relationship between potassium and enzyme chemistry has been very fruit-ful **Evans and Sorger (1966)** tabulated some 40 different enzymes that either do not function at all, or function at a reduced rate in the absence of potassium.

From the foregoing, it becomes evident that potassium is very intimately associated with the substances that are responsible for plant metabolic processes. This is dispite the fact that potassium ions exist in plant essentially in solution in ionic form.

In order to present the major point concerning the response of sugar beet to potassium fertilizer, the available review of literature will be as follows:

Effect of potassium fertilization on growth, root components and yields of sugar beet:

Tinker (1970) showed that K tended to increase root yield slightly on feem peat soil. Similarly, potassium increases root yield and sugar percentage with consequent increased in total sugar yield. Although potassium often increases yield of tops early in the growing period, and this effect disappeared at harvest **(Draycott, 1972)**.

Kochi (1978) noticed that K increased root weight by favouring transport of metabolites to the storage organ.

On the other hand, **Bishr et al. (1973)** pointed that K application did not affected beet yield of root.

Under Egyptian conditions, **El-Geddawy (1979)** illustrated that potassium fertilization up to 60 kg/fed did not affected root diameter and