BIOCHEMICAL STUDIES ON SOME VARIETIES OF BEANS. "PHASEOLUS VULGARIS L.,,

BY

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(B. Sc., SOILS.)

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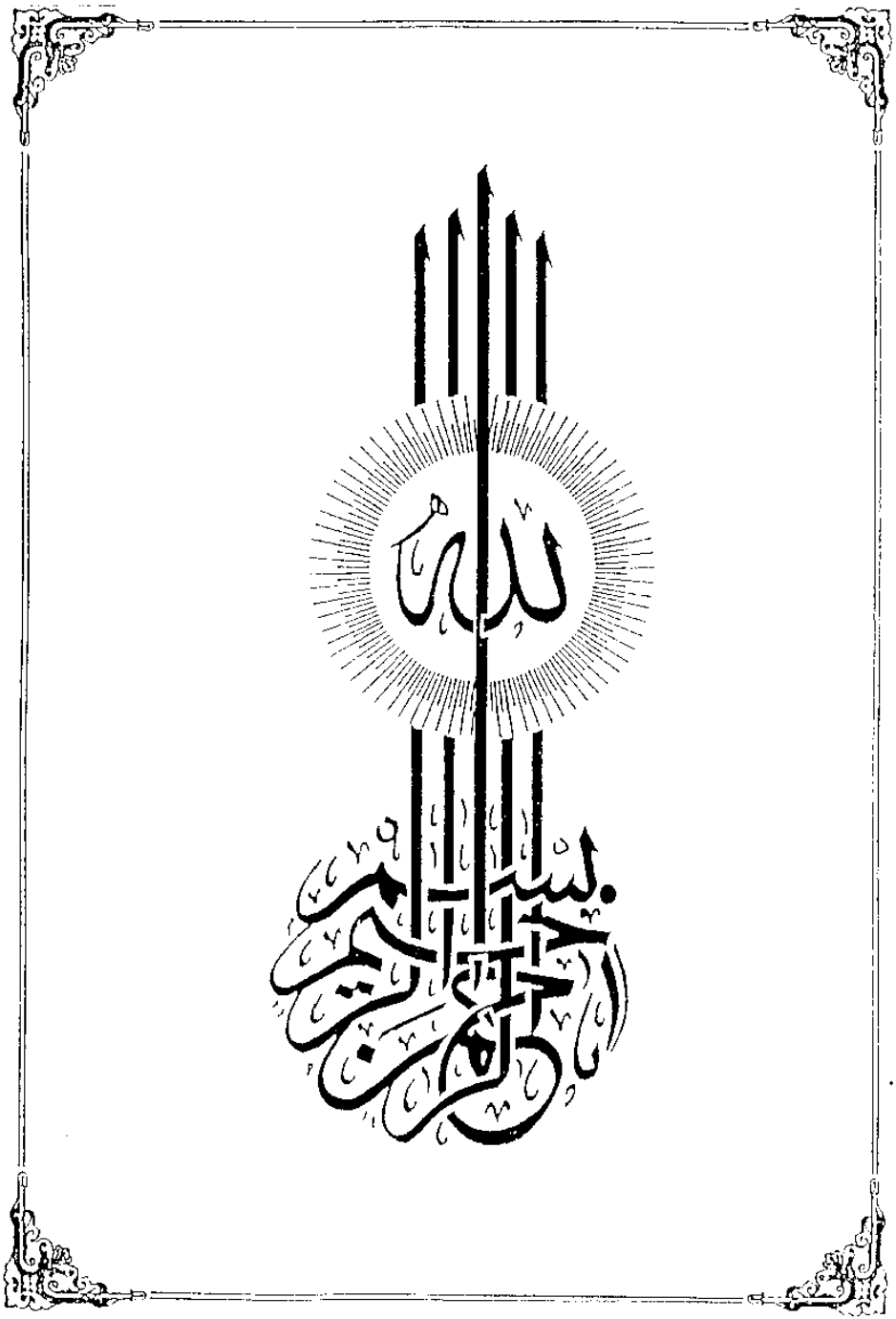

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INTRODUCTION

Snap beans represent a favourite commodity among the vegetables grown in Egypt. The green pods as well as the dry seeds of Phaseolus vulgaris L. are among the popular food receipes in our country as a proteinic source of diet.

For the potentialities of exporting this vegetable, the present status of production reveals that efforts should be done for its improvement. Among the recent pathways followed in this track in other countries is the utilization of some growth substances among which are the gibberellins and 2,4-D.

It is now well established that GA_3 produces a wide variety of growth responses in higher plants. In other words GA_3 has a promoting effect on rosette plants. Where 2,4 dichlorophenoxy acetic acid (2,4-D) is a hormone type weed killer and as well promote growth when applied in low concentrations to shoot of plants.

These two substances being of a hormonal nature to plants probably might affect bean growth in different ways. The basic evaluation of their effects in this respect will logically be the biochemical side.

Thus, the present work aimed to investigate the effect

of the different concentrations of GA_3 and 2,4-D treatments on performance and yield of snap beans. This will include the main morphological characters and the principal bio-chemical constituents of plants. For this, the two dominant varieties in Egypt namely seminol and swiss blanc were chosen for this work.

REVIEW OF LITERATURE

Though considerable work has been done on the effect of growth substances on vegetable crops, yet those dealing with the legume crops of vegetables are infrequent and even those are limited to some members of this family, i.e. peas.

Among the various compounds studied in this regard are the 2,4-dichlorophenexy acetic acid (2,4-D) which have been widely tried, mostly as a weed killer, and recently the gibberellin was also comprised. The effect of these substances on plant growth and its physiological processes occurring within treated plants varied with the crops.

The present review deals with their effects on a group of leguminous vegetables.

Gibberellic acid (GA_3)

The marked effect of GA_3 on plant growth has been well established through extensive investigations during the past decade. Gibberellins are the generic name of several closely related chemical substances which exert profound effect on plant behaviour (Sciuchetti, 1961). Recently thirty four gibberellins have been characterized, identified and are designated as GA_3.

Concerning the mechanism of their action, several works have been done, among which Bernier et al,(1964), Jacobs et al., (1959), and Sachs and Lang,(1961) reported its effect on cell division in the stem apex, increase of cell number, supplying potentially expandable cells. In general their effect accounts for a portion of tremendous growth responses. Furthermore, the daughter cells are also stimulated to elongate by such treatments Foley,(1965) suggested that GA_3 has enhanced auxin effects. Lockhart,(1954) reported that GA_3 induced an increase in plasticity very similar to that observed with auxin. Nitsch and Nitsch,(1959) found that when dwarf kidney beans treated with GA_3 the auxin was ten times compared to the untreated plants.

Regarding the effect of GA_3 on the cells, it appears that both cell extension and cell division play an important role in GA_3 induced growth. Sachs and Lang,(1961) found that induction of GA_3 to stem elongation in rosette plants was due to the stimulation of mitotic activity immediately below the apical meristem and add that the cells produced in this zone after application constitute the tissue of the elongate mature stems.

The physiological action of Gibberellins:

Regarding the effect of GA_3 on plant growth and dry weight, it does not follow a definite trend. When GA_3 promote

elongation they do not always cause a parallel increase in dry weight.

Hans (1937) and Edward (1940) found that stem elongation of Azuki bean was not paralleled by fresh weight increases when the plants were treated with GA_3. The detailed studies of Brian et al ,(1954) showed that the total dry weight of pea increased by GA_3 treatment. Alvim (1960) concluded that in bean plants treated with GA_3 the dry weight of the roots was reduced but that of the leaves was not significantly altered. Buckovac and Wittwer,(1961) mentioned that GA_3 treatments caused a promotion effect on the vegetative extension of bean epicotyl. Gwan et al., (1964) found that treating pea seeds with aqueous GA_3 solution for 6 hours resulted in improved growth of seedlings.

Norica et al (1964) found in three pea varieties that although the shoot height increased with GA_3 treatments, the dry weight decreased in both shoots and markedly the roots. Kalinin et al ,(1964) from their work on 78 plant species, concluded that GA_3 treatments led to increases in the dry matter content of most plants. Broughton and McComb,(1966) reported that GA_3 application to dwarf pea plants, caused a marked increase in the cell wall expansion and the length of the internodes. Neskovic ,(1967) mentioned that GA_3 treatment induced

elongation of young internodes greater than in case of older internodes, and that the stem elongation of pea plants was attributed to the second internode. Uprety,(1968) reported that GA_3 application to Cicer arietirum l. dwarf c.v resulted that the plant height was increased while the dry weight was decreased. Soleimani,(1968) reported that GA_3 application to pea plants increased the stem elongation. Cheng and Marsh, (1968) found that GA_3 application at concentrations between 10^{-6} and 10^{-4} promoted stem elongation of dwarf pea "Pisum sativum L."

Nanda and Daindsa,(1968) mentioned that soybean plants when treated with GA_3 at levels of 1, 10 and 100 p.p.m. this stimulated extension of growth of the stem through increasing the elongation of internodes. Broughton,(1969) found that when GA_3 was applied to the fifth internode of young pea plants, the cell elongation and cell wall synthesis were stimulated and the plants were more higher than the non-treated controls. Mange, (1969) mentioned that GA_3 treatment caused an acceleration in internode elongation when the Cicer arietirum L. plants were in dark, and in the light, it increased the dry weight of the above ground parts. Broughton et al.,(1970) found that GA_3 treated shoots of dwarf pea were more higher than the untreated

ones, and suggested that GA_3 actively directed glucose supply to elongate internodes. Andersen,(1971) reported that GA_3 treated pea plants were more higher than the unsprayed controls and the shoot growth was increased.

Regarding the effect of GA_3 on the carbohydrates, Ergle, (1958) mentioned that GA_3 application caused a somewhat variable effect on the individual carbohydrate fractions. Swan et al., (1964) found that treating pea seeds with aqueous GA_3 solution for 6 hours has resulted in increases of the reducing sugars in the first internode, and as well the rate of starch disappearance from the cotyledon was increased due to the increment of amylase activity. In peas Norica et al,(1964) reported that the concentration of the carbohydrate fractions increased in GA_3 treated plants. Said et al,(1966) found that soaking the seeds of Vicia faba in GA_3 solution for 24 hours, sucrose and the polysaccharide content in the seeds were increased. Kalinin et al,(1964) found that sucrose was reduced in the central part of stem in 78 plant species when treated with GA_3. Nanda and Daindsa,(1968) reported that GA_3 application to soybean plants with concentrations 1, 10 and 100 p.p.m., the starch content decreased with each successive internode from the base and upwards. The starch content pf corresponding internodes was