EFFECT OF TREATING SEEDS ON GROWTH, METABOLISM OF SOME CHEMICAL COMPONENTS AND YIELD OF SNAP BEAN

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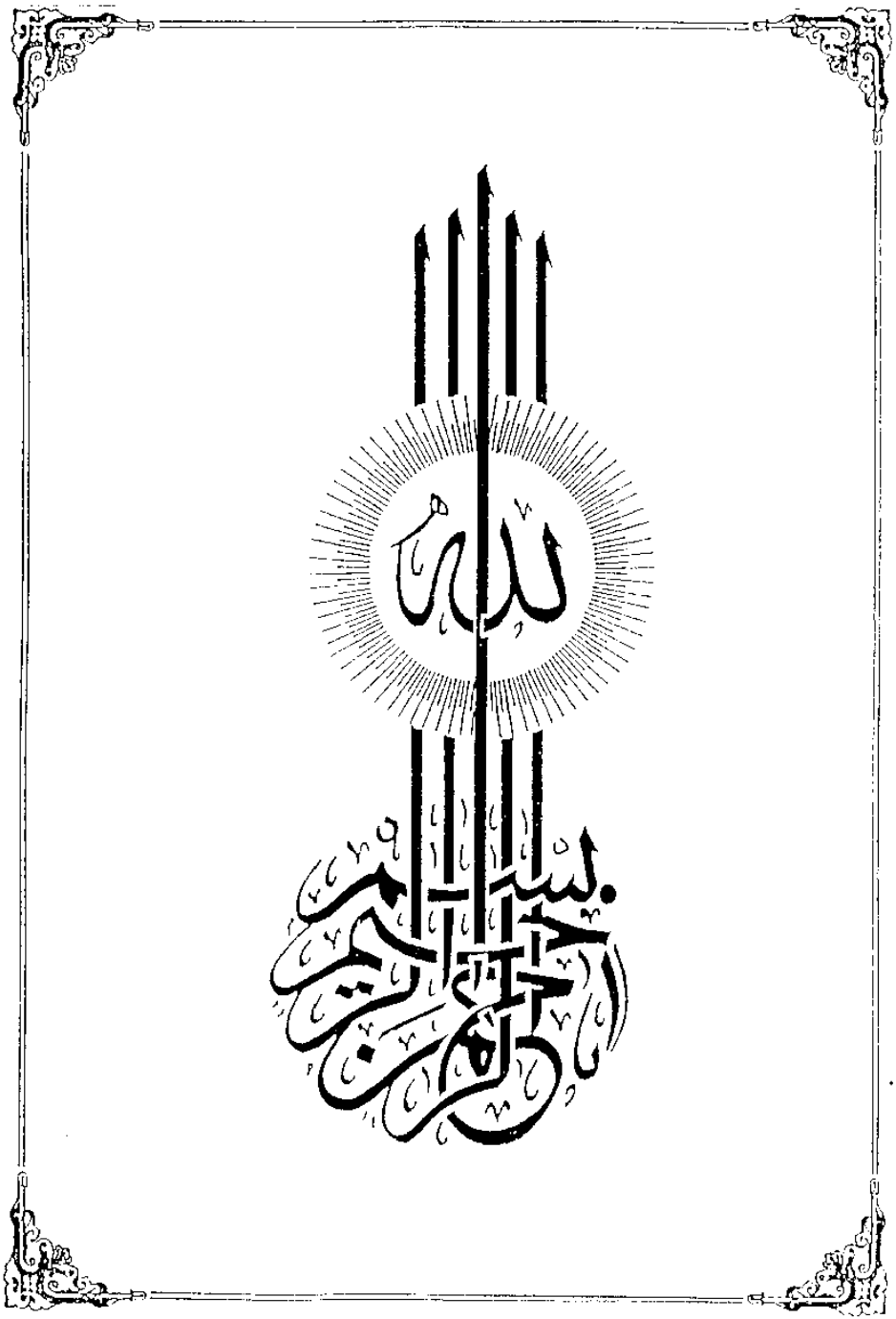

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Snap bean (Phascolus vulgaris L.) is one of the most important leguminous vegetable crops grown in A.R.E. It is cultivated for seeds and pods which used as green snaps. The mean annual acreage amounted to 572, 2817, 6000, 19359 and 21561 faddan in 1929, 1939, 1949, 1965 and 1970 show - ing a marked increase in the total acreage during the last three decades.

The Egyptian government is pressing hard to increase the production of vegetable crops as snap bean to meet the increaseing demand of the population and to increase the tonnage for export. This could be achieved by horizontal expansion as well as by vertical expansion. Vertical expansion refers to increase the total yield per unit area. This could be accomplished by growing heavy yielder culti- vars, improving the cultural practices, better control of pests, plant diseases..... etc.

Treating seeds by vitamins, micronutrients, hormones , insecticides, heat and some other factors is a new trend which is gaining a great popularity in both research work and practical application.

This work was performed to investigate the effect of soaking seeds in, some micronutrients, i.e. molybdenum and manganese, some hormones, i.e. IAA and NAA, some vitamins, i.e. vit. B_1 and vit. C beside irradiating seeds with Co^{60} gamma rays on the yield of snap bean plants. To interpet the causes of variation in yield between different treatments, the effect of the above mentioned factors on the germination percentage, chemical contents of the different parts of the plant during different stages of growth were given due consideration.

REVIEW OF LITERATURE

I - MICRONUTRIENTS

Effect of molybdenum and manganese on the germination and growth of plants.

Molybdenum is essential to the normal development of plants and for the completion of their life cycle (37, 92, 120, 132, 134, 146). The deficiency of molybdenum was associated with depression in growth of beans, peas and broad bean (77, 120). Addition of molybdenum prevented the appearance of the foliar symptoms and caused a marked improvement in growth rate and colour. These results were obtained on cowpeas and beans by adding 1 p.p.m. in low molybdenum soil (88), on peas by supplying to the soil 2 oz. per acre (19), on red clover by applying 8 oz/acre (170), or by applying 4½oz sodium molybdate per 100 gall. water per morgen (168), on lucerne by adding 1 Kg. Na_2MoO_4 per hectare (8), on birdstoof, trefoil, lucerne, ladino and red clover by adding 5 - 8 oz Na_2 Mo O_4 per acre (98) or by applying 300 g. Na_2 Mo O_4 per acre (199). Spraying plants with molybdenum as ammonium molybdate caused a marked improvement in growth rate and clour as shown on pea at $\frac{1}{3}$ oz. in 2 gall. water (45), on

red clover at rates of 71 and 142 G./ha (16), and on lucerne (0.03% solution) and fodder beans (0.05 % solution) of $(NH_4)_2 MoO_4$ (195).

Musakhanov (135), found that soaking horse bean seeds in Mo or Mo + Mn solution was as effective as, and more economic than foliar spraying. Similar results were found by Filippova et al (51), on beans.

Molybdenum had a positive influence on the growth rate and accumulation of dry substances of green fodder of beans (51), lucerne (57, 222) and clover (59) and *Centrosema pubescens* and *Pueraria phaseoloides* (223) plants.

Johnson et al (89), studied the effect of different molybdenum sources on germination of soya-bean seeds. They concluded that neither different sources of Mo nor rates of ammonium molybdate up to 8 oz./60 lb of seed caused germination losses. On the other hand, germination of the pea seeds was not influenced by the lower rates of seed application by sodium molybdate. The highest rate of seed application which gave seed molybdenum levels in excess of 0.5%

reduced germination. Molybdenum toxicity in these trials was expressed principally as a reduction in growth (166).

Date and Hiller (41), found that no significant responses in dry weight of clover by increasing molybdenum levels in low Mo-soil.

Many investigators studied the effect of manganese on the germination, growth and the production of dry matter of plants. Manganese deficiency affected growth of subterranean clover (212). Using manganese sulphate at a rate of 2 and 3 mg./Kg. dry soil increased the weight of stems and leaves over control (113). Spraying twice with 7.5 Kg. Mn S O_4/800 liters of water per hectare increased red clover and lucerne yields (21). Yield of subterranean clover were doubled by application of 40 lb/acre Mn S O_4 (212).

Germination of lucerne seeds in sandy culture (43), and legumes seeds in green house experiments (200) was not affected by Mn application.

Manganese treatment had little effect on dry matter of pasture legumes species. The relative tolerance of species appeared to depend partly on Mn retention with the root system (7). Tolerance to Mn toxicity varied within the varieties (200). On the other hand, manganese had a significant depressing effect on shoot height and weight of soyabean plants by using 4 p.p.m. in water culture (196), 100 p.p.m. on lucerne (43, 54). In nutrient culture, 1.00 p.p.m. increased dry weights and the top/root and pod/stem and leaf ratios of pea plants over the control (46). Musakhanov (135) found that Mo + Mn were more effective on horse beans than Mo alone.

Schweigart and Hartmann (186), working on 21 different crops, showed that plants which seeds had been enriched with trace-elements were strongly activated. This became evident by a shortenning of the germination period and earlier germ leaf formation, better root formation and denser vegetation.

Effect of molybdenum and manganese on mineral contents of plants.

Insufficient and excessive supply of trace-elements affected the utilization rather than the uptake of the other nutrients, resulting in a modified ratio between the organic and inorganic components in the plant, while the ratio of cations to anions remained practically unaffected (185). Molybdenum proved to be indispensable for nitrate reduction in plants (49, 130, 131, 132), in green plants as well as in fungal and bacterial cells it acts as a catalyst in nitrate reduction (132),and for full nitrogen fixation (49). Similar results to nitrogen fixation were obtained on peas (130, 134), beans (174), lucerne (222), and soyabeans plants (175). Molybdoflavoprotein similar to hydrogenase, plays a role in nitrogen fixation by symbiotic bacteria analogous to that proposed for hydrogenase in certain free-living micro-organisms. Molybdenum has an essential role as an electron carrier in certain flavoprotein-nitrate reductase (49). Molybdenum increased the protein content in peas (29, 71, 118, 136, 137, 140, 146, 150, 156, 157, 165, 231), beans (4, 123, 135, 137, 149, 155 156, 158, 159, 220,225), soyabean(70, 175), red clover (26, 59, 146 , 148 ,

159, 191), lucerne (8, 57, 86, 137, 159); berseem (171, 198), lupins (137), legumes (9), Centrosema pubescens and Pueraria phaseoloides (223), ladino clover (141), seradella (146), vetch (137, 159), Glycine wighii (121) and Glycine max plants (23). Ratner and Akimockina (163) revealed that molybdenum increased the nitrate-reduction activity of the lettuce leaves. They added, molybdenum led to an increase in the ratio of protein-N to nitrate-N in the leaves.

Parker and Harris (144), found that the increases in soyabeans yield caused by application of Mo were associated with increases in leaf-N and seed-protein.

On the other hand, some investigators came to the conclusion that molybdenum had no significant effect on the content and uptake of nitrogen (3, 41, 88, 133, 197).

Kliewer and Kennedy (98), found on birdstoof, trefoil, lucerne, ladino and red clover that nitrogen content was correlated with the number of nodules per plant. In lacking molybdenum condition, root nodules developed, but their N-fixing activity was markedly

reduced and the plants showed sever N-deficiency symptoms (132). Molybdenum improved the growth of root system and increased the number and size of the nodules (26, 51, 61, 190, 195). Ruschel et al (174), found that molybdenum reduced nodule numbers of bean plants. Date and Hillier (41) found that no significant responses in nodule numbers were obtained by increasing molybdenum levels.

Molybdenum and manganese increased N content of soyabean (37), and horse beans plants (135).

Molybdenum produced increases in P and K contents of peas (134, 140, 150, 231), clover (148, 191), beans (149), and little or no effect on P and K content of soyabean (112), and cowpeas plants (197).

Chuikov and Petrakova (38), found that manganese increased protein content in Vicia faba .