SOYBEAN GROWTH AND YIELD AS AFFECTED BY PLANT POPULATION, NITROGEN FERTILIZATION AND WATER SUPPLY

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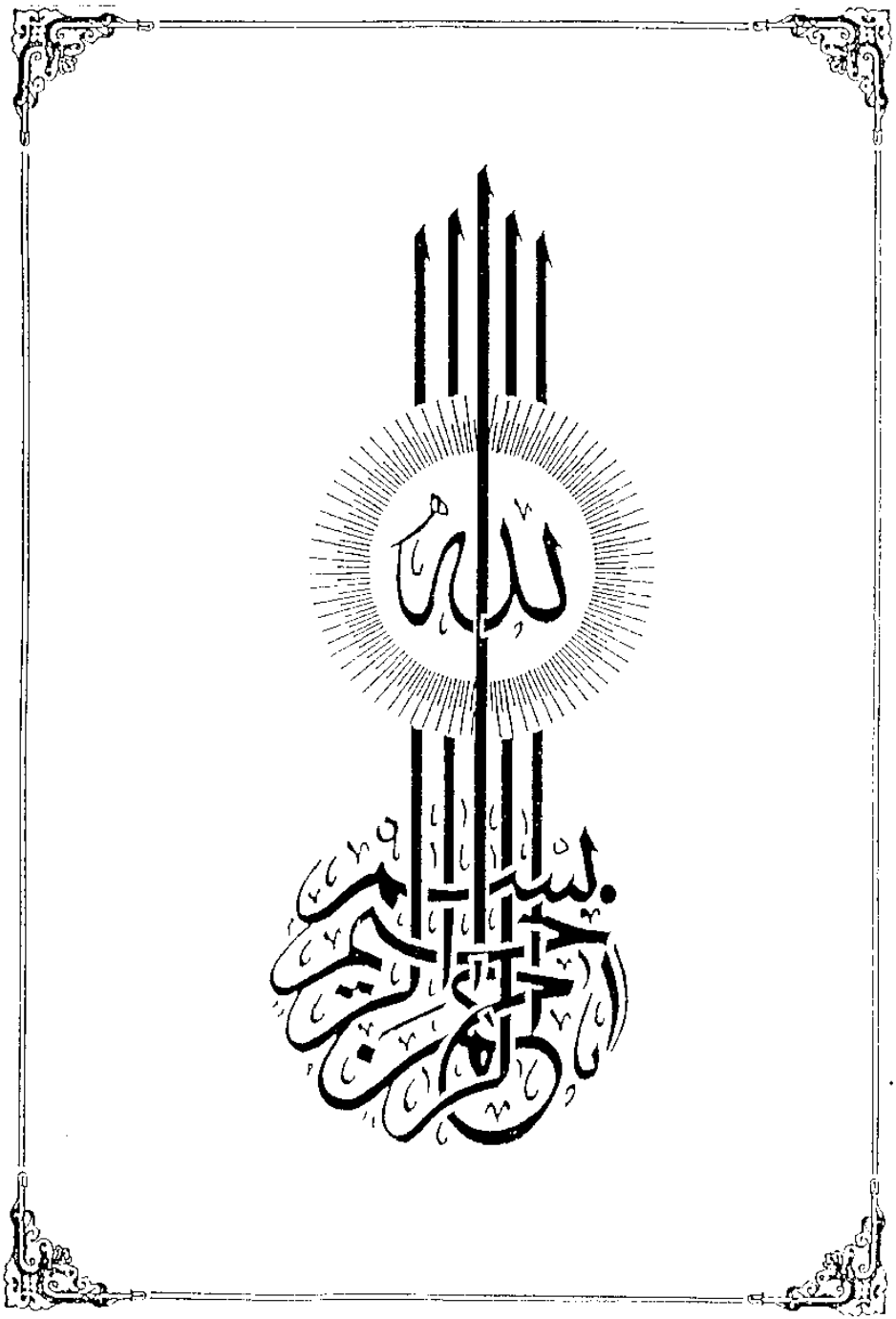

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INTRODUCTION

Soybean as one of the most important protein and oil crops in the world was introduced to Egypt to cover some of the local shortage in these products while agriculture production has not kept pace with the continous increasing of population. In Egypt, soybean is grown for oil and protein and as a soil improving crop. Many products could be obtained from soybean for human food and animal feed.

In Egypt, the cultivated area is still small and it is difficult to disturb or to change the crop rotation in the cultivated land so, it must be to pay attention to increase the amount of soybean seeds with increasing yield per area unit which could be done by improving the agricultural treatments, fertilization, plant population, irrigation, weed control, ...etc. The recent trend is to grow dense plantings to get greatest yield. Soybean is a leguminous crop, it can get its nitrogen requirements from nitrogen in the soil air by the aid of nodulule bacteria and by adding different amounts of nitrogen supply. Also, water requirements play a major role in growth and yield.

The aim of the present study, is to answer the question of to what extent it will be required to increase the amount of fertilizers and the amount of water supply with increasing plant density. Due consideration was given to the influence of these factors on growth and yield improvement of soybean plants.

REVIEW OF LITERATURE

1. Effect of nitrogen fertilization and plant density on :

A. Growth and growth analysis :

Shannon et al. (1971) reported that there were no significant differences in plant height among different populations 3, 6, 9 and 12 plant hills through spacing from 30 to 65 cm between hills in soybean plants.

Hassan (1981) investigated that the dry weight of plant, leaf area, relative growth rate (R.G.R.) and plant height increased with increasing nitrogen fertilization up to 90 kg N/fad.

Karim et al. (1981) showed that plant height was significantly greater at narrow spacing at 30 cm rows apart.

El-Kady et al. (1982) found that high nitrogen levels (up to 2 N $NaNO_3$ supplied with nutrient sol.) resulted in increasing soybean plant height, leaf area, stem and leaf dry weight and net assimilation rate.

Ashour and Thalooth (1983) studied the applying of nitrogen fertilizer at rate of 35, 70 or 105 kg/ha applied to the soil or foliar sprayed as urea, they found that applications of nitrogen at pod filling increased fruit-set and pod weight of soybean plants.

Martignone and Nakayama (1983) stated that applying urea with foliar fertilization for soybean plants sown in pots increased leaf and seed nitrogen percentage, leaf and seed weight, specific leaf weight (SLW), fruit relative growth rate (RGR) and net assimilation rate (NAR) on a leaf area basis suggested greater assimilatory activity.

Mohamed (1985) observed that increasing nitrogen rate (up to 80 kg N/fad.) increased soybean plant height, number of branches, leaves and pods and dry weight of stem, leaves and pods. Nitrogen fertilization also increased leaf area (LA), leaf area index (LAI), specific leaf area (SLA) per plant while specific leaf weight (SLW) and relative grown rate (RGR) of pods were decreased.

Bharati et al. (1986) found that nitrogen application to 270 kg/ha for soybean plant increased lodging and plant height.

B. Yield and yield components :

Arnold (1964) pointed out that 1.5 inch plant spacing within the row gave greater yield than 3-inch spacing in soybean plants.

Shannon et al. (1971) found that soybean seed weight differed significantly among varying plant numbers per hill at 3, 6, 9 and 12 plants per hills through spacing from 30 to 65 cm between hills.

Rahman et al. (1978) stated that the number of soybean pods/plant was max. at the highest level of fertilization up to 40 lb N/ac.

Cassel et al. (1978) concluded that the application of nitrogen fertilizations at the rate of 24 kg N/ha increased soybean grain yield.

Nelson and Weaver (1980) reported that the rate of dry matter accumulation per hectar and distribution of nitrogen within the soybean plants was not greatly affected by different planting densities (48500, 97000, 194000 plants/ha).

Bashir et al. (1980) indicated that nitrogen fertilization at the high rate of 112 kg N/ha increased significantly seed yield of soybean.

Hamissa et al. (1980) stated that soybean yields was increased with increasing application of nitrogen fertilizer up to 45 kg N/fad.

Tunio et al. (1980) observed that the max. soybean grains yield was obtained at 30 cm row spacing and 15 cm plant spacing.

Mahler and Mollum (1981) showed that irrigated soybean seed yields were significantly greater when inoculated with rhizobia than non-irrigated treatments.

Karim et al. (1981) investigated that seed yield increased significantly with increasing rates of nitrogen up to 67 kg N/ac. and potassium with narrow rows spacing (30 cm apart between rows).

Hassan (1981) investigated that the seed yield and number of pods/plants increased with increasing nitrogen fertilization up to 90 kg N/fad.

Gomaa et al. (1981) pointed that increasing soybean plant density increased plant height at harvest while seed yield, number of pods/plant, seeds/pod, 100-seed weight and number of branches/plant decreased with increasing density up to 141000 plant/fad.

Miah et al. (1981) concluded that soybean yield was icnreased with decreasing in inter-plant spacing to 2.5 cm.

El-Kady et al. (1982) found that high nitrogen levels up to 2 N $NaNO_3$ supplied with nutrient sol. decreased soybean seed yield, pod yield, number of pods and 100-seed weight.

Cordonnier and Johnston (1983) stated that decreasing row spacing from 76 to 51 cm and increasing spacing in row from 20 to 32 plants/m both generally increased soybean yields.

Boquet and Paxton (1983) reported that yield losses was less severe with the narrow row spacing (10 and 20 inch between rows).

Sojka and Parsons (1983) observed that there was no signficant differences in soybean yield due to row sapcing (1.02, 0.76, 0.51 or 0.36 m).

Irwin et al. (1983) stated that planting density of 25 plants per sq. meter gives yields about 15% higher than 15 plants per sq. meter.

Watanabe et al. (1983) reported that yield was increased by the application of 20 kg N/ha ten days after flowering.

Dubetz et al. (1983) stated that soybean yield was increased substantially with nitrogen fertilizer at rate of 160 kg N/ha.

Walker and Fioritto (1984) observed that an 18% average soybean yield increase resulted from decreasing row widths from 76 to 19 cm.

Mohamed (1985) investigated that increasing nitrogen rate up to 80 kg N/fad. caused significant increments in both soybean seed, straw yield/fad. Increasing in seed yield due to increasing seed yield per plant and number of seeds per pods.

C. Chemical composition :

Taire et al. (1979) observed that significant differences in seed protein and carbohydrate contents with different rates fertilizer (25, 50 and 100 kg N/ha) and plant density had no effect on soybean seed composition.

Rahman et al. (1978) pointed that seed carbohydrate content was max. and oil content min. at the highest level of fertilization up to 40 lb N/ac.

Bello et al. (1980) found that the effect of plant population between 380000 and 760000 plant/ha. was not evident in increasing seed nitrogen or seed yield.

Hassan (1981) investigated that the oil percentage decreased and protein percentage increased with increasing nitrogen fertilization up to 90 kg N/fad.

El-Kady et al. (1982) stated that seed protein content increased with increasing N supply up to 2 N $NaNO_3$ supplied with nutrient sol.

Watanabe et al. (1983) concluded that protein content of the seeds was increased by the fertilizer application of 120 kg N/ha.

Pal and Saxena (1983) studied 6 levels of nitrogen fertilizer between 0 and 300 kg/ha. They found that increasing N specially synbiotically fixed gave greater crude protein and oil content.

Ashour and Thalooth (1983) stated that seed yields of oil and protein were increased with increasing nitrogen fertilization up to 105 kg N/ha.

Mohamed (1985) found that increasing nitrogen rate up to 89 kg N/fad. caused significantly increments in protein, oil and carbohydrate yields/fad.

2. Effect of water supply and plant density on :

A. Growth and growth analysis :

Mahmoud (1976) reported that the soybean plant height decreased when hill spacing increased up to 20 cm between hills.

Sivakumar and Shaw (1978) showed that relative growth rate (R.G.R.) of soybean showed a negative correlation with leaf water potential up to (20 Bar).

El-Wakeel (1979) studied the effect of water regime on growth, growth analysis and yield and its components. He found that leaf area and specific leaf weight (S.L.W.) increased with increasing soil moisture up to 50%, but plant