EFFECT OF NITROGEN FERTILIZATION AND 2,4-D SPRAYS ON THE GROWTH AND YIELD IN NAVEL ORANGES

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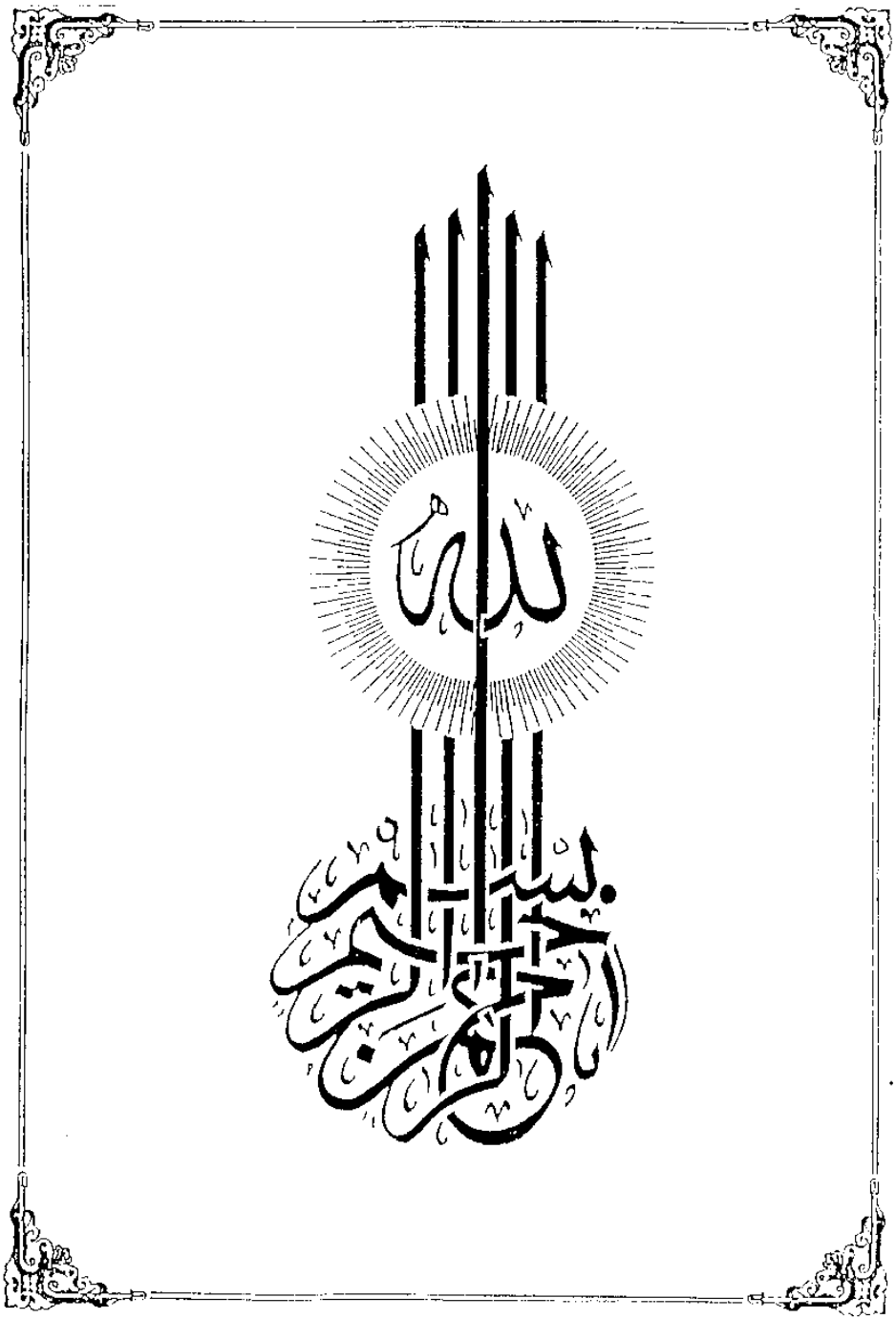

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I. INTRODUCTION

Citrus is an important fruit crop in tropical and subtropical countries. Citrus fruits rank third after grapes and apples, as far as world production is concerned. The total acreage of citrus in the Arab Republic of Egypt, is about 137000 feddans according to the latest statistics of the Egyptian Ministry of Agriculture in 1969.

Navel orange is the most promising fruit for export in Egypt. The greatest draw back in Navel orange trees is the variability in its strains which is reflected in fruit shape and size. The greatest problems in Navel orange trees is its low fruit set and severe shedding. Moreover, the preharvest fruit drop is not uncommon. which affects the yield drastically.

The purpose of this investigation is to study the effect of nitrogen fertilization and 2,4-D sprays on: fruit set, June drop, preharvest drop, vegetative growth, mineral status in tree leaves, yield and fruit quality of Navel orange.

II. REVIEW OF LITERATURE

A. Effect of Nitrogen fertilization on vegetative growth:

Reitz (1961) studying the citrus needs for adequate nutrition, found that the removal of 500 boxes of oranges per acre is equivalent to the loss of 145 lb. K_2O, 80 lb. N, 35 lb. CaO, 17 lb. MgO and 23 lb. P_2O_5. Nutritional deficiencies result in reduced growth, leaf chlorosis patterns, premature defoliation with increased sensitivity to cold winter weather.

Smith and Rasmussen (1961) working on Marsh grapefruit found that growth was unaffected by the different sources of nitrogen. An increased N supply increased leaf N and decreased leaf P and K.

Rodney and Sharples (1961) working on Lisbon lemon found that the P content of leaves was unrelated to phosphate applications, but was inversely related to the amounts of N applied. The K content of leaves was relatively high in the low-N series of treatments, and lower where phosphate and the higher levels of N were applied.

Sato and Ishihara (1964) studied the effect of N and K on the growth and leaf analysis of mandarin oranges. They found that the plants which were treated with the 2 higher rates of N showed stronger growth than those treated with the lowest rate. Total weight per tree increased with increasing applications of N. No marked differences were observed in the leaf N contents at the 2 lower rates of N but an increase was shown in the third treatment. The effects of K applications on plant growth and leaf N content were not apparent, but the leaf K contents increased in proportion to the applications of K in all the N series. When the same level of K was applied the leaf K contents decreased with increasing applications of N. However, the total plant contents of K were hardly affected by N levels.

Challen and Mabbitt (1967) stated that the application of 8 lb./ acre of calcium ammonium nitrate to lemon trees at the rate of 1 lb./month during the growing period resulted in vigorous growth especially when organic fertilizer was added to the basic application. In comparison, similar trees receiving an annual dressing of 1:1:1 fertilizer at 4 lb./tree developed yellow foliage and made little growth.

Sakamoto and Okuchi (1968) studied the effects of time of nitrogen supply on the tree growth and leaf nitrogen of Satsuma orange. The N supply was maintained at 40-50, 80-100 or 140-160 p.p.m. N from May to October. High N levels promoted vigorous growth and a high N content in the leaves. Trees grown with 40-50 p.p.m. N were also given 200-250 p.p.m. N for the periods May-June, July-August or September-October. Tree growth was very vigorous after the May-June boost especially in the non-fruiting year. July-August applications enhanced vigour to a lesser extent. Increased N in September-October was generally unfavourable. Early additional N was more effective in increasing both growth and raising the leaf N content.

Lenz and Cary (1968) working on Navel orange trees reported that the leaf, stem and root growth of cuttings was reduced by the fruit and this was more pronounced in plants with low levels of N and P. Total dry matter of cuttings was increased by high levels of N and P. However, there was little difference between total dry matter of fruiting and non-fruiting cuttings in each of the nutrient treatments, which indicates higher net efficiencies of leaves in fruit bearing plants.

Sharples and Hilgeman (1968) working on Valencia orange trees found that additional N up to 3.63 kg./tree did not further increase trunk growth. Nitrogen in leaves of unfertilized trees decreased from 2.07% to 1.89% with leaf N significantly correlated with fruit production. Leaf N values associated with graphically estimated optimum yields were calculated from regression coefficients. They ranged from 2.15% to 2.27% and the mean was 2.21%. Leaf P was unaffected and leaf K was significantly reduced by increased N rates.

Smith (1968) studied the effects of nitrogen rates and timing on Marsh grapefruit in Florida. He found that the tree size and the number of new shoots per flush of growth were essentially unaffected by rate of N. The number, size and longevity of leaves were all increased by N. Low N caused a continual yellowing and shedding of mature leaves so that leaf life was limited to about 12 months. Such trees were continually pale in colour and thinly foliated whereas trees with adequate N were density foliated with the leaves persisting up to 24 months and always a darker green. Timing of N application did not affect the total amount of vegetative growth or the

period of bloom. Post-bloom applications, especially in summer, reduced the amount of spring growth and increased the summer growth. Nitrogen determinations on spring-flush leaves of various ages indicated that 2-month-old leaves were more sensitive indicators of N treatment and tree status than older leaves. Leaves 8 months and older were relatively insensitive. At best, total leaf N was not a good indicator. Consistent trends were found by extensive sampling but differences caused by treatments were relatively small. Using 4- to 5-month-old spring leaves from non-fruiting shoots, a value of about 2.5% N appeared to be optimal for best growth and production. Both yearly fluctuations and timing of N application may affect the N content of leaves. Visual scoring showed colour and density of canopy to be closely related. Colour ratings reflected tree condition and N responses better than N determinations of leaves at various seasons. The results indicate that a single application of a moderate rate of N in autumn or winter would be ample for commercial practice in Florida.

B- Effect of nitrogen fertilization on fruit set and fruit drop:

Singh (1961) working on some varieties of sweet orange and mandarin showed that flower production and initial fruit set were usually highest with the highest level of N.

Reitz (1961) found that the nutritional deficiencies result in premature fruit drop sometimes accompanied by fruit splitting.

Dhillon et al. (1964) working on sweet lime found that the percentage of perfect flowers produced and fruit set were increased, and fruit drop was reduced, by N application. Rates of 2 and 6 lb. per tree gave the best results for shy- and normal bearing trees, respectively.

Dhillon and Singh (1965) studied the effect of plant regulators and nitrogen application on fruit drop in Nagpuri mandarin. They found that the ammonium sulphate + 20 p.p.m. 2,4-D and 10 p.p.m. 2,4,5-T resulted in a significantly greater retention of fruit after the June drop; 20 p.p.m. 2,4-D and ammonium sulphate + 10 p.p.m. 2,4,5-T caused a marked reduction in the pre-harvest fruit

drop. When 2,4,5-T was applied alone or in combination with N the amount of fruit remaining on the trees until harvest was greatly increased.

Lenz (1966) found that the main bloom period in Valencia Late orange was delayed in leafy inflorescences, particularly under higher N treatments. In leafy inflorescences and with higher N status heavier fruit-set was favoured and was associated with late fruit-drop, a long interval between style-fall and fruit-drop, a short time of flowering, and a short interval between petal-fall and style-fall. At low N levels and in leafless inflorescences fruit-set was poor.

Lenz and Cary (1968) studied the relationship between vegetative and reproductive growth in leafy and leafless inflorescences of Washington Navel orange trees receiving different N levels. They found that flower formation decreased with increasing numbers of fruits per cutting, and this was not affected by different nutrient levels. Differentiating leaves of inflorescences delayed their early flower development. At a later stage, however, the growth of reproductive organs was favoured

by leaves. Fruit set was better in leafy than in non-leafy inflorescences, particularly if trees received adequate nitrogen.

Cutuli (1969) studied the effect of foliar treatment with urea on fruit drop in forced lemons. Spraying the foliage of the variety Monachello at petal fall with 1% urea, in addition applying ammonium nitrate to the soil at the resumption of irrigation, increased the number of fruits formed by 34.8%, the number falling prematurely by 24.7% and greatly increased the number and yield of fruits per tree.

Lenz (1969) studied the effect of varying N doses on the flower development and fruit set of leafy and non-leafy inflorescences of Washington Navel oranges. The length of the inflorescence was determined by the presence or absence of leaves, particularly at high-N levels. Removing the leaves on the inflorescence during its development reduced its growth. The flowers of leafy inflorescences had a lower fresh weight than those of non-leafy ones; this weight could be increased by defoliating the inflorescences 14 days before flowering.

The reproductive organs of fruit set were larger, the flowering period and time from anthesis to post blossom drop was longer, the main drop occurred later and fruit set was higher with leafy than with non-leafy inflorescences. Most of these factors were enhanced by high N levels. A lower fruit set occurred in 1964 (a heavy-flowering year) than in 1963.

C- Effect of nitrogen fertilization on yield and fruit quality:

Singh and Agrawal (1960) studied the nitrogen requirements of citrus. Trials showed that spread and volume of tree and fruit yield were positively, and total soluble solids and vitamin C content of the fruit were negatively, affected by N levels, but that tree height, juiciness of fruit, acid in juice and T.S.S./acid ratio were not affected. It is recommended that for 1- to 7-year-old mandarins the N schedule should be the same as that used for sweet oranges, viz. 6 increasing to 36 oz. N per tree per year.

Rodney and Sharples (1961) working on Lisbon lemon trees found that increasing N fertilization from 1 lb./tree/year to 2.5 or 4.0 lb. resulted in no increase in the number of fruits produced, except where phosphate or steer manure was supplied in addition to the N. Fruit size was increased by applications of steer manure, but not by the other fertilizer treatments.

Smith and Rasmussen (1961) found that production and fruit quality of grapefruit were unaffected by the