CHAPTER VI.

SUMMARY AND CONCLUSIONS

The investigations reported in this thesis, concern the study of the effect of different water tables and salinity levels; various combinations and concentrations of salts; stock and scion relationship with reference to salt tolerance and the effect of some major nutrients, and micronutrients on citrus.

A) EFFECT OF DIFFERENT WATER TABLES AND SALINITY LEVELS ON CITRUS

The experiment to study the effect of different water tables and salinity levels was conducted on Ludhiana sandy loam soil, using Blood Red variety of sweet orange budded on rough lemon. For this purpose a special apparatus was designed so as to maintain the depth of water table at 1, 2, 3 and 4 feet. Assuming that the effect of water table is also dependent upon the concentration of salts present in the soil water, four levels of salinity with electrical conductivity of the water 1, 2, 4 and 6 m.mhos/cm at 25°C were also maintained. Thus there were in all 16 treatments. The effect of these treatments on citrus is summarized below:

The plant growth was affected most markedly by one foot water table. This effect was most significant only in case of height of plant, stem diameter, spread of the plant and chlorophyll content of leaves. The differences between 2, 3 and 4 feet water table were non-significant. Similar effect was noticed on the fresh and dry weight of roots and shoots separately as well as together. The
results clearly show that one foot water table is most harmful for citrus. Out of the 4 levels of salinity, the most marked adverse effect was produced by the highest level of salinity (C₉) i.e. electrical conductivity of 6 m.mhos/cm. This effect was significant in case of spread of plants and chlorophyll content of leaves. Similar marked effect on fresh and dry weight of roots and shoots and their total weight was also visible. This effect became more appreciable when C₉ level of salinity was combined with 1 foot water table.

The top growth, root growth and depth of penetration of roots were found to increase with the depth of water table. At deeper water tables, the roots were numerous and more fibrous, and they were adversely affected by the high salinity level.

Na content of leaves showed the maximum value with one foot water table whereas Mn, Zn and Fe & Mo showed the lowest values. With one foot water table the uptake of K was almost 3 times as much as that with 2, 3 and 4 feet water table treatments, whereas the Ca content followed just the opposite trend. The uptake of Mn, Zn and Fe registered decrease at high water table. The K content was markedly depressed by C₉ and C₄ levels of salinity but Ca showed opposite trend. The Cu and B content was depressed by the high level of salinity but Zn and Fe showed an increase.

These results show that 1 foot water table and C₉ (6 m.mhos/cm. at 25°C) conductivity are significantly harmful to citrus.

B. Effect of different levels and combinations of salts on citrus.

To study the effect of salts, their forms and concentration series of experiments were conducted on light and heavy soils of
Ludhiana in large containers with Blood Red variety of sweet orange budded on rough lemon. High, medium, low and reduced salt concentrations with different combinations of sodium chloride, sodium sulphate, sodium bicarbonate and borax were tried.

The total salt concentration under high, medium, low and reduced salt combinations ranged from 8220 to 8000 ppm, 1912.5 to 1100 ppm, 1100 to 275 ppm and 762.5 to 550 ppm respectively. There were seven treatments including control under high and medium salt concentrations; six under low and four under reduced concentrations.

It was observed that the salt concentration greater than 1100 ppm proved highly detrimental to the growth of plants. Even 500 ppm of NaCl and 600 ppm of sodium sulphate whether used alone or in combination proved harmful. No adverse effect was noticeable when the total concentration of NaCl + Na₂SO₄ was 550 ppm. At the same concentration of salts, sodium sulphate was found to be less harmful than sodium chloride. The harmful effect of the salts was more marked in light than in heavy soil. In the light soil addition of 2.5 ppm of borax seemed to be beneficial.

The chlorophyll content of leaves decreased with the increase in the concentration of salts. The reduction in the chlorophyll content of the leaves was accompanied by higher uptake of sodium and lower uptake of K, Ca and Fe.

Sweet orange grown one after the other in the pots where sweet orange had failed showed good growth even under medium concentrations of salts indicating that these crops are more...
tolerant of salts than sweet orange. Wheat proved to be superior to maize in this respect. The results also show that good growth of these crops should not be used as criterion for the success of citrus.

From these studies it appears that 550 ppm salt concentration may be considered a safe limit for Blood Red sweet orange provided the sodium chloride content does not exceed 250 ppm.

Comparison of different rootstocks and scions with regard to their salt tolerance

Relative tolerance to salts of Blood Red variety of sweet orange budded on Jatti Khatti (Citrus limonia), kharma khatta (Citrus kurna), galgal (Citrus limon) and trifoliage orange (Poncirus trifoliata) rootstocks and of sweet orange varieties viz. Blood Red, Hamlin, Valencia late and Pineapple budded on a common rootstock - rough lemon was also studied during these investigations. The salt combination used for this comparison contained sodium chloride 1500 ppm, sodium sulphate 200 ppm, sodium bicarbonate 210 ppm and borax 2.5 ppm. The results are summarized below:

i) The plants budded on kharma khatta (C. Karna) showed more tolerance to salts than the ones on the other three rootstocks. Kharma khatta was followed by galgal, trifoliage orange and rough lemon respectively.

ii) Out of various scions budded on a common rootstock - rough lemon, Hamlin and Valencia late proved more tolerant to salts than Pineapple and Blood Red.

iii) Blood Red showed the minimum root growth indicating that it is the most susceptible variety and, therefore,
unsuitable for saline conditions.

101 Effect of macro and micronutrient elements on sweet orange

In another experiment, the effect of N, NPK and micronutrients was studied on Blood Red sweet orange grown in pots on Ludhiana sandy loam soil. N, NPK and control formed the main treatments and Fe, Zn, Mn, Cu, B and control as sub-treatments. Thus in all, there were 18 treatments. The major nutrients were applied to the plants in the soil and micronutrients through the foliar sprays. The chlorophyll and the nutrient contents of the leaves were determined. The main results are as follows:

(i) The chlorophyll content of leaves varied in the order NPK / Control. The application of Zn and Fe also increased the chlorophyll content.

(ii) Compared with N alone, NPK reduced N, Ca, Zn and Cu content of leaves and increased P and K content while the application of N increased the N, Ca and Mg content of the leaves.

(iii) Na and B content of leaves in all the treatments was higher as compared to the limits fixed for these by the various workers in foreign countries. It seems probable that the critical limits for various nutrients are dependent upon stock and scion combinations.

(iv) Sprays with micronutrients increased the content of the respective nutrient in leaves. Iron sprays, however, reduced Zn, Na and Cu content of leaves.

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