CHAPTER I

INTRODUCTION

As a result of the partition of the Punjab in 1947, most of the well established citrus orchards were lost to Pakistan. The truncated State of the Punjab (India) was left with an area of less than 4000 acres under citrus fruit trees (Cheema et al., 1954), and the citrus industry was rudely shaken. Nevertheless, the partition proved a blessing in disguise in as much as it offered an opportunity to the experienced fruit growers to show their worth once more. An ambitious project of garden colonies was undertaken to fill the void thus created. Fruit growers in some parts of the State were enthused to take up citrus growing in preference to ordinary farm crops. As a result of the renewed fillip the citrus industry began to expand. Soon the fruit area rose to 15,000 acres, which is one-fourth of the total area under fruits in the State.

A few years after these orchards were planted, a general decline in plant vigour began to manifest itself. The trees gave an unhealthy look with chlorotic leaves. It was disconcerting to the fruit growers and baffling to the research workers.

Theoretically, the situation could be attributed to one or several possible causes such as nutritional disorders, a high water table, salinity and alkalinity, toxicity of certain ions, bad irrigation water, defective soil management, poor rootstock, certain pathogens and insects, growing of exhaustive crops, presence of a hard pan in the soil and defective soil structure. The first three appear to be the most common.
The observation, that the malady does not afflict the trees early is a pointer to some nutritional disorder, for during the first four years after planting, the citrus trees require very small amounts of micronutrients. At the same time, the effect of a high water table, which is rising year after year, cannot be lost sight of. Salinity and alkalinity are also ever on the increase. The causes and effects of all of them are so much intermingled and mutually interrelated that one cannot be studied to the exclusion of the other.

Lately, the menace of water logging has assumed alarming proportions in the Punjab State. It is estimated that about 5.2 million acres of area in the canal irrigated tracts has water table within five feet from the natural soil surface; and another 5.8 million acres of area has water table within five to ten feet (Uppal, 1962). Exceptionally heavy rains during the past 15 years or so, coupled with frequent floods, are responsible for the present situation. Our denuded hills, impeded underground and surface drainage, and seepage from canals aggravated the problem of water logging. According to Uppal (1962), colossal amount of 112 cusecs out of every 182 cusecs of canal water let in at the head, seeps into the underground. This may be an exaggerated estimate but seepage is enormous.

Water logging is known to hinder plant growth due to reduction in oxygen and accumulation of carbon dioxide in the rootzone of growing plants. It has an adverse effect on the soil temperature, biological activity and structural stability of soils. Nutritional and physiological activities of the plants are seriously disturbed.
Incompletely oxidized and reduced organic compounds e.g. methane, methyl compounds, and complex aldehydes along with sulphide, ferrous and manganous ions play havoc with plant life. Root activity, transpiration, photosynthesis and respiration are all hampered. Plant diseases gain an easy access.

Apart from the menace of a high water table, more than three million acres of land is affected with alkalinity and salinity. Water logging, defective drainage, nature of parent material from which our soils are formed and faulty irrigation water have all helped in the spread of alkalinity and salinity. In arid tracts of the south eastern districts, soil water evaporates, leaving salt deposits on the surface of the soil. Along with deterioration in soil structure and the consequent impairment in its air capacity the nutritional balance of the plant is seriously disturbed by the osmotic effects of salt concentration. Availability of phosphorus, iron, manganese, zinc and copper is adversely affected to the detriment of plant life. Certain cations and anions such as sodium, carbonate, chloride, sulphate and borate accumulate to such an extent that they prove directly or indirectly toxic to many plants. Frequently, a hard clay pan develops under high sodium soils, which seriously impairs the root development of fruit plants.

Chlorotic patterns noticed on the citrus leaves are symptoms of deficiency of nutrients. Two major nutrients viz. nitrogen and phosphorus are usually deficient in soils of the Punjab plains. Kanwar and Randhawa (1959) and Kanwar and Dhingra (1961) while listing the causes of chlorosis of citrus in the Punjab State have reported rise of water table and hence poor
aeration, as one of the important soil factors responsible for this malady. Kanwar and Randhawa (1960) while comparing healthy and chlorotic citrus leaves and soils having normal and chlorotic citrus plants, have reported that besides salinity, higher uptake of P and Mn resulting in the deficiency of Zn and probably of Fe is responsible for this malady. Kanwar et al. (1963) have also reported that soils having chlorotic citrus plants are deficient in exchangeable Cu, Zn and Fe and high in K and Ca.

From the above discussion it will be apparent that there is an urgent need for the study of the effect of different water tables, salinity levels and nutrient levels on the growth of citrus in the Punjab. The present study, therefore, was undertaken at Ludhiana to study the effect of water table, salt concentration and nutrients on sweet orange (Citrus sinensis) under Punjab conditions. The results achieved throw some light on the problem of citrus decline in the Punjab and are expected to help plan corrective measures against this growing menace.