INTRODUCTION

India is a major oil seed producing country. In economic terms, oilseeds contribute almost four per cent of India's Gross National Product. Among all the major oilseed crops, groundnut has the largest area under cultivation (46%) having an estimated oilseed and edible oil production of 67 and 59 per cent, respectively. Groundnut also dominates the agricultural fat economy of India. Nevertheless, on the national basis, there is an acute shortage of edible oils. Therefore, there is a need for bringing newer areas under oilseed cultivation, especially groundnut.

It is generally known that groundnut exerts specific demands on the physical conditions of the soil because of their peculiar growing habit, fruits developing in the soil after the penetration of the pegs. Therefore, it becomes essential to study the optimum soil condtions such as soil water, temperature, aeration and mechanical impedance from seeding to yield, so that the desired condition may be created through proper soil and water management.

Knowledge of soil moisture status throughout the growing season is useful in predicting final yields at harvest (Idso et al., 1975). The facility of irrigation, particularly in this part of the country, is meagre. This calls for a judicious irrigation scheduling that can be used at farmers' field level. A modified meteorological approach based on the ratio between irrigation water (IW) and cumulative pan evaporation

(CPE) as a practical guide for scheduling irrigation, has been in use in recent days. The advantage of this approach is that the farmers need not change the amount of water from one irrigation to another. In the event of rain, the interval for the next irrigation would have to be only increased. Where the pattern of pan evaporation during the growing season does not vary much yearly, it also permits the computation of a time table for irrigation.

The present experimental soil, Kharagpur lateritic sandy loam soil is highly permeable in the surface layers with low water retentive capacity, but the moisture retention in the layers down the profile is comparatively higher because of increasing content of finer particles. Extensive net of roots of groundnut plants are mostly concentrated in the shallow depth of 10 and 25 cm (Arnon, 1972), and can not therefore extract water, though present in the lower layers unless water is rendered available to the effective root zone. The effective root zone of the groundnut plant, has a direct bearing on the crop production. The presence of an adequate water supply in the upper most few centimeters of the soil is also essential for proper seed germination and crucial early development of the emerging crops. The utilisation of the stored moisture will depend on the favourable soil physical environment; the latter can be achieved by maintaining desired soil surface conditions. Mulch has been widely used to increase the water intake, storage

(Corey and Kemper, 1968; and Schneider and Mathers, 1970), and to improve moisture distribution in soil profile, or, to decrease evaporation (Adams, 1962; Willis et al., 1963; and Bennett et al., 1966). Any reduction of soil moisture evaporation would be as beneficial to crop growth as additional water intake by the soil.

Evaporation is an important consideration in the scheduling of many farming operations particularly irrigation, in both irrigated and dry land agriculture. High soil evaporation rates and low storage efficiencies can very much thwart all efforts to increase crop production. A knowledge of the movement of the soil moisture drying front into the soil during evaporation gives information useful in advancing knowledge of the evaporation processes.

Soil temperature is recognized as one of the most important factors in the production of crop. Some degree of manual control of soil temperature is possible through regulation of soil moisture, soil cover and tillage. In addition to such factors as soil water content and soil temperature, plants are sensitive to the aeration status of the soil. It has been fairly well recognized that poor soil aeration is detrimental to plant growth. The rate of oxygen diffusion is, in general, a unique function of the water free porosity of the soil (Taylor, 1950). Management practices should therefore aim at maintaining a soil physical condition favourable for a soil aeration pathway.

Measurement of soil temperature by automatic temperature recorder is though precise, yet its use is restricted because of unavailability of power supply and other technical problems in the field. Keeping this in view, a portable battery operated thermocouple amplifier for in situ temperature measurement has been designed and fabricated. And to study the soil physical properties in almost natural field condition in the laboratory, the necessity of an undisturbed soil core sampler was felt. With this objective, a soil core sampler was also designed and fabricated.

Tillage modifies physical edaphic condition of the soil surface, but its requirement varies with the crop as well as with the prevailing soil-climatic conditions. It is important to define the optimum tillage conditions with respect to the physical necessities of the crop root zone for a particular crop. Root proliferation depends mostly on the physical environment in the soil. Tillage directly affects soil bulk density. A higher bulk density in the root zone may adversely affect root growth. Phillips and Kirkham (1962), and Parker and Taylor (1965) have reported a parabolic relationship between soil density and crop growth. A proper tillage would be one that fulfils all these conditions at a reasonable cost and at the same time harvests the best crop yield.

Seedling emergence is the expression of a complex interaction of seed and soil factors. An understanding of the influence of seed germination and seedling emergence in the field is essential if predictable crop establishment is to be achieved. It is of particular interest to analyse and evaluate the water uptake pattern as affected by the soil water potential or the rates of the water flow from soil to the seed through the seed-soil-interface or inside the seed itself. Improper seed-soil contact reduces seed germination even at high soil water matric potential. Low water uptake rate prolongs the imbibition period during which the top soil dries out (William and Shaykewich, 1971). Tillage reduces the seed-soil-water contact impedance and provides an improved environment for seed performance in field.

There is good prospect of growing groundnut in the south-west region of West Bengal, having well drained acid lateritic sandy loam soil with low lime and cation exchange capacity and poor fertility. The poor fertility and low humus content (Oram, 1958), well drained sandy loam with good structure (Arnon, 1972) and slightly acid reaction, pH 6.0-6.4(Woodroof, 1966), are favourable soil conditions for growing groundnut. Sandy to sandy loam soil favours the crop because of ease in harvesting and peg penetration (Wagenaar, 1965; and Chesney and Diyalijee, 1969). While a lot of information is already available on nutritional requirement of groundnut crop, there is little information on the soil physical environment optimum for groundnut crop.

In order to have a better understanding of the soil physical environment, the present study through a series of experiment over seed germination to harvesting, under varying water management and tillage practices, was conducted. An attempt has been made to quantify the optimum range of physical condition in terms of edaphic factors for best realisation of the potential yield of groundnut, and to develop a groundnut agronomy for this region suggesting an appropriate technology.