CHAPTER I

INTRODUCTION

Area-wise, wheat (*Triticum aestivum* L.) is the second major crop of the country. Low productivity (economic yield/unit area), especially from dry lands with low rainfall and poor irrigation potentials, is the major problem of concern in wheat cultivation. Such dry areas mainly contribute to the low total production in the country. No doubt the introduction of the Mexican dwarf and semi-dwarf wheats did contribute in the green revolution programme which the country experienced in 1971 but the impact remained restricted to the irrigated areas and the dry regions remained neglected. Since such areas make a sizeable contribution towards the total acreage under crops in the country (75%), due emphasis should be allotted to the management aspects of the crop production in such areas if higher and stable production is envisaged. Productivity level of 4-6 tons/ha obtained on the farmers field against 1.25 tons national average suggests the urgency of bridging up this gap in the yield levels through proper management. Even in the water rich areas there exists a large gap between the present and the potential yield levels (Swaminathan, 1977) which must be bridged through extension and other management efforts.
The increase in the production is possible only through raising the present level of productivity when there is no or only little possibility for increase in the area under this crop because of exploitation of almost all lands which can be kept under cultivation. By and large, natural hazards like poor and erratic rains and lack of alternative irrigation resource, and short supply of essential plant nutrients do not permit to grow as successful a crop of wheat as harvested in many water rich areas. Alternatively, therefore, the crop is to be grown with the minimum water use and methodology has to be developed for increasing water and nitrogen utilization efficiencies of the crop in such situations. There can be no doubt that the use of fertilizers on dry lands or partially irrigated lands often stimulates growth and increases water use rate but the significance of this depends on the availability of other essential inputs especially water at critical periods. Consequently, conserving water through artificial surface evaporation barriers and increasing nitrogen utilization through improved water availability and vice versa may be a few important steps in this direction.

Varieties do differ in their inherent genetic potentials but these are further varied by the supply of essential inputs like fertilizer and water. The competition effects of the dwarf and semi-dwarf plants for such inputs
are also different and their responsiveness depends on various interactive processes including the environment. It is in this context that different varieties of wheat having different plant types may allow us to select a kind of plant which can give maximum response to the available nutrients and water under constraint situation. Managing water and soil to conserve water to produce the highest economic yield leads to best water use efficiency. Farmers can make best use of available water only if his fertilizer practices, crop varieties and other management practices are optimum for the water available. Crop yields may be increased, unaffected, or decreased by a given change in fertility level, depending upon the initial fertility level, and the water supply. Efficiency in the use of water by crop may be said to increase with the supplies of all nutrients up to those associated with maximum yields. Heavy fertilization with nitrogen promotes much higher yields in years with ample water supply and not in dry seasons. Conversely, ample available water in soil leads to higher yields only if the soil nitrogen level is adequate. It could therefore, be said that the efficiency of water use is increased by nitrogen fertilization and that of the use of nitrogen, by increasing the supply of water. Further, the mineralization of soil organic nitrogen occurs at a gradually increasing rate as the water content of soil is increased from air dry condition. In other words, while heading for higher water use efficiency, soil, water and crop management factors cannot be ignored.
Since from one-fourth to one-half of ET for a crop is made up of evaporations from the soil surface (Peters and Russell, 1959; Fritschen and Shaw, 1961; Peters, 1960), investigators have turned their attention to the use of evaporation retardant chemicals, organic mulches and plastic films for the control of evaporation from the soil surface. Among several kinds of mulches, use of plastic films has proved to be most promising for reducing evaporation. Letey and Peters (1957) reported 96 bushels of corn yield with 7.0 inches of water from an acre plot initially wet and then covered with polyethylene film to cut off summer rainfall and evaporation as against 81 bushels with natural rainfall and evapotranspiration of 13.8 inches and 97 bushels with natural rainfall and irrigation. Some such similar effects could be achieved by applying organic mulches or inert materials on the surface which are comparatively cheaper. The cost factor may probably restrict the use of plastic films to only high value cash crops but a lot much is yet to be known about the comparative efficiency of different kind of mulches when superimposed with different kind of environments like plant types and nutrient elements.

Keeping these points in view the present research project was initiated to work out (1) the relative yields and total water use by different dwarf and semi-dwarf wheats, (2) the efficiency of different kind of organic and
inorganic mulches in reducing evaporation from the soil surface and their impact on reducing irrigation needs of the crop, (3) water use efficiency and moisture depletion patterns of different varieties under different kinds of mulches, (4) the response of wheat varieties to low and high fertility levels, (5) nitrogen utilization efficiency of different varieties as influenced by nitrogen levels and kind of mulches, (6) the interactive effect of various factors namely varieties, nitrogen and mulches on the final economic yield of the crop, and finally (7) the economics of various nitrogen and mulch treatments applied to different varieties of wheat.