INTRODUCTION
CHAPTER I

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Agricultural production since time immemorial has led to the realisation that irrigation is an important component in increasing the productivity as testified by the evidences from the great river valley civilisations. In a country like India which has to feed a population of 935 millions by the turn of the century, a concerted attempt to improve the production to a level of 205 to 225 million tons of food grain can be achieved only by efficient management of inputs, the chief of which is irrigation water. In the background of no appreciable extra land being made available for extensive cultivation, the need for utilising efficiently the available irrigation water not only deserves immediate attention but it should continue to receive higher priority in the coming decades too.

The Government of India has well realised this fact and through successive plans has almost doubled the irrigated area since independence. But the concomitant integrated water use has only started receiving attention in recent times but mainly with reference to major irrigation projects. In Andhra Pradesh, eventhough 4.3 million hectares are under irrigation, the proportionate share under wells is 1.28 million hectares. In a region like Rayalaseema which has no potential in the near-future to tap river waters, the dismal 10 per cent of the irri-
gated area, as it exists today coupled with low rainfall leaves no option than to depend on ground water which is not only scarce but also costly to exploit and lift.

In this background, it is to be noted that 77 per cent of water under wells is also diverted to rice production, especially in seasons where there is no appreciable rainfall. The cropping system is mostly rice based under wells with precarious availability of water in times of need. The ways and means of efficiently integrating agronomic knowledge on crop production with available irrigation water to bring out the best combination of these, for the season and for the annual cycle is very much called for. Eventhough knowledge has been generated from scattered and diffused work on the water requirement of individual crops, no serious efforts have been made to establish a cropping system keeping in view the availability of water in different times of the year because the water availability in majority of the wells fluctuates depending on the rainfall, deep percolation and re-charge, etc.

From the information available from several experiments on sandy and sandy clay loams which are the major soil groups in this region, the water requirement of rice crop is 2000 to 2400 mm (Reddy, 1982). No doubt, some area and water has to be allocated to rice by every farmer to meet his family food requirements, besides, to the pulse and oilseed crops and also
to the fodder for his cattle. The area that a well commands is usually less than 5 hectares but occasionally it may be more. Even for this limited area, availability of water to meet the crop water needs especially in summer and kharif seasons is problematic. Experiments to decide the suitability of different crops, for different seasons viz., summer, kharif, late kharif and rabi did not receive much attention. It is well known that efficient utilisation of water primarily rests on maximisation of productivity of the crop which in turn is an agronomic management. Application of water, no doubt improves the productivity but the responses may not be to the desirable extent unless a suitable crop is grown. It is a wasteful practice either to over or under irrigate a crop. This again depends on the crop demand as influenced by weather factors. Hence, the frequencies of irrigation for different crops in different seasons have to be determined. The thrust has to be not only to maximise the production and net returns but also the water use efficiency by working out production functions and subjecting them to analysis to derive a model for a dynamic cropping system in the command areas of the wells to meet the ever changing situations.

Several methods of scheduling irrigation are in vogue; but evaporation which integrates the influence of weather factors is widely used as it is simple and easy. The ratio between the depth of irrigation water and the evaporation
from USWB Class A pan evaporimeter (IN/CPE ratio) is used as a parameter to schedule irrigations (Prihar et al. 1976). It is possible to relate evaporation from this USWB Class A pan evaporimeter to that of can evaporimeter which can be used easily by farmers to schedule irrigations (Reddi, 1976).

Experiment was, therefore, conducted through four seasons, summer, kharif, late kharif and rabi during 1986-87 with several crops suitable to this area to fit into annual cropping cycle. The crops tried in the experiment were groundnut, blackgram, greengram, sorghum, fingermillet, pearlmillet, maize and sesame in agronomically suitable seasons with four irrigation frequencies. The objectives of the study are:

1. To evaluate the suitability of crops for different seasons in terms of high productivity.
2. To find out the relationship between the frequencies of irrigation on growth and yield of various crops in different seasons.
3. To study the moisture relationships of various crops and cropping systems as influenced by irrigation frequencies.
4. To find out the suitable cropping system for maximisation of production and net returns with the available irrigation water.
5. To suggest an annual cropping system for maximising net returns with and without crop and land constraints.
6. To develop a model for extending these results to other areas in similar agro-climatic zones.