CHAPTER I

INTRODUCTION
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Majority of indians are vegetarian, therefore, the use of vegetative oils in their dite is the only richest source of fat. A large number of oil seed crops viz. groundnut (Arachis hypogaea L.), rapeseeds-mustards (Brassica spp), soybean (Glycine max L.), sunflower (Helianthus annus L.), castor (Ricinus communis L.), sesamum (Sesamum indicum L.), safflower (Carthamus tinctorius L.), linseed (Linum usitatissimum L.) wnd nizer (Guizotia abyssinica L.) are grown in different part of the country under different cropping seasons. Total oil production from these oil seed crops of the nation is not sufficient to meet the demands of the vegetable oil for the consumers. Thus two options remain to fulfill the needs of vegetable oil in the country. First is to increase the acreage and productivity of oil seeds and next is to import the desired quantity of oil with a very high exchange of foreign money. Dependency on import of oil will pose severe crises in foreign exxhange of the nation, hence first alternative remains the choice to meet the requirement of vegetable oil in future. For this purpose, not only increase in average production of traditional oil seed crops is important, but the extension of acreage under oil-seeds in non-conventional areas and seasons has also great concern.
Sunflower was introduced in India as an oil seed crop about 35 years back. But its cultivation did not receive much attraction by the growers earlier because of its low oil content in seeds and high disease susceptibility in plant of the varieties then introduced. Now several high yielding varieties with high oil content (>50%) have been developed which have revived the interest of growers for its cultivation. Now a days, it has been proved to be a highly promising oilseed crop under varying agro-climatic regions of India because of its photo-thermo insensitive nature and high production potential. Being a photo-neutral nature crop, it can be grown all the year round in almost all parts of the country. But its productivity varies from season to season and place to place. Some of the desirable attributes of this crop like short growth period (85 to 110 days), drought evading ability, high quality edible oil (high degree PUFA content with cholestrol and anti cholestrol properties), low seed rate and high seed multiplication ratio etc. have also the attraction of the growers in popuralizing its production in large scale.Consequently, now it has become the second most important oil seed crop in the World (Beard, 1981 and Jonés, 1984). As a commercial crop, it has wide future in India and can help substantially to meet the shortage of vegetable oil in the country. In India, its production has contributed 14.8 lakh tones out
of the total oil seeds production of 242.1 lakh tonnes from all oil seed crops during 1996-97 and thus it ranked on fourth position (DOE and E). In Madhya Pradesh, its cultivation is gaining popularity as winter season irrigated crop. Owing to wide adaptability and high yield potential, its acreage is spreading increasingly in the state from 5210 ha area during 1990 to 18843 ha area during 1994.

When it is grown as a winter season non-traditional crop, management of irrigation water may has great concern for improving the yield. Water is essential for many physiological processes of crop plants such as absorption and translocation of essential food nutrients, photosynthesis, respiration, cell formation & cell multiplication and other metabolic activities. These physical and biochemical reactions within the plants deviate adversely resulting in poor growth due to inadequate availability of optimum quantity of water. These deviations from an optimum plant water balance are commonly manifested as reduction in yield and quality of produce. Hence the management of irrigation water appears to be most important factor for good harvest of sunflower when grown during winter season.

The water requirement of crop depends on several natural, edaphic, plant and managerial factors. Temperature, solar
radiation, wind velocity, day length, crop growing season are the common natural factors influencing water requirement (of crop). Among the edaphic factor, type of soil and moisture retention capacity of soil mainly influence the water requirement of the crop. Crop varieties and their root characteristics as well as phenological stages are the important plant parameters for determining the water requirement of crop. Practice of various cropping system and irrigation method also affect the irrigation schedule of crop. Not only the application of sufficient water is important for good growth and yield of crop, but its proper time of application (irrigation schedule) also plays the key role. Irrigation schedule means supply of water to the crops in accordance to their need after considering the effect of above mentioned factors which are responsible for water requirement of the crop. In agriculture irrigation schedule of a particular crop is decided on the basis of several approaches. Among them, scheduling of irrigation according to critical physiological stages of crop, prevailing weather conditions and existing soil moisture contents are the most commonly applied approaches of recent interest, since they give fairly good account of water requirement for a particular crop.

Not much work on sunflower in relation to irrigation schedule in the country and outside has been reported. The period in the life cycle of a plant, when it is very sensitive to
moisture deficit is known as the critical period. The existence of a moisture sensitive period or periods has been identified for some crops. A knowledge of critical period of crop will enable to schedule irrigation. Economic and efficient utilization of water there-fore becomes a must in water use programme for which pre use knowledge of water requirement is imperative. Adequate and timely water supply is the main principle of water management for obtaining potential crop yields. The judicious use of optimum irrigation water supply may probably be helpful for good growth of the crops and ultimately high yield.

While considering the plant factor for deciding the irrigation schedule of sunflower, flowering and grain filling stages were found to be most critical for irrigation to improve the growth and yield in some parts of the country (Raghu and Choubey, 1978, Jana et al., 1982, Unger, 1982 and Hegde, 1988). But accordig to Choudhary et al., (1994), 4-5 leaf stage, bud formation, 50% flowering and grain filling were the important phenological stages for scheduling irrigation in sunflower at Nurasari (Gujrat) to obtain the potential yield. Similarly, Sharma(1994) emphasized that pre-sowing, pre-flowering and grain filling were important growth stages of irrigation for sunflower on clay loam soils of Jabalpur.

Plants fulfill their need of water through rains and dew, most of the desired water is absorbed by the plants from the
available moisture of the soil. In the areas where available soil moisture is inadequate to meet the water requirement of the crop, scheduling of irrigation based on pattern of soil moisture depletion also has been of recent interest, since it gives economical use of water particularly when availability of irrigation water is limited.

While considering climatic factors for scheduling irrigation, application of two or three irrigations at 0.6 IW/CPE in sunflower gave the best results in Italy (Amoto and Giordano, 1983) in Palampur, India (Vivek and Chakor, 1992). Later on Vivek et al. (1994) emphasized that yield of sunflower significantly increased with three to four irrigations scheduled at 0.9 IW/CPE when high level of fertilizers was applied. Nalayini and Sankaran (1993) reported that nutrient uptake and oil content in sunflower increased by irrigating crop with 1.00 IW/CPE at Coimbatore, while seed yield did not show significant increase beyond the irrigations scheduled at 0.75 IW/CPE.

On looking the overall picture of above facts, it is clear that scheduling of irrigation in sunflower on the basis of several approaches like irrigation schedules based on critical growth stages or soil moisture regimes or climatic parameters have their own merits and demerits. Therefore, it is imperative to threshold which one approach is more efficient under agro-ecosystems of Kymore plateau region. Simultaneously, proper schedule of irrigation for
each approach also needs to be worked out for improving the water use efficiency.

Faulty Method of irrigation that is irrigating the crop with more or less quantity of water at improper time of irrigation not only increases cost of cultivation of crops, but also reduces the crop yield and deteriorates the soil-health. Irrigation water is becoming scare and costly wealth of the nation. Hence, it is imperative to undertake an intensive study on the efficient use of irrigation water according to the need of the crop. Two areas which offer considerable promise for increasing water, use efficiency are improved irrigation techniques and intensified water application methods. There is dearth of information on improved irrigation schedules for recently introduced sunflower to improve the growth and yield. Hence, this field deserves the detailed study.

Keeping the above view in the mind, the present investigation entitled "Role of irrigation schedules on the productivity of sunflower" has been undertaken to improve the productivity of high valued energy rich oil-seed crop sunflower in Kymore plateau region of Madhya Pradesh with the following objectives:

(1) To compare the water use efficiency under different approaches of irrigation schedules.
(2) To delineate the important phenological stages for irrigations that are critical for the water needs of sunflower.

(3) To determine the growth pattern of sunflower under varying approaches of schedules.

(4) To assess the effect of different approaches of irrigation schedules on yield attributes, seed yield and oil yield of sunflower.

(5) To determine the economic viability of various treatments.