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Original Research Article

Summer Groundnut (*Arachis hypogaea* L.) Productivity Influenced By Irrigation Scheduling: A Climatological Approach

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A B S T R A C T

A field experiment to study the effect of different irrigation schedules on the productivity of summer groundnut grown in Vertisols. The soil of the experimental site was low in organic carbon and nitrogen, medium in available phosphorus and fairly rich in potassium and slightly alkaline in reaction. The experiment was laid out in randomized block design with four replications. The net plot size was 6.0 m x 4.2 m. The treatments comprising of four irrigation schedules viz., I_1-0.6 IW: CPE, I_2-0.8 IW: CPE, I_3-1.0 IW: CPE and I_4-As per the canal rotation interval. During both years, seeds of summer groundnut Var. 'TAG-24' were dibbled with spacing of 30 cm x 10 cm on 30th January in flat beds. Scheduling of irrigation was done on the basis of climatological approach (IW: CPE). Depth of irrigation was maintained 60 mm per irrigation in each treatment. All the recommended agronomic practices were followed throughout the cropping period. Pooled results revealed that summer groundnut performed significantly better throughout the growth stages and recorded higher values of dry pod, haulm, kernel, oil, biological yields and bio-energy under irrigation scheduled at 1.0 IW: CPE (15 irrigations) which being on par with 0.8 IW: CPE (12 irrigations), as compared to 0.6 IW:CPE (10 irrigations) and canal rotation interval (10 irrigations) treatments. Whereas, significantly lowest values of economic yields were recorded by canal rotation interval treatment than others. During both the years of study, highest mean daily and total consumptive use of water was recorded with 1.0 IW: CPE ratio, while the lowest values were recorded with canal rotation interval treatment than others. WUE was decreased with the increase in frequency of irrigation schedules. Thus, it can be concluded that for realizing higher yield of summer groundnut; it should be irrigated with 1.0 IW: CPE ratio (15 irrigations) in assured irrigated conditions of Vertisols of Parbhani, Maharashtra (India).

Keywords

Climatological approach, Consumptive use, Irrigation scheduling, Summer groundnut, Water use efficiency

Introduction

Groundnut (*Arachis hypogaea* L.) is a world prospective oilseed crop grown in almost all the tropical and sub-tropical countries. Developing countries in the semi-arid tropics (SATs) contribute to 50 per cent of its global production; while India and China account for 30 and 20 per cent share, respectively. In India, the king of the oilseed crops is groundnut that alone accounts 45 per cent of the total oilseed area and 60 per cent of the total oilseed production, which cultivated in three seasons *viz.*, rainy (85 per cent), post-rainy (10 per cent) and summer (5 per cent). Groundnut is grown in 11 States of the country on an area of 7.6 M Ha with a production of 7.8 M T of pods per

annum. Although, India ranks 1st in the world with respect to area and production; but it ranks 8th in productivity. The average productivity of groundnut in India is about 1000 kg ha^{-1} which is stagnating for the last several years (Poshiya *et al.*, 2006).

Groundnut is one of the most important oilseed crops of Maharashtra state. During 2004-05; the *kharif* and summer groundnut was cultivated on 34.66 and 6.94 lakh hectare area with 35.88 and 10.2 lakh tonne production and 1035 and 1444 kg ha^{-1} productivity, respectively (Anonymous, 2005). In the irrigated command areas of Maharashtra, summer groundnut has become increasingly popular due to higher and stable yields compared to traditional *kharif* season, mainly because of bright sunshine, controlled soil-moisture and low incidence of insects, pests and diseases. However, high water requirement (800-1000 mm) of this crop in the summer; involving 13-15 irrigations associated with undependable water supply in the major commands limits its hectarage (Ghadekar, 1989). Despite this, the productivity of summer groundnut is higher, its water-use efficiency is low. Similarly, higher use of canal water is likely to pose the threat of soil salinity on Vertisols which are dominant in the commands.

Various approaches have been advocated for scheduling irrigation to groundnut crop in different seasons and soil types. Now, the evaporative demand from the atmosphere has gained importance as the main factor in determining the water requirement of crop (Prihar *et al.*, 1974). For that, scheduling of irrigation to groundnut crop on the basis of climatological approach (IW: CPE) had been studied by many research workers in India, as reviewed by Lourduraj *et al.*, (1998). Similarly, the stability in yield of summer groundnut is largely determined by genotype, its adoption to the new environment and responsiveness to irrigation application. Considering these different views in mind, the present investigation was carried out to study the response of summer groundnut to different irrigation schedules on Vertisols of Parbhani (M.S.).

Materials and Methods

A field experiment was conducted at AICRP on Irrigation Water Management, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra (India.). The soil (Vertisols) of the experimental site was low in organic carbon and nitrogen, medium in available phosphorus and fairly rich in potassium and slightly alkaline in reaction. The experiment was laid out in randomized block design with four replications. The net plot size was 6.0 m x 4.2 m. The treatments comprising of four irrigation schedules Viz., I_1-0.6 IW: CPE, I_2-0.8 IW: CPE, I_3-1.0 IW: CPE and I_4-As per the canal rotation interval. During both years, seeds of summer groundnut Var. 'TAG-24' were dibbled with spacing of 30 cm x 10 cm on 30th January in flat beds. Scheduling of irrigation was done on the basis of climatological approach (IW: CPE). Depth of irrigation was maintained 60 mm per irrigation in each treatment. All the recommended agronomic practices were followed throughout the cropping period.

Results and Discussion

Data presented in Table 1 revealed that the dry pod, haulm, kernel, oil, biological yields and bio-energy of summer groundnut were significantly higher under irrigation scheduled at 1.0 IW: CPE which being on par with 0.8 IW: CPE, as compared to rest of the irrigation schedules. However, during second year of study, in respect of kernel and oil yields; 1.0 IW: CPE ratio was comparable with 0.8 and 0.6 IW: CPE ratio and proved significantly better over canal rotation interval treatment.

Table.1 Dry pod, haulm, kernel, oil, biological yield and bio-energy of summer groundnut as influenced by various irrigation schedules

Treatment	Dry Pod Yield (kg ha^{-1})			Bio-energy (M Cal)			Dry Haulm Yield (kg ha^{-1})		
	Ist Year	IInd Year	Pooled	Ist Year	IInd Year	Pooled	Ist Year	IInd Year	Pooled
Irrigation Schedules:									
I_1= 0.6 IW:CPE	1652	2189	1921	9497	12584	11041	3927	4643	4285
I_2= 0.8 IW:CPE	2089	2202	2146	12010	12659	12335	4964	4872	4918
I_3= 1.0 IW:CPE	2135	2354	2245	12274	13533	12904	5075	5208	5142
I_4= As per canal rotation interval	1468	1639	1554	8439	9423	8931	3490	3626	3558
S.E.(M) ±	60	51	55	295	311	332	134	143	126
C.D. (P=0.05)	187	154	167	918	941	1006	404	432	366

Treatments	Biological Yield (kg ha^{-1})			Kernel Yield (kg ha^{-1})			Oil Yield (kg ha^{-1})		
	Ist Year	IInd Year	Pooled	Ist Year	IInd Year	Pooled	Ist Year	IInd Year	Pooled
Irrigation Schedules:									
I_1= 0.6 IW:CPE	5580	6832	6206	1093	1495	1294	507	698	603
I_2= 0.8 IW:CPE	7053	7073	7063	1440	1534	1487	684	731	708
I_3= 1.0 IW:CPE	7209	7562	7386	1480	1648	1564	707	786	746
I_4= As per canal rotation interval	4958	5265	5112	941	1097	1019	435	511	473
S.E.(M) ±	202	167	187	62	57	46	28	34	31
C.D. (P=0.05)	598	507	550	191	175	144	84	104	92

Table.2 Water-expense components utilized by summer groundnut crop

Treatment	Irrigation frequency (No.)	Irrigation water applied (mm)	Irrigation interval (Days)	Consumptive-use (mm) (From 0-60 cm soil depth)	Daily water-use (mm day^{-1})	Water-use efficiency (kg ha^{-1} mm^{-1})
Ist Year						
Irrigation Schedules:						
I_1= 0.6 IW:CPE	11	660	12	733.53	6.67	2.25
I_2= 0.8 IW:CPE	12	720	10	795.99	7.24	2.62
I_3= 1.0 IW:CPE	15	900	8	968.92	8.81	2.20
I_4= As per canal rotation interval	10	600	13	702.88	6.39	2.09
IInd Year						
Irrigation Schedules:						
I_1= 0.6 IW:CPE	10	600	14	720.00	6.55	3.04
I_2= 0.8 IW:CPE	12	720	10	781.16	7.51	2.82
I_3= 1.0 IW:CPE	15	900	8	950.49	8.80	2.48
I_4= As per canal rotation interval	10	600	14	689.99	6.16	2.38

Maintenance of adequate available soil moisture in the root zone coinciding with critical growth stages of crop would be conducive for proper uptake as well as utilization of nutrients. It creates a favourable impact on growth as well as yield components leading to better pod yield in groundnut crop. Several workers have reported the increasing yield of groundnut crop with the successive increase in moisture regimes (Lourduraj *et al.,* 1998; Deshpande, 1999; Ramasamy *et al.,* 2000; Vinod Kumar *et al.,* 2000; Shaikh *et al.,* 2004; Bandopadhyay, 2005 and Chitodkar *et al.,* 2005).

On the other hand, data shown in Table 2 indicated that in summer groundnut, higher WUE was recorded under 0.8 IW: CPE ratio during first year, while it was higher under 0.6 IW: CPE ratio during second year of investigation. WUE decreased with the increased number of irrigations or increased WUE can be achieved through decreased consumptive-use (Cu) of water. Water requirement was increased with an increase in the level of irrigation, however, mean maximum WUE was recorded with lower moisture regimes. These results are in consonance with the results obtained earlier by Deshpande (1999), Vinod Kumar *et al.,* (2000), Raskar and Bhoi (2003) and Chitodkar *et al.,* (2006).

Based on two years of study, it can be concluded that for realizing higher yield of summer groundnut; it should be irrigated with 1.0 IW: CPE ratio (15 irrigations) in assured irrigated conditions of Vertisols of Parbhani (M.S.).

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