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Impact of Improved Water Management Technique for Groundnut in LBP Command Area

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A B S T R A C T

The experiment consisted of improved water management technology (0.6 IW/CPE ratio with gypsum application in splits) and conventional method (Irrigation once in 8-10 days) was conducted in Lower Bhavani Project (LBP) area. The mean total water use under improved irrigation was 486 mm which was considerably lesser than conventional method which utilized 639 mm water and quantity of water saving by 31.87 per cent. Averaging over locations, improved irrigation registered a mean yield of 1854 kg ha^{-1} which was significantly higher than surface irrigation and normal fertilizer application (1584 kg ha^{-1}). The average yield increment by improved irrigation was 17.05 per cent over conventional method of irrigation. Higher net income and Benefit Cost ratio of Rs 57,371ha^{-1} and 2.64 were registered by improved irrigation as compared to Rs 39,916 ha^{-1} and 2.03 respectively under conventionally irrigated and fertilized groundnut. Thus it is evident that adoption of improved irrigation gained an additional mean net income of Rs. 17,455 ha^{-1} than conventional method.

Introduction

Groundnut (*Arachis hypogaea* L.), popularly known as "King" of oilseeds. In India, it is grown on an area of 5.53 m ha, having annual production of 7.4 m t with an average productivity of 1338 kg ha^{-1} (Anonymous, 2016; Thiyagarajan *et al.,* 2010b). Although India ranks first in area under cultivation of this crop, the productivity is low compared to other groundnut growing countries. The reason behind that the most of the area is under rainfed and remain as an unpredictable legume, showing inconsistency in pod and oil yields. Further, it has been proved that water is most critical input that effects on crop

growth and yield, their unavailability leads to great reduction in productivity of groundnut (Ramachandrappa and Kulkarni, 1992;Thiyagarajan *et al.,* 2010c).

In groundnut, the WUE is often expressed as the ratio of pod yield to the amount of water depleted by the crop. In general, the WUE will decrease with increasing number of irrigations in groundnut (Desai *et al.,* 1984; Thiyagarajan *et al.,* 2010a). Similar trend were observed by Narasimham *et al*., 1977; Reddy and Reddy, 1977. Water use efficiency explains effective utilization of water by crop in terms of water saving as well as yield augmentation.

The field experiments were conducted at Agricultural Research Station, Bhavanisagar under AICRP- Irrigation Water Management project resulted better performance of improved irrigation methods compared to conventional method of irrigation in groundnut. To test verify that proven technology of improved irrigation in groundnut, Operational Research project were conducted at farmers holdings in the kugalur distributory of LBP canal area.

Materials and Methods

On farm experiment under Operational Research Projecton improved water management technologies in groundnut were conducted in farmers fields one each at head, middle and tail reaches of kugalur distributory of Lower Bhavani Project canal command areas during 2015 and 2016under All India Co-ordinated Project on Irrigation Water Management. The experiment consisted of improved water management technology (0.6 IW/CPE ratio with gypsum application in splits) and conventional method (irrigation once in 8-10 days). The major soil type of the study area was sandy loam in nature and the soil fertility status was low in available nitrogen (198 kg ha^{-1}), medium in phosphorus (14 kg ha^{-1}) and high in potash (282 kg ha^{-1}). Two irrigation methods of groundnut cultivation viz., improved irrigation method and conventional method were compared by using the variety CO2. The planting of groundnut in the study area was mainly (December - January). The recommended dose of fertilizer 25: 50: 75 kg NPK ha^{-1} applied in the form of urea, super phosphate and MOP. The nitrogen and potash in three splits *viz.*, 50 % N & K as basal + 25 % N and K at 20 DAS + 25 % N and K at 45 DAS were applied. Gypsum @ 400 $kgha^{-1}$ was applied in splits of 200 $kgha^{-1}$each at sowing and at 40-45thDAS.The total water use was calculated by adding irrigation water applied and effective rainfall. The details of test verification in the study area are furnished in Table 1. Groundnut yield was recorded and total water used, water use efficiency (WUE) and economics were worked out and presented.

Results and Discussion

Effect of irrigation on total water used and water use efficiency

The water use studies of both the methods of irrigation clearly indicated the beneficial effect of improved irrigation in terms of water saving and higher Water Use Efficiency (WUE) (Table 2). The mean total water use under improved irrigation was 486 mm which was considerably lesser than conventional method which utilized 639 mm water. Thus a substantial quantity of water saving by 31.87 per cent was noticed due to the adoption of irrigation based on IW/CPE ratio of 0.6 with split application of gypsum application. The higher yield coupled with enormous quantity of water saving under improved irrigation resulted in higher water use efficiency in both the years of experimentation.

Lenka and Mishra (1973) revealed that highest yield in groundnut was obtained at 25% depletion of available moisture which was 828 mm as compared to 50 and 75% depletion of available moisture with 810 and 730 mm water, respectively. Hosamani and Janawade (2007) reported that 504 mm was proved to be sufficient for getting good pod yield in groundnut. Patel *et al.*, 2008 reported that groundnut crop irrigated at 40 mm cumulative pan evaporation (17 irrigations) registered mean higher value of consumptive use of water (795.8 mm).

Table.1 Details of ORP on drip fertigation in the kugalur distributory

Particular	2015	2016
Area of demonstration (ha)	3.0	3.0
No of farmers (Head, middle, tail)	3	3
Name of the farmers	V.K.Sampath M.Muthusamy M.Kuppusamy	M.Muthusamy K.Chinnusamy Sathasivam
Name of the villages	Vettaikarankoil Kullampalayam Bommanaikanpalayam	Kullampalayam Bommanaikanpalayam Konnamadai
Total rainfall during the cropping period (mm)	193	71

Table.2 Yield, water use, water saving and economics of groundnut

Particular	2015		2016		Mean	
	Imp.*	Conv.**	Imp.	Conv.	Imp	Conv.
Yield (Kg ha^{-1})	1827	1542	1881	1626	1854	1584
Percent yield increase	18.48	-	15.68	-	17.05	-
Total water use (mm)	462	646	510	632	486	639
Percent water saving	39.83	-	23.92	-	31.87	-
Water Use Efficiency (kg hamm^{-1})	3.95	2.39	3.69	2.58	3.82	2.49
Cost of cultivation (Rs ha^{-1})	36758	42033	33890	36497	35324	39265
Gross income (Rs ha^{-1})	91333	77083	94056	81278	92695	79181
Net income (Rs ha^{-1})	54575	35050	60166	44781	57371	39916
Additional net income (Rs ha^{-1})	19525	-	15385	-	17455	-
B:C ratio	2.49	1.83	2.78	2.23	2.64	2.03

*Improved irrigation (Imp.) ** Conventional method (Conv.)
Groundnut pod – Rs.50/kg

Effect of improved irrigation on groundnut yield

In the present study, yield of groundnut was substantially increased due to the adoption of improved irrigation technology (Table 2). Averaging over locations, improved irrigation registered a mean yield of 1854 kg ha^{-1} which was significantly higher than surface irrigation and normal fertilizer application (1584 kg ha^{-1}). The average yield increment by improved irrigation was 17.05 per cent over conventional method of irrigation. Higher yield under improved irrigation was mainly due to the availability of sufficient nutrient for improving growth and yield attributes. It coupled with adequate availability of soil moisture and nutrients throughout the crop growth period. Climatologically based irrigation scheduling of IW/CPE 0.75 attained higher growth parameters over the other irrigation scheduling as the optimum quantity of water supplied at appropriate interval might have resulted in better root growth without compensating the shoot growth of the crop. While, studies indicate that optimum irrigation frequency supplied to the crop could have retained adequate soil moisture content throughout the growth period of the crop which in turn facilitated better and proper utilization of nutrients thereby increasing yields (Behera *et al.,* 2015; Lokhande *et al.,* 2018).

Irrigation at 0.8 IW/ CPE ratio increased the pod yield by 14.5 per cent and oil yield of groundnut by 16.94 per cent than rainfed check in medium deep alfisols at ICRISAT Centre (Rao *et al.,* 1985). Taha and Gulati (2001) revealed that the pod yield in groundnut increased with increasing IW/ CPE ratio, the maximum yield of 22.4qha-1 was obtained at 1.4 IW/ CPE with 525 mm evapotranspiration. Raskar and Bhoi (2003) observed that irrigation scheduling at 75 mm CPE to summer groundnut recorded significantly higher dry pod yield of 34.08 q ha^{-1}. A field experiment was conducted by Bandyopadhyay *et al.,* (2005) on bunchy variety of peanut having IW/ CPE ratio of 0.9, 0.7 and 0.5. Result revealed that the total pod yield and water productivity were recorded higher in 0.9 IW/ CPE ratio compared with 0.7 and 0.5 IW/ CPE.

Economics of improved irrigation in groundnut

The economic analysis of both the methods of irrigation (Table.2) revealed that though the cost of cultivation was comparatively higher under improved irrigation it was found to be economically better than conventional method of irrigation. Improved irrigation fetched a mean gross income of Rs.92,695 ha^{-1} as against Rs 79,181 ha^{-1} under conventional method. In addition, higher net income and benefit cost ratio were also associated with improved irrigation. Higher net income and Benefit Cost ratio of Rs 57,371ha^{-1} and 2.64 were registered by improved irrigation as compared to Rs.39,916 ha^{-1} and 2.03 respectively under conventionally irrigated and fertilized groundnut. Thus it is evident that adoption of improved irrigation gained an additional mean net income of Rs 17,455 ha^{-1} than conventional method.

In conclusion the adoption of IW/CPE ratio-based irrigation in groundnut is a relatively cheapest technology that can conserve water and increase profits. The application of irrigation based on IW/CPE ratio in groundnut has convincingly shown that the technique results in high water use efficiency, saves water, provides higher pods yield. However, if not followed properly, it may result in waste of water, time and yield. Application of irrigation based on IW/CPE ratio requires careful study of all the relevant factors like land, soil, water, crop and agro-

climatic conditions. Adoption of improved irrigation (IW/CPE ratio) with gypsum application in groundnut cultivation is technically feasible and economically viable.

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