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

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ABSTRACT

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

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 57,371 ha⁻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.

Keywords

Groundnut, IW/CPE, Water saving, Water use efficiency, Yield

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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 kg ha⁻¹ was
applied in splits of 200 kg ha⁻¹ each at sowing
and at 40-45th DAS. 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

<table>
<thead>
<tr>
<th>Particular</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area of demonstration (ha)</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>No of farmers (Head, middle, tail)</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Name of the farmers</td>
<td>V.K.Sampath M.Muthusamy M.Kuppusamy</td>
<td>M.Muthusamy K.Chinnusamy Sathasivam</td>
</tr>
<tr>
<td>Name of the villages</td>
<td>VettaiKarankoil Kullampalayam Bommanaikanpalayam</td>
<td>Kullampalayam Bommanaikanpalayam Konnamadai</td>
</tr>
<tr>
<td>Total rainfall during the cropping period (mm)</td>
<td>193</td>
<td>71</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Particular</th>
<th>2015</th>
<th>2016</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield (Kg ha⁻¹)</td>
<td>1827</td>
<td>1542</td>
<td>1881</td>
</tr>
<tr>
<td>Percent yield increase</td>
<td>18.48</td>
<td>-</td>
<td>15.68</td>
</tr>
<tr>
<td>Total water use (mm)</td>
<td>462</td>
<td>646</td>
<td>510</td>
</tr>
<tr>
<td>Percent water saving</td>
<td>39.83</td>
<td>-</td>
<td>23.92</td>
</tr>
<tr>
<td>Water Use Efficiency (kg hamm⁻¹)</td>
<td>3.95</td>
<td>2.39</td>
<td>3.69</td>
</tr>
<tr>
<td>Cost of cultivation (Rs ha⁻¹)</td>
<td>36758</td>
<td>42033</td>
<td>33890</td>
</tr>
<tr>
<td>Gross income (Rs ha⁻¹)</td>
<td>91333</td>
<td>77083</td>
<td>94056</td>
</tr>
<tr>
<td>Net income (Rs ha⁻¹)</td>
<td>54575</td>
<td>35050</td>
<td>60166</td>
</tr>
<tr>
<td>Additional net income (Rs ha⁻¹)</td>
<td>19525</td>
<td>-</td>
<td>15385</td>
</tr>
<tr>
<td>B:C ratio</td>
<td>2.49</td>
<td>1.83</td>
<td>2.78</td>
</tr>
</tbody>
</table>

*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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