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# COMPARATIVE EFFICIENCY OF SPRINKLER IRRIGATION OVER CHECK BASIN IRRIGATION IN GROUNDNUT AT DIFFERENT IRRIGATION SCHEDULES

K. Suresh[1], D. Balaguravaiah[2], V. Ramulu[3] and CH Sujani Rao[2]

[1]Farmers Call Centre, Secunderabad, ANGRAU
[2]Dept. of Soil Science, College of Agriculture, ANGRAU, Rajendranagar
[3]Water Technology Centre, Rajendranagar, ANGRAU.

**ABSTRACT:** The field experiments were conducted for consecutive two years to assess the comparative efficiency of sprinkler irrigation over check basin irrigation at different irrigation schedules for groundnut (K-6) during rabi season. Split plot design was adopted for the experiment with two methods of irrigation as main treatments $M_1$ – Sprinkler method and $M_2$ – Check basin irrigation and three irrigation schedules based on IW/CPE ratio at 0.6 ($I_1$), 0.8 ($I_2$) & 1.0 ($I_3$) as sub treatments, replicated thrice. During 2004-05, there was no significant difference in the pod yield obtained between the methods of irrigation, however irrigation scheduled at 1.0 IW/CPE ratio significantly out yielded (1511 kg/ha) the pod yield obtained at 0.8 & 0.6 IW/CPE ratios. The WUE and shelling percent were also not influenced by the irrigation methods and schedules. Significantly higher pod yield was obtained during 2005-06 under sprinkler method of irrigation (2020 kg/ ha) as compared to check basin of irrigation (1762 kg/ha). Irrigation at IW/CPE of 1.0 ($I_3$) resulted in significantly higher pod yield (2123 kg/ha) when compared to $I_1$ and was on par with that of 0.8 IW/CPE ratio ($I_2$). Results indicated that sprinkler method of irrigation scheduled at 1.0 or 0.8 IW/CPE ratios would be beneficial to groundnut crop as compared to check basin method of irrigation.

**Key words**: Groundnut, sprinkler irrigation, IW/CPE, pod yield, WUE

## INTRODUCTION

Groundnut is grown on large scale in almost all the tropical and sub-tropical countries of the world. India occupies the first position in the acreage as well as production. It is grown over an area of 75.48 lakh hectares with total production of 63.87 lakh tons. Its cultivation is mostly confined to the southern Indian states. The major groundnut growing districts in Andhra Pradesh are Anantapur, Chittor, Kurnool, Cuddapah and Mahboobnagar. The soils of the 'Rayalseema' region are predominantly red sandy loams with characteristic subsoil hard pan. Black soil patches are, however, present in the Cuddapah and Kurnool districts. In the 'Telengana' region, groundnut is grown both in medium black (Mahboobnagar and Nizamabad districts) and sandy loam (Nalgonda, Warangal and Karimnagar districts) soils. The Southwest monsoons which end by mid-September bring the region's only rainfall. With the vagaries of monsoons and the associated low productivity during rainy season, cultivation of groundnut during rabi season under limited irrigated conditions is assuming importance. For long term sustained production under faster depleting ground water resources ideal method of irrigation with higher productivity and more water use efficiency (WUE) has to be tested and adopted.

One of the critical challenges to water resources management is to shift from the extensive supply oriented approach to the one focusing upon deficit applications [8]. There are several ways of increasing efficiency in irrigation. One way is changing from surface to pressurized methods of irrigation and second is to apply deficit water. The extent to which these measures are undertaken mainly depends upon the economics of water use.

The main objective of deficit irrigation is to increase the water use efficiency of a crop by eliminating irrigations that have little impact on yield [7]. The resulting yield reduction may be small compared with the benefits gained through diverting the saved water to irrigate additional area or other crops for which water would normally be insufficient under traditional practices [1]. In irrigation scheduling, a climatological approach based on IW/CPE ratio (IW – irrigation water, CPE – cumulative pan evaporation) has been found most appropriate. This approach integrates all the weather parameters that determine water use by the crop and is likely to increase production by at least 15–20% [2]. Optimum scheduling of Irrigation led to increase in pod yield and water use efficiency (WUE) [9]. The concept of scheduling of irrigation at IW/CPE ratios assumes importance in optimizing the water requirement with various methods of irrigations adopted.

Before implementing the scheduling of irrigation programme with various irrigation methods it is necessary to know crop yield responses to water applications [5]. Hence the experiment was designed to study the efficiency of irrigation methods at different irrigation schedules for groundnut.

## MATERIALS AND METHODS

The experiment was conducted at Agricultural Research Station, Garikapadu in Krishna district of Andhrapradesh on sandy loam soil with low in available nitrogen, medium in available phosphorus and medium to high in available potassium, during two consecutive rabi seasons of 2004-05 and 2005-06. The variety tested was K-6 which is a semi spreading short duration variety suitable for rabi season. The crop was sown at a spacing of 30 cm x 10 cm on 22.11.2004 and 18.11.2005 during both the years of study respectively. Split plot design was adopted for the experiment with two methods of irrigation as main treatments $M_1$ – Sprinkler method and $M_2$ – Check basin irrigation and three irrigation schedules based on IW/CPE ratios at 0.6 ($I_1$), 0.8 ($I_2$) & 1.0 ($I_3$) as sub treatments, replicated thrice. The individual plot size of groundnut was 9 m x 9 m with provision of buffer channels all round the plots. Daily pan evaporation was recorded from the open pan evaporimeter available at the meteorological observatory of the research station. The irrigation water given was measured with the help of the water meter fixed to the pipeline and the irrigation was scheduled accordingly as per the sub treatments. Pod and haulm yield at harvest was recorded and the shelling per cent and WUE was arrived thereon. The data obtained on the different growth and yield components and yield were analyzed statistically by the method of analysis of variance as per the procedure outlined for split plot design given by [3].

## RESULTS AND DISCUSSION:

During rabi 2004-05, significantly more pod yield was obtained with irrigation scheduled at 1 IW / CPE (1511 kg/ha) over 0.8 ($I_2$) and 0.6 ($I_1$) IW/CPE ratios irrespective of method of irrigation. The pod yield recorded with sprinkler irrigation scheduled at 1.0 IW / CPE (1641 kg/ha) was considerably more as compared with that of basin method of irrigation scheduled at 1.0 IW/CPE rate (1380 kg/ha), however it was not significant. WUE was not significantly influenced either by methods of irrigation or by irrigation scheduling. However increased WUE was obtained with sprinkler irrigation scheduled at 1.0 IW/CPE (4.68) over basin irrigation (3.94). Shelling % was not influenced by methods of irrigation or irrigation schedules (Table 1 to 3).

During 2005-06, pod yield of rabi groundnut was influenced by methods of irrigation (Sprinkler and basin) as well as schedules of irrigation. Significantly higher pod yield was obtained under sprinkler method of irrigation (2020 kg/ ha) as compared to surface method of irrigation (1762 kg/ha). The increase in pod yield in sprinkler irrigation was mainly due to high frequency irrigation which in turn maintained the soil moisture content in the active root zone at adequate level throughout the crop period, as reported by [6]. Irrigation at IW/CPE of 1.0 ($I_3$) resulted in higher pod yield (2123 kg/ha) when compared to other two ratios. However, irrigation at IW/CPE of 0.8 and 1.0 were on par interims of pod yield with 50mm of less irrigation at IW/CPE of 0.8 ($I_2$) as compared to I3 (8.48 kg/ha mm). [4] reported 42 per cent saving in irrigation water over 1.00 IW/CPE ratio. Shelling percentage was not affected by schedule of irrigation as well as methods of irrigation (Table 4 to 6).

**Table 1: Pod yield (kg/ha) as influenced by different treatments during 2004-05**

| Irrigation schedule | Method of irrigation | | Mean |
|---|---|---|---|
| | M1 | M2 | |
| I1 – 0.6 IW/CPE ratio | 1068 | 964 | 1016 |
| I2 – 0.8 IW/CPE ratio | 1250 | 1250 | 1250 |
| I3 – 1.0 IW/CPE ratio | 1641 | 1380 | 1511 |
| Mean | 1320 | 1198 | |

C. D. (5%) – between main treatments – NS
C. D. (5%) – between sub treatments – 161
C. D. (5%) – Main at same or different level of sub - NS

**Table 2: Water Use Efficiency (kg/ha.mm) as influenced by different treatments during 2004-05**

| Irrigation schedule | Method of irrigation | | Mean |
|---|---|---|---|
| | M1 | M2 | |
| I1 – 0.6 IW/CPE ratio (200 mm) | 4.27 | 3.85 | 4.06 |
| I2 – 0.8 IW/CPE ratio (250 mm) | 4.16 | 4.17 | 4.16 |
| I3 – 1.0 IW/CPE ratio (350 mm) | 4.68 | 3.94 | 4.31 |
| Mean | 4.37 | 3.99 | |

C. D. (5%) – between main treatments – NS
C. D. (5%) – between sub treatments – NS
C. D. (5%) – Main at same or different level of sub - NS

**Table 3: Shelling percentage as influenced by different treatments during 2004-05**

| Irrigation schedule | Method of irrigation | | Mean |
|---|---|---|---|
| | M1 | M2 | |
| I1 – 0.6 IW/CPE ratio | 73.3 | 71.6 | 72.5 |
| I2 – 0.8 IW/CPE ratio | 78.3 | 78.3 | 78.3 |
| I3 – 1.0 IW/CPE ratio | 75.0 | 75.0 | 75.0 |
| Mean | 75.5 | 74.9 | |

C. D. (5%) – between main treatments – NS
C. D. (5%) – between sub treatments – NS
C. D. (5%) – Main at same or different level of sub - NS

**Table 4: Pod yield (kg/ha) as influenced by different treatments during 2005-06**

| Irrigation schedule | Method of irrigation | | Mean |
|---|---|---|---|
| | M1 | M2 | |
| I1 – 0.6 IW/CPE ratio | 1748 | 1517 | 1633 |
| I2 – 0.8 IW/CPE ratio | 2014 | 1823 | 1918 |
| I3 – 1.0 IW/CPE ratio | 2299 | 1946 | 2123 |
| Mean | 2020 | 1762 | |

C. D. (5%) – between main treatments – 243
C. D. (5%) – between sub treatments – 258
C. D. (5%) – Main at same or different level of sub - NS

**Table 5 : Water Use Efficiency (kg/ha. mm) as influenced by different treatments during 2005-06**

| Irrigation schedule | Method of irrigation | | Mean |
|---|---|---|---|
| | M1 | M2 | |
| I1 – 0.6 IW/CPE ratio (150 mm) | 11.65 | 10.07 | 10.86 |
| I2 – 0.8 IW/CPE ratio (200 mm) | 10.06 | 9.08 | 9.57 |
| I3 – 1.0 IW/CPE ratio (250 mm) | 9.19 | 7.77 | 8.48 |
| Mean | 10.3 | 8.97 | |

C. D. (5%) – between main treatments – NS
C. D. (5%) – between sub treatments – 1.55
C. D. (5%) – Main at same or different level of sub - NS

**Table 6: Shelling percentage as influenced by different treatments during 2005-06**

| Irrigation schedule | Method of irrigation | | Mean |
|---|---|---|---|
| | M1 | M2 | |
| I1 – 0.6 IW/CPE ratio | 72.3 | 70.0 | 71.0 |
| I2 – 0.8 IW/CPE ratio | 73.3 | 75.0 | 74.0 |
| I3 – 1.0 IW/CPE ratio | 75.6 | 75.0 | 75.0 |
| Mean | 74.0 | 73.0 | |

C. D. (5%) – between main treatments – NS
C. D. (5%) – between sub treatments – NS
C. D. (5%) – Main at same or different level of sub - NS

## CONCLUSION

Overall, our results suggested that sprinkler irrigation of groundnut at 0.8 IW/CPE is cost-effective and contributed to enhanced yields over other types and irrigation schedules under the conditions evaluated. Precise irrigation schedules and methods for maximizing production levels in groundnut are to be investigated in detail for sustainable pod yields in post-rainy season under assured irrigated conditions. Water deficit situation prevails in certain pockets of groundnut cultivation and it is at this juncture, timing of irrigation to precisely utilize harvested/scarcely available water so as to reap sustainable pod yields. In our present study, irrigating the crop by sprinklers at IW/CPE of 0.8 yielded at par with IW/CPE of 1.0 with no significant differences in pod yields. Further, a saving of 50 mm of irrigation water could be obtained by sprinkler irrigation of crop at this schedule over others. Based on our results, it can be concluded that sprinkler method is beneficial over check basin in irrigating groundnut. Further, scheduling of sprinkler irrigation at 0.8 IW/CPE compared to at an IW/CPE of 1.0 can be economical in post-rainy seasons, especially under water deficit situations.

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