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# Response of Summer Greengram to Irrigation Systems Based on IW/CPE Ratio

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## ABSTRACT

**Results of the experiment conducted at GAU, Navsari showed that irrigation scheduled at IW/CPE ratio of 0.75 recorded higher grain and stover yields of greengram as well as higher values of consumptive use of water. Whereas, negative trend was observed for crop water use and field water use efficiency. The higher gross and net realization was also observed under this ratio in both the methods of irrigation. Higher initial cost of sprinkler system, surface method was found economical but mini sprinkler method saved 2.1 per cent water which covered an additional area of 0.27 ha at IW / CPE ratio 0.75.**

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## INTRODUCTION

Of late, the cultivation of pulse crop has received major attention in India in view of the increased demand for meeting the protein requirement of the escalating population. Among these, greengram *(Vigna radiata* (L) Wilczek) occupies a prominent place and gaining increasing popularity by virtue of its short growth period, high yield and outstanding nutritional value of food, feed and forage. Optimal utilization of water resources as one of the most critical factor in agriculture. The crop production generally depends upon the prudent application of water essential for the higher production per unit area and time. Pampatiwar *et al.*, (1983) observed that the sprinkler method of irrigation is more efficient from the water use efficiency and water saving point of view. Present investigation was therefore carried out to evaluate the mini - sprinkler method of irrigation with different IW/CPE ratio in summer greengram.

## MATERIALS AND METHODS

A field experiment was conducted at the farm of Gujarat Agricultural University, Navsari during the summer seasons of 1992-93 and 1993-94. The treatment comprised of four irrigation levels based on IW/CPE ratio (0.30, 0.45, 0.60 and 0.75) and two methods of irrigation (surface and mini - sprinkler) laid out in randomized block design with six replications. The typic Ustochrepts soil was deep black clayey (13.4% sand, 19.9% silt and 66.6% clay), low in available nitrogen (231 kg N/ha), medium in available phosphorus (35 kg $P_2O_5$/ha),

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high in available potash (350 kg $K_2O$/ha) and the soil reaction was slightly saline pH 7.8. Greengram cv. K-851 were sown on 20th and 29th March during 1992-93 and 1993-94, respectively. A basal dose of 20 kg N/ha and 40 kg $P_2O_5$/ha was applied uniformly to the experimental plots before sowing. The gross and net plot size were 6.0 m x 4.5 m and 4.0 m x 2.7 m for surface method and 7.5 m x 7.5 m and 2.5 m x 3.3 m for mini sprinkler method, respectively. Two meter buffer strip were kept around the plot. Two common irrigations, first immediately after sowing with 80 and 50 mm depth and second four days thereafter with 60 and 30 mm depth in surface and minisprinkler method of irrigation, respectively, were provided for proper germination and establishment of the crop. The remaining irrigations were scheduled as per irrigation treatments with 60 and 50 mm depth of water in surface and mini - sprinkler method, respectively. The CPE values were calculated after second common irrigation from USWB open Pan Class A evaporimeter. Irrigation was applied when CPE values approaches to 80, 100, 133 and 200 mm for surface and 67, 83, 111 and 167 mm in mini-sprinkler for 0.75, 0.60,

*TABLE 1*

**Economic of surface and mini-srpinkler method of irrigation at varying IW/CPE ratios (Mean of 1992-93 and 1993-94).**

| *Treatment* | *Yield (kg/ha)return Gross* | | | *Cost of production (Rs/ha)* | | | *Net ruturn (Rs./ha)* | *With reference to 0.30 IW/CPE ratio* | |
|---|---|---|---|---|---|---|---|---|---|
| | *Grain* | *Stover* | *(Rs/ha)* | *Fixed* | *Variable* | *Total* | | *Adidtional return (Rs/ha)* | *Additional cost (Rs/ha)* |
| **IW/CPE ratio** | | | | | | | | | |
| | | | | **Surface Method** | | | | | |
| 0.30 | 626 | 1035 | 8034 | 210 | 5773 | 5983 | 2651 | – | – |
| 0.45 | 825 | 1455 | 10633 | 210 | 5312 | 5522 | 5111 | 2460 | 139 |
| 0.60 | 861 | 1752 | 11209 | 210 | 5451 | 5661 | 5548 | 2897 | 165 |
| 0.75 | 961 | 1939 | 12497 | 210 | 5590 | 5800 | 6907 | 4256 | 417 |
| C.D. at 5% | 94.8 | 198.1 | | | | | | | |
| | | | | **Mini-Sprinkler Method*** | | | | | |
| 0.30 | 545 | 1794 | 7436 | 2373 | 4894 | 7267 | 169 | – | – |
| 0.45 | 695 | 2231 | 9454 | 2373 | 5036 | 7409 | 2045 | 1876 | 142 |
| 0.60 | 962 | 3076 | 13077 | 2373 | 5321 | 7694 | 5383 | 5214 | 427 |
| 0.75 | 1102 | 3423 | 14939 | 2373 | 5496 | 7867 | 7102 | 6933 | 570 |
| C. D. at 5% | 92.1 | 295.7 | | | | | | | |
| | | | | **Economics of Irrigation Methods** | | | | | |
| Surface method | 961 | 1939 | 12497 | 210 | 5590 | 5800 | 6907 | – | – |
| Mini srpinkler method | 1400 | 4347 | 18974 | 3014 | 5987 | 9001 | 9973 | 3066 | 3201 |
| C.D. at 5% | NS | NS | | | | | | | |

* Partially portable system with 0.25 ha area coverage in as shifting alongwith additional area 0.27 ha to be irrigated with saved water. Cost of production also can be computed as per area basis.

0.45 and 0.30 IW/CPE ratios, respectively. The quantity of irrigation water was measured with the help of 7.5" Parshall Flume for surface method and time of operation of minisprinkler was calculated by uniformity co-efficient.

*TABLE 2*

**Consumptive use of water, WUE, saving in water (%) and increase in yield (%) as influenced by irrigation methods and IW/CPE ratios (Mean of 1992-93 and 1993-94).**

| Sr. No. | Particulars | Mini sprinkler method IW/CPE ratios | | | | | Surface method** IW/CPE ratios | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.30 | 0.45 | 0.60 | 0.75 | Mean | 0.30 | 0.45 | 0.60 | 0.75 | Mean |
| 1. | Total water applied (mm*) | 130 | 180 | 280 | 330 | 230 | 220 | 286 | 352 | 418 | 319 |
| 2. | Consumptive use of water (mm) | 117 | 157 | 229 | 226 | 192 | 182 | 224 | 261 | 304 | 243 |
| 3. | Crop water use efficiency (kg/ha-mm) | 4.66 | 4.43 | 4.20 | 4.14 | 4.36 | 3.44 | 3.69 | 3.30 | 3.16 | 3.40 |
| 4. | Field water use efficiency (kg/ha-mm) | 4.19 | 3.86 | 3.43 | 3.34 | 3.71 | 2.85 | 2.87 | 2.45 | 2.30 | 2.42 |
| 5. | Saving in water (%) over respective ratios of surface method | 40.91 | 37.06 | 20.45 | 21.05 | 27.90 | – | – | – | – | – |
| 6. | Increase in yield (%) over respective ratio of surface method | -13.01 | -15.82 | 11.67 | 14.75 | 0.92 | – | – | – | – | – |
| 7. | Additional possible area can be covered (ha) over respective ratios of surface method | 0.69 | 0.59 | 0.26 | 0.27 | 0.39 | – | – | – | – | – |

* Including two common irrigations for establishment of crop.

** Ten per cent application losses was added in surface irrigation method.

## RESULTS AND DISCUSSION

### Effect of IW/CPE ratios

The grain and stover yields increased with the increase in the supply of soil moisture in both the methods of irrigation. Significantly the highest grain (961 and 1102 kg/ha) and stover (1993 and 3423 kg/ha) yields (Table : 1) were recorded under IW/CPE ratio of 0.75 in surface and mini-sprinkler method of irrigation, respectively. Consumptive use of water was increased with the increase in moisture regimes from 0.30 to 0.75 IW/CPE ratios in both the

methods (Table : 2). Adequate moisture supply favourably improved nutrient uptake and translocation which ultimately linked with the plant growth and development. Beneficial effect of these partmeters resulted in higher grain and stover yields and ultimately more consumptive use of water. Irrigation schedule influenced the water status of the soil profile, evapotranspiration and water use efficiency in greengram. An increase in the frequency of irrgation resulted in higher soil moisture content and greater ET. Frequent wetting of the upper surface layer exposed to the hot atmosphere in 0.75 IW/CPE ratio created a higher vapour pressure gradient between the crop canopy and the atmosphere, which might have caused relatively larger loss of water from the soil surface than in other schedules which resulted in lower field and crop water use efficiency. The results are in line with those of Khade *et al.* (1986) and Patel (1994).

**Effect of irrigation method**

Greengram irrigated through mini-sprinkler produced higher grain (1400 kg/ha) and stover (4347 kg/ha) yields (Table-1) and higher values of crop and field water use efficiency than surface method of irrigation (Table-2). This was mainly due to higher yield in mini-sprinkler with less evapotranspiration than surface method. An increase in quantity of irrigation water reduced the field and crop water use efficiency in surface method due to proportionately greater loss of water than correspondingly increase in yield. The findings are in agreement with those of Khade *et al.*, (1989) in greengram and Patel (1994) in safflower.

Frequent irrigation through mini-sprinkler at 0.75 IW/CPE ratio resulted in 21 per cent water saving which cover an additional area of 0.27 ha and gave 15 per cent higher grain yield over the surface method of irrigation in same IW/CPE ratio.

**Economics**

The net return and cost of cultivation were increased with the increase in IW/CPE ratio in surface method. The maximum gross return Rs. 12497/ha and net return Rs. 6907/ ha were realized at 0.75 IW/CPE ratio followed by 0.60, 0.45 and 0.30 IW/CPE ratio (Table-1).

The mini-sprinkler method was not viable compared to surface method due to initial higher cost. To minimize the initial cost of mini-sprinkler system, partially portable system covering 0.25 ha area with additional area of 0.27 ha coverage due to saved water in shifting showed miximum net profit of Rs. 7102/ha followed by Rs. 5383, Rs. 2045 and Rs. 169/ha at IW/CPE ratio 0.75, 0.60, 0.45 and 0.30 respectively.

**REFERENCES**

Khade, V. N. Khanvilkar, S. A. and Dongale, J. H. (1996). Studies on irrigation and nitrogen requirement of summer mung in Lateritic soil. *J. Maharashtra agric. Univ.* 11 (1) : 62-65.

Khade, V. N. Patil, B. P. Khanvilkar, S. A. Dongale, J. H. and Thorat, S.T. (1989). Evaluation of sprinkler method of irrigation for greengram and groundnut. *J. Maharashtra agric. Univ.* **14** (1) : 117 - 118.

Pampatiwar, P. S. Patil, B. R. Shinde, S. H. and Mande, T. A. (1983). Evaluation of sprinkler method of irrigation for summer groundnut. Paper presented at the seminar on sprinkler irrigation. Organised by AIRD, Pune and Engineering Staff College. Nasik, pp. 82-88.

Patel. P. G. (1994). Response of safflower to irrigation scheduling based on IW/CPE ratios under surface and mini-sprinkler methods in Vertisol of South Gujarat. Ph.D. thesis submitted to Gujarat Agricultural University, Sardar Krushinagar.