# Response of Chickpea to Drip Irrigation and Integrated Nutrient Management under Saurashtra Region of Gujarat

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## ABSTRACT

***A field experiment was conducted during the rabi seasons from 2009-10 to 2011-12 at Micro Irrigation Scheme, Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh (Gujarat). There were 12 treatments, consisting of 4 main plots of irrigation levels through drip ($I_1$- Drip irrigation at 0.4 PEF, $I_2$- Drip irrigation at 0.6 PEF, $I_3$- Drip irrigation at 0.8 PEF and $I_4$- Surface method of irrigation at 0.8 IW/CPE ratio) and 3 sub plots consisting of 3 levels of integrated nutrient management ($F_1$-RDFi.e. 20-40-00 NPK kgha$^{-1}$, $F_2$-RDF + FYM @ 1.0 t ha$^{-1}$ and $F_3$- RDF + FYM @ 2.5 t ha$^{-1}$). The experiment was laid out in split plot design with 4 replications. The gram cv. GG-1 was sown at 45 x 10cm spacing. On the basis of three years pooled data, significantly highest chickpea seed and stover yields of 1699 and 2531 kgha$^{-1}$, respectively were recorded when crop was irrigated at 0.8 PEF through drip ($I_4$). Percent increase in chickpea seed and stover yields under this treatment over 0.4 PEF ($I_1$) was to the tune of 57.6 and 44.1%, respectively. Application of FYM @ 2.5 tha$^{-1}$ along with 20-40-00 NPK kgha$^{-1}$ ($F_3$) produced significantly maximum seed and stover yields of 1533 and 2294 kgha$^{-1}$, respectively which was 18.7 and 11.9% higher over RDF ($F_1$). Mean data of gross return, net realization, B:C ratio and WUE showed that irrigating the crop through drip at 0.8 PEF and application of FYM @ 2.5 t ha$^{-1}$ along with RDF gave maximum gross and net retune, B:C ratio as well as WUE. Almost all growth and yield attributing characters were also observed significantly higher when crop was irrigated through drip at 0.8 PEF and fertilizing the crop with RDF+ FYM @ 2.5 t ha$^{-1}$.***

## 1. INTRODUCTION

In Gujarat, chickpea occupied an area of 2.15 lakh hectares with a production of 2.10 lakh tones with an average productivity of 977 kgha$^{-1}$, accounts 2.46% and 2.80% area and production of country, respectively (Singh, 2010). But the state's productivity in comparison with other state's average productivity is low. The reason for low productivity of chickpea in Gujarat may be due to lack of proper scheduling of irrigation, balance nutrition, weed management etc. Among various factors affecting, proper scheduling of irrigation is the key factor for enhancing productivity of crop, particularly through drip because water is a scare commodity, is key natural resource for any crop production particularly in arid and semi arid regions, where availability of irrigation water

posses a serious threat to the sustainability of crop production therefore it is considered as liquid gold. In drip irrigation method, water is applied to the soil from the dripper without any pressure or at extremely low pressure. It is well suited to areas of acute water shortage. Deep percolation, surface runoff and evaporation losses can be minimized. As the water in the soil is maintained at near field capacity all through, plants take water with ease and never subjected to moisture stress.

Organic manures particularly, farm yard manure play a crucial role in crop production. It acts on the soil physical properties, promotes formation of soil crumbs, thus makes the soil friable and thereby facilitates the proper movement of air and water as well as absorption of water. It also adds plant nutrients to the soil and organic acids during decomposition which act on the insoluble nutrient reserve in the soil and make them available. Biologically, it provides food for the beneficial soil micro organisms.

Recently high yielding varieties responsive to higher levels of irrigation and nutrients are evolved and therefore, better irrigation and nutrient management has prime importance in chickpea production. Drip irrigation system and integrated nutrient management offer great promise for exploiting the yield potential of chickpea. At present, drip system is preferably installed for widely spaced plantation and cash crop. Such use has great potential for utility of drip system, once installed, all round the year. Keeping this in view, the field experiment was planned to study the judicious use of irrigation water through drip and integrated nutrient management in chickpea.

## 2. MATERIALS AND METHODS

A field experiment was conducted during the *rabi* seasons of 2009-10, 2010-11 and 2011-12 at Micro Irrigation Scheme, Instructional Farm, Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh (Gujarat). The soil was medium black containing 0.68% organic carbon, 20.5 kgha$^{-1}$ available P and 326.0 kg ha$^{-1}$ available K with 7.9 pH. There were 12 treatments, consisting of 4 main plots of irrigation levels through drip ($I_1$- Drip irrigation at 0.4 PEF, $I_2$- Drip irrigation at 0.6 PEF, $I_3$- Drip irrigation at 0.8 PEF and $I_4$- Surface method of irrigation at 0.8 IW/CPE ratio) and 3 sub plots consisting of 3 levels of integrated nutrient management ($F_1$-RDF i.e. 20-40-00 NPK kgha$^{-1}$, $F_2$-RDF + FYM @ 1.0 t ha$^{-1}$ and $F_3$- RDF + FYM @ 2.5 t ha$^{-1}$). The experiment was laid out in split plot design with 4 replications. The gram cv. GG-1 was sown at 45 x 10cm spacing. The drip irrigation system was laid out at lateral spacing of 90cm with dripper spacing of 60cm and operated at pressure of 1.2 kg cm$^{-2}$ with 4 LPH discharge rate. The scheduling of irrigation was done with 0.4, 0.6 and 0.8 PEF at alternate day irrigations were applied through drip and in surface method, 50mm depth irrigations were applied at 0.8 IW/CPE ratios. Recommended dose of fertilizer and FYM as per treatments were applied before sowing the crop in previously opened furrows. All the other package of practice was followed during the crop period as per recommendation made for the crop.

## 3. RESULTS AND DISCUSSION

### *3.1 Effect of irrigation*

Effect of different irrigation treatments on growth and yield attributes of chickpea was significant in pooled results (Table-2). Crop irrigated at 0.8 PEF ($I_3$) recorded maximum plant height (40.7cm), plant spread (34.0cm), number of branches per plant (6.0) and number of pods per plant (37.5). The minimum values of all the growth and yield attributing characters were recorded when crop was irrigated through drip at 0.4 PEF ($I_1$).

Seed and stover yields of chickpea were significantly influenced by various irrigation treatments during the course of investigation and in pooled data (Table-1). Application of irrigation through drip at 0.8 PEF ($I_3$) produced significantly maximum seed (1699 $kgha^{-1}$) and stover yields (2531 $kgha^{-1}$), respectively on pooled data. Per cent increase in chickpea seed and stover yields under 0.8 PEF over 0.4 PEF was to the tune of 57.6 and 44.1%, accordingly. Application of adequate amount of water in root zone as per need of crop during crop growth period might be increased yield. Crop receives irrigations at 0.8 PEF recorded maximum WUE of 4.88 $kg^{-1}ha^{-1}$ $mm^{-1}$. Where as it was the lowest under surface method of irrigation. Deolankar and Derad (1999) reported significantly higher chickpea grain yield, saving of 51.33% water and higher WUE in drip method of irrigation over surface method of irrigation. Dixit *et al*., (1993) also reported similar results in chickpea and observed that chickpea produced higher yield under 0.8 and 0.6 IW/CPE ratio. Same results were also reported by Patel, *et al*., (2012) in fennel that irrigating the fennel through drip at 0.8 ADPEF gave significantly higher seed and stover yields.

Maximum gross (Rs. 56032 $ha^{-1}$) and net (Rs.29257 $ha^{-1}$) realization with BCR of 2.09 were obtained when crop was irrigated at 0.8 PEF. This treatment gave additional net income of Rs. 10178 and Rs. 3507 $ha^{-1}$ over irrigating the crop through drip at 0.4 PEF and surface method, respectively.

### *Effect of integrated nutrient management*

Different integrated nutrient management treatments significantly affect the all the growth and yield attributing characters. Application of recommended dose of fertilizer (20-40-00 NPK kg $ha^{-1}$) along with FYM @ 2.5 t $ha^{-1}$ exhibited significantly more plant height (39.2cm), plant spread (31.8cm), number of branches per plant (5.9) and number of pods per plant (37.2) than rest of the INM treatments (Table-2).

Application of recommended dose of fertilizer along with FYM @ 2.5 t $ha^{-1}$ ($F_3$) resulted in significant increase in seed and stover yields over RDF only ($F_1$). Chickpea fertilized with 20-40-00 NPK $kgha^{-1}$ along with FYM @ 2.5t $ha^{-1}$ ($F_3$) produced significantly higher seed and stover yields of 1533 and 2294 kg $ha^{-1}$, respectively (Table-1) which was 18.7 and 11.9% higher over

RDF only ($F_1$). The increase in growth and yield attributes as well as yields with the application of FYM because of FYM contains primary, secondary and micronutrients. Manures also exert favourable effect upon granulation and aeration in the soil for good moisture status to ensure free flow of nutrients and improve plant growth, which ultimately reflected in yield improvement.

Crop fertilized with 20-40-00 NPK kg $ha^{-1}$ along with FYM @ 2.5 t $ha^{-1}$ gave maximum gross and net realization of Rs. 50578 and 23066 $ha^{-1}$, respectively with BCR of 1.84. Maximum WUE of 5.08 $kgha^{-1}mm^{-1}$ was also observed under this treatment.

## 4. CONCLUSION

It could be concluded from the three years pooled results that for getting higher yields, gross and net realization as well as WUE, chickpea should be irrigated through drip at 0.8 PEF and crop should be fertilized with 20-40-00 NPK kg $ha^{-1}$ along with FYM @ 2.5 t $ha^{-1}$ under Saurashtra region of Gujarat.

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**Table-1 Effect of irrigation and integrated nutriment management treatments on seed and stover yields of chickpea**

| Treatment | Seed yield ($Kgha^{-1}$) | | | | Stover yield ($Kgha^{-1}$) | | | |
|---|---|---|---|---|---|---|---|---|
| | 2009-10 | 2010-11 | 2011-12 | Pooled | 2009-10 | 2010-11 | 2011-12 | Pooled |
| Irrigation | | | | | | | | |
| $I_1$ | 1023 | 1009 | 1200 | 1078 | 1674 | 1794 | 1804 | 1757 |
| $I_2$ | 1365 | 1394 | 1406 | 1388 | 2039 | 2203 | 2129 | 2124 |
| $I_3$ | 1708 | 1801 | 1588 | 1699 | 2499 | 2712 | 2381 | 2531 |
| $I_4$ | 1556 | 1666 | 1493 | 1572 | 2366 | 2543 | 2210 | 2373 |
| C.D.at 5% | 295.5 | 158.4 | 115.5 | 107.2 | 267.2 | 260.8 | 199.2 | 128.0 |
| INM | | | | | | | | |
| $F_1$ | 1229 | 1363 | 1281 | 1291 | 2015 | 2171 | 1964 | 2050 |
| $F_2$ | 1479 | 1493 | 1463 | 1478 | 2254 | 2323 | 2158 | 2245 |
| $F_3$ | 1532 | 1547 | 1521 | 1533 | 2164 | 2445 | 2272 | 2294 |
| C.D.at 5% | 192.2 | 70.1 | 95.8 | 72.8 | 128.0 | 112.4 | 176.4 | 79.0 |

**Table-2 Effect of irrigation and integrated nutriment management treatments on growth and yield attributes, economics and WUE of chickpea (Pooled of 3 years)**

| Treatment | Growth and yield attributes | | | | Realization (Rs.ha$^{-1}$) | | B:C ratio | WUE (Kg ha$^{-1}$ mm$^{-1}$) |
|---|---|---|---|---|---|---|---|---|
| | Plant height (cm) | Plant spread (cm) | No. of branches /plant | No. of pods/ plant | Gross | Net | | |
| Irrigation | | | | | | | | |
| $I_1$ | 35.4 | 26.4 | 5.3 | 31.2 | 35854 | 9079 | 1.34 | 4.81 |
| $I_2$ | 37.4 | 30.7 | 5.5 | 34.9 | 45888 | 19113 | 1.71 | 4.85 |
| $I_3$ | 40.7 | 34.0 | 6.0 | 37.5 | 56032 | 29257 | 2.09 | 4.88 |
| $I_4$ | 38.7 | 31.3 | 5.7 | 36.8 | 51906 | 25750 | 1.98 | 4.51 |
| C.D.at 5% | 1.2 | 1.1 | 0.3 | 2.1 | | | | |
| INM | | | | | | | | |
| $F_1$ | 37.0 | 29.3 | 5.4 | 32.7 | 42830 | 16793 | 1.64 | 4.27 |
| $F_2$ | 37.9 | 30.7 | 5.5 | 35.4 | 48830 | 22293 | 1.84 | 4.89 |
| $F_3$ | 39.2 | 31.8 | 5.9 | 37.2 | 50578 | 23066 | 1.84 | 5.08 |
| C.D.at 5% | 0.8 | 0.7 | 0.2 | 2.9 | | | | |