

Effect of fertigation on growth, yield and water use efficiency of chickpea (*Cicer arietinum*)

K.P. DEOLANKAR AND S.M. BERAD

Inter Faculty Department of Irrigation Water Management, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra 413 722

Received: February 1998

ABSTRACT

A field experiment was conducted during 1994-97 at Rahuri to find out suitability of fallow drip system (system used after harvest of main crop of *kharif*) for irrigation and fertigation in chickpea (*Cicer arietinum* L.). A 75% of recommended fertilizer dose (18.75 : 37.50 : 18.75 kg N, P₂O₅, K₂O/ha) in liquid form (75% RDLF) was found sufficient to sustain better growth and statistically equal grain and straw yield as that of 100% recommended fertilizer dose applied either solid or liquid form. This indicated 25% fertilizer saving with 11.07% increase in yield over N (urea) through drip treatment. Drip method of irrigation attributed significant increase in yield with 51.33% saving in water compared with surface method of irrigation.

Key words : Chickpea, Fertigation, Drip irrigation

Chickpea (*Cicer arietinum* L.) is one of the important *rabi* crops of Maharashtra and premium pulse crop of India. The productivity of chickpea is low in Maharashtra. Besides many other factors, limited soil moisture in *rabi* season coupled with low fertilizer use is a major reason for low productivity. Recently high yielding varieties responsive to higher levels of irrigation and fertilizers are evolved and therefore better irrigation and fertilizer management has prime importance in chickpea production. Drip irrigation system and fertigation offer great promise for exploiting the yield potential of these varieties. At present, drip

system is preferably installed for widely spaced cash crops only. 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 assess the utility of drip irrigation for *rabi* crop of chickpea.

MATERIALS AND METHODS

A 2-year field trial to assess the effect of fertigation through drip was conducted at Rahuri. The soil was clay loam in texture with pH 8.41. The fertility level of the soil was 165.18, 7.83 and 276.4 kg N, P and K/ha respectively. The experiment was planned

in randomised block design with 7 treatments, replicated thrice. Ridges and furrows technique was used. The treatments comprised 5 levels (150, 125, 100, 75, 50%) of recommended fertilizer dose (25:50:25 kg N, P₂O₅ and K₂O/ha) applied through drip by using liquid fertilizer grade, 8:8:8 (i.e. equal proportion of N, P₂O₅ and K₂O) in 4 splits at 15 days interval. The remaining 50% P₂O₅ (25 kg) was applied by using filtered single superphosphate solution (dissolving single super phosphate in sufficient water for 24 hr and then filtered and used). Besides liquid fertilizer levels, another 2 treatments, viz. N as urea, through drip and P₂O₅ and K₂O were applied to soil and surface irrigation (control) with recommended fertilizer dose.

In surface irrigated treatment, irrigation was scheduled at 1.0 IW/CPE ratio with 6 cm depth of water per irrigation. While under drip irrigation, alternate day irrigation was scheduled and irrigation water requirement was calculated with 60% wetted area. The stage-wise crop coefficient values were taken as suggested by Doorenbos and Kassam (1979). Ridges and furrows were prepared at 90 cm distance. The seeds of 'PG 87207' variety were dibbled at 10 cm distance on middle of the both the side of ridge (45 cm). The top of the ridge was flattened and 1 lateral line was laid.

RESULTS AND DISCUSSION

Yield-contributing characters

Application of different levels of liquid fertilizers and N as urea through drip resulted in significant increase of all biometric parameters studied. Application of 150% more fertilizer than recommended dose being at par with 125% level exhibited significantly

Table 1. Effect of fertigation on growth, yield and water use efficiency of chickpea (pooled means)

Treatment	Plant height (cm)	Plant spread (cm)	No. of pods/plant	Grain yield (q/ha)	Straw yield (q/ha)	Grain : Straw ratio	Total seasonal water requirement (cm)	Water saving (%)	Water use efficiency (kg/ha-cm)
T ₁ : SI + RDSF	48.77	36.23	24.78	19.25	18.80	1.02	34.44		53.08
T ₂ : DI + RDSF (N' through drip)	50.52	38.54	27.55	20.04	20.08	1.00	16.76	51.33	116.65
T ₃ : DI + 150% RDLF	58.22	42.40	37.44	22.71	22.39	1.01	16.76	51.33	130.55
T ₄ : DI + 125% RDLF	57.48	41.63	37.28	22.53	21.97	1.03	16.76	51.33	129.00
T ₅ : DI + 100% RDLF	56.31	41.11	36.86	22.36	21.78	1.03	16.76	51.33	127.57
T ₆ : DI + 75% RDLF	54.66	39.76	36.20	22.30	21.63	1.03	16.76	51.33	126.61
T ₇ : DI + 50% RDLF	46.26	34.09	23.31	18.02	17.97	1.00	16.76	51.33	104.24
CD (P = 0.05)	0.80	1.37	2.81	0.30	2.39	NS			

SI : Surface irrigation, DI : Drip irrigation, N.S. : Non-significant

RDSF/RDLF: Recommended fertilizer dose (25:50:25) through solid/liquid form fertilizer

more plant height and number of pods/plant than rest of the treatments. However, these levels were on par with 100 and 75% of recommended dose of liquid fertilizer in respect of number of pods/plant. All the parameters except number of pods per plant were reduced with the decrease in fertility levels, as compared to control. The use of N as urea applied through drip treatment proved inferior to 75% of recommended dose of liquid fertilizer and showed better growth as compared to 50% recommended dose of liquid fertilizers. The results are in conformity with Singh and Yadav (1971) and Rathi and Singh (1976).

Yield

Application of liquid fertilizer as well as N as urea through drip resulted in significant increase in grain as well as straw yield as compared to control. However, 50% level of recommended fertilizer dose through liquid fertilizer was not found effective in respect of the grain yield as compared to surface control. Chickpea responded positively to increased liquid fertilizer level, of 150% in respect of grain yield (22.71 q/ha), however, it was at par with 125% level (22.53 q/ha). Except 50 and 150% levels, all other liquid fertilizer levels attributed at par grain yield which indicates 25% fertilizer saving. Although recommended dose of N as urea applied through drip showed significant increase in grain yield over the control, but did not reach up to the level of any of the liquid fertilizers except 50%. Our findings support the results of Sharma and Singh (1972) and Singh and Singh (1989).

Water saving and water use efficiency

The total seasonal water requirement was 34.44 cm (consisting 5 irrigations) in surface method of irrigation, while it was only 16.76 cm in drip treatments. It indicates that if drip system is used for irrigation in chickpea, it attributes about 51.33% water saving over the surface method. The water use efficiency was considerably higher under drip irrigation treatments (124.24 to 130.55 kg/ha-cm) compared with the control (53.08 kg/ha-cm). As levels of liquid fertilizers increased, the water use efficiency also increased. The differences between 150 to 75% were however minimum. Water use efficiency of urea application treatment was less than former liquid fertilizer treatments, but was higher than 50% liquid fertilizer treatment.

REFERENCES

- Doorenbos, J. and Kassam A.H. 1979. Yield response to water : FAO. *Irrigation and Drainage Paper* No. 33. FAO, Rome.
- Rathi, S.S. and Singh, D. 1976. Effect of N and P fertilization on the growth and yield of gram. *Indian Journal of Agronomy* 21 (2) : 305-306.
- Sharma, J.P. and Singh Mahendra, 1972. Note on effect of direct application of phosphate to legume and the effect of nitrogen on the succeeding cereal crop of Rice. *Indian Journal of Agricultural Science* 42 (11) : 1069-1071.
- Singh, D.P. and Singh, T.P. 1989. Response of gram to row spacing and phosphate fertilization. *Indian Journal of Agronomy* 34 (1) : 107-109.
- Singh, R.S. and Yadav, S.C. 1971. Effect of number of cultivation and increasing levels of N and P on yield and quality of gram (*Cicer arietinum* L.). *Indian Journal of Agricultural Research* 5 (1) : 51-54.