

## Evaluation of Spaced Channel Irrigation Method and Nutrient Management in Chickpea (*Cicer arietinum* L.)

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### Abstract

A field experiment was conducted during winter season of 2004-05 and 2005-06 to determine the effect of spaced channel methods of irrigation and nutrient management on growth, yield attributes and yield of chickpea (variety JG-74). Five spaced channel irrigation method viz. channel spaced at 0.75 m ( $T_2$ ), 1.25 m ( $T_3$ ), 1.75 m ( $T_4$ ) and 2.25 m ( $T_5$ ) including local flood irrigation method ( $T_1$ ) in main plot and three nutrient management treatment viz. absolute control ( $F_0$ ), recommended dose of fertilizers (RDF) 25 : 50:25 N,  $P_2O_5$  and  $K_2O$  kg/ha ( $F_1$ ) and RDF + FYM at 10 t/ha in sub-plot were tested in split plot design with three replications, during dry winter season. The amount of water applied to 6 m long, 0.25 m wide and 10 cm deep channel spaced either side of the plot was measured by discharge of water through irrigation pipe at the spaced irrigation channel. Total of three irrigations were applied to the crop i.e. come up irrigation at sowing for uniform germination, at branching and pod filling stage. The results showed that channel spaced at 1.75 m width ( $T_4$ ) was optimum for chickpea in sandy clay loam soil during dry winter season, which was recorded the highest growth (i.e. plant height, number of branches per plant), yield attributes (number of pods per plant, 1,000-seed weight) and yield (13.92 q/ha seed yield and 19.11 q/ha straw yield) as compared to other treatments. However, water use efficiency was the highest when irrigation channel spaced at 2.25 m width (108.28 kg/cm per/ha) for irrigation in the chickpea. Application of recommended dose of fertilizer (100% RDF) 25 : 50 : 25 N,  $P_2O_5$  and  $K_2O$  kg/ha + FYM 10 t/ha ( $F_3$ ) recorded significantly highest growth, yield attributes and yield attributes and yield of chickpea (17.82 q/ha) as compared to rest of the nutrient management treatments. Application of 100% RDF along with FYM 10 t/ha ( $F_3$ ) also showed higher values of water use efficiency over other nutrient management treatments.

**Key words :** Spaced channel irrigation, Chickpea, Come up irrigation, Nutrient management.

Chickpea (*Cicer arietinum* L.) is traditionally grown under rainfed condition with minimum inputs by utilizing residual soil moisture available during the post monsoon period, however it shows response to irrigation (1). In Chhattisgarh state chickpea is usually being grown after harvest of kharif rice (*Oryza sativa*) in irrigated and limited water supply situation, flood irrigation method of irrigation during growth period of gram is being practiced by most of the farmers in the state causing uneven distribution of irrigation water in the field and temporary yellowing in the field. Information available on the behavior of chickpea to spaced irrigation method of irrigation and nutrient application particularly on sandy clay loam soil is scanty, therefore the present investigation was undertaken to study the influence of spaced channel irrigation method and nutrient management on growth yield and water use efficiency of chickpea.

### Methods

A field experiment was conducted during winter season of 2004-05 and 2005-06 at Regional Agricultural Research Station, IGKVV, Raigarh (CG), to study the influence of spaced channel irrigation method and nutrient management on growth, yield and water use efficiency of chickpea (*Cicer arietinum* L.) under sandy clay loam soils. The experimental soil had 188, 7.4 and 212 kg/ha available N,  $P_2O_5$  and  $K_2O$  respectively, with 6.7 pH. The experiment was laid out in split-plot design with three replications, having five spaced irrigation methods viz.  $T_1$  = Farmers practice flood irrigation,  $T_2$  = Channel irrigation after three rows of chickpea (0.75 m),  $T_3$  = Channel irrigation after 5 rows of chickpea (1.25 m),  $T_4$  = Channel irrigation after seven rows of chickpea (1.75 m),  $T_5$  = Channel irrigation after seven rows of chickpea (2.25 m) as

**Table 1.** Influenced of spaced channel method of irrigation and nutrient management on growth, yield attributes, yield and water use efficiency of chickpea (pooled data of 2 years).

Treatment	Plant height (cm)	Branches/plant (No.)	Pods/plant (No.)	Test wt (g)	Seed yield (q/ha)	Straw yield (q/ha)	WUE (kg/cm/ha)
<b>SCM (Spaced Channel Method of Irrigation)</b>							
T <sub>1</sub>	38.88	5.04	13.14	15.43	5.27	8.85	13.51
T <sub>2</sub>	39.81	5.62	15.73	15.99	8.69	12.66	26.99
T <sub>3</sub>	41.27	6.56	17.79	16.25	12.30	17.85	65.42
T <sub>4</sub>	41.97	6.68	18.19	16.38	13.92	19.11	97.47
T <sub>5</sub>	41.07	5.85	15.86	15.80	12.02	16.05	108.28
SE ±	0.83	0.30	0.76	0.2	0.39	0.50	
CD at 5%	1.74	0.88	2.24	0.41	1.16	1.50	
<b>NM (Nutrient Management)</b>							
F <sub>0</sub>	38.89	5.16	14.25	15.32	8.53	11.51	36.71
F <sub>1</sub>	40.58	5.97	15.58	16.07	10.58	15.42	45.54
F <sub>2</sub>	42.47	6.68	18.58	16.52	12.30	17.82	52.86
SE ±	0.73	0.41	0.51	0.15	0.35	0.61	
CD at 5%	2.08	1.17	1.45	0.42	1.00	1.75	
<b>Interaction</b>							
SE ±	1.44	0.53	1.32	0.34	0.68	0.90	
CD at 5%	NS	NS	NS	NS	NS	NS	

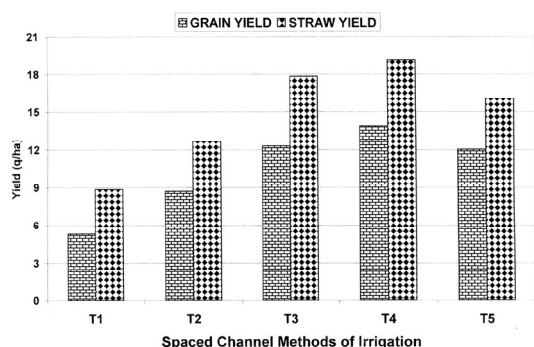
main plot treatments ; and three nutrient management levels F<sub>0</sub> = No nutrient, F<sub>1</sub> = 25 : 60 : 25 (N : P<sub>2</sub>O<sub>5</sub> : K<sub>2</sub>O) kg/ha, F<sub>2</sub> = F<sub>1</sub> + FYM 10 t/ha as sub-plot treatment. Chickpea variety (JG-74) was sown on first week of December and third week November during first and second year, respectively. Sowing was done in 25 cm wide rows, plant to plant distance of 10 cm was maintained about 15 days after sowing by thinning and gap-filling. The irrigation was applied to 6 m, long 0.25 m wide and 10 cm deep channel spaced either side of the plot. The amount of water applied to fill the each channel was fixed irrespective of their plot area. The plot for conventional flood irrigation was maintained separately. The same amount of water applied to the each spaced channel irrespective of their plot area. Whereas amount of water applied to conventional flood irrigation (farmers practice) was up to full saturation of the soil of the plot. The applied water to the spaced channel and flood irrigation was measured by discharge of water through irrigation pipe at the plot. Total of three irrigations were given to the crops, just after sowing, branching and pod filling stage at 35 and 75 days after sowing. The

crop was harvested on second week of March during both the years.

## Results and Discussion

### *Effect of Spaced Channel Irrigation Method*

Application of irrigation through spaced channel irrigation method significantly influenced yield and yield attributing characters of chickpea over conventional flood irrigation method (farmers practice) during both the years and in pooled analysis (Table 1, Fig 1). Irrigation channel spaced at 1.75 m (T<sub>4</sub>) recorded significantly superior grain and straw yield of chickpea over other spaced channel irrigation method and conventional flood irrigation method (T<sub>1</sub>, farmers practice), mainly due to the better growth, yield attributes compared to other spaced irrigation treatments. Fixed amount of irrigation water feed to spaced channel T<sub>4</sub> (1.75 m) uniformly distributed in plot which might have optimum to the better crop growth and yield attributes compared to other irrigation methods. Other treatments might be suffered by excessive/



**Figure 1.** Effect of spaced channel methods on chick pea.

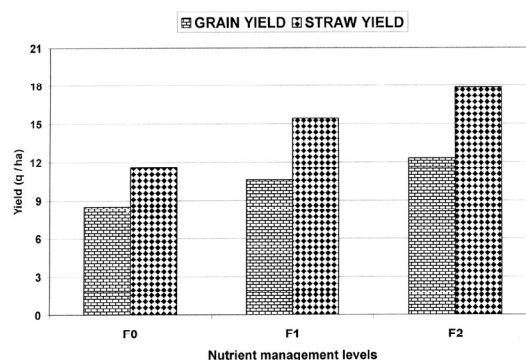
scarcity of soil moisture because of fixed amount of water applied to other spaced channel (2).

#### *Effect of Nutrient Management*

Application of recommended dose of fertilizer at 25 : 50 : 25 N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O kg/ha along with FYM at 10 t/ha (F<sub>3</sub>) gave significantly highest grain and straw yield over other treatments, due to higher number of branches/plant, pods/plant and 1,000-seed weight. The increase in yield might be due to additional supply of nutrients (through FYM) along with N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O and better conservation of soil moisture that favored efficient nodulation, which might have resulted in increased assimilation of nitrogen by chickpea and thus recorded higher number of pods/plant with bolder seed (Fig. 2). This finally resulted in higher grain yield (1).

#### *Effect on Water Use Efficiency*

Application of irrigation through channel spaced at 2.25 m (T<sub>5</sub>) recorded the highest values for water use efficiency whereas lowest water use efficiency was noticed when irrigation channel spaced at 0.75 m (T<sub>2</sub>) and test with conventional flood irrigation method (T<sub>1</sub>). However, irrigation channel spaced at 1.75 (T<sub>4</sub>) recorded moderate values of water use efficiency, next to treatment T<sub>5</sub> and significantly superior grain yield over T<sub>5</sub> and other treatments of irrigation method. This might be due to applied water in treatment T<sub>5</sub> was not sufficient to express yield potential of the crop. These results indicate that water use efficiency decreased



**Figure 2.** Effect of nutrient management levels on chick pea.

with increase in availability of water in space between two irrigation channels due to relatively smaller plot area led to higher consumptive use of applied water without much increase in grain yield (3). In flood irrigation method crop yellowing and mortality of plants due to excessive soil moisture with poor drainage might have reduced the yield attributes and yield of chickpea. Among the nutrient management treatments application of farmyard manure in conjunction with recommended dose of fertilizer (RDF 25 : 50 : 25 N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O kg/ha and FYM 10 t/ha) increased water use efficiency over RDF alone (F<sub>2</sub>) and control (F<sub>1</sub>). Increased water use with RDF + FYM caused better crop growth, yield attributes and yield. Cook et al. (4) stated that application of organic amendment to the soil surface ameliorate top soil physical conditions, specially with respect to temperature, evaporation and water content. Hati et al. (5) found that application of farmyard manure in conjunction with NPK to soybean in central India increased seed yield and water use efficiency by 103 and 76% respectively, over the control.

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