J Krishi Vigyan 2018, 6(2) : 172-175 DOI : 10.5958/2349-4433.2018.00008.9

Performance of Chickpea (*Cicer arietinum* L.) Sown on different Seed Bed Configurations in Malwa Region of Madhya Pradesh

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ABSTRACT

The major concern of Furrow Irrigated Raised Bed System (FIRBS) is to enhance the productivity and save the irrigation water. In this system of planting chickpea crop is sown in paired rows on ridges or beds. The height of the beds is maintained at about 20 to 25 cm with a width of about 40 to 50 cm for the chickpea sowing. The field experiments were conducted at different villages of Dewas district of Madhya Pradesh viz. Narana, Nanadharakhedi and chidawad during the year 2013-14, 2014-15 and 2015-16 to evaluate the performance of chickpea under different land configurations. The trials involved three seed bed configurations i.e. flat sowing (T1), raised bed with pair row of crop at 20 cm spacing on one bed and 40 cm furrow width (T2) and raised bed with pair row of crop at 30 cm spacing on one bed with 50 cm furrow width (T3) with 10 replications. It was found that treatment T3 recorded 25.5 and 8.89 per cent more nodulation as compared to treatment T1 and T2, respectively. Number of pods/plant were also maximum with raised bed planting of treatment T3 (106.5) which was significantly higher than flat bed T1 (23%) and T2 (14%). Grain yield, straw yield and biological yield were also significantly influenced by the different sowing methods and it were found maximum (19.35, 30.45 and 49.80 q/ha respectively) by sowing of chick pea in raised bed with pair row of crop at 30 cm spacing on one bed with 50 cm furrow width (T3). Hence, it was concluded that treatment T3 (raised bed with pair row of crop at 30 cm spacing on one bed with 50 cm furrow width) was economically feasible as compared to other methods of sowing of chick pea.

Key Words:- Chick pea, Land configuration, Raised bed and FIRBS.

INTRODUCTION

Chickpea (*Cicer arietinum* L.) is the premier pulse crop grown in 8.3 million ha with annual production of 7.7 million tonnes with an average productivity of 928 kg/ha (Annon, 2013). Chickpea is mainly grown during Rabi season in India under diverse production systems including both rain fed and irrigated, but its maximum area and production is mostly confined to Madhya Pradesh, Rajasthan, Maharashtra, Karnataka, Andhra Pradesh and Uttar Pradesh. In Madhya Pradesh chickpea occupy 2.6M ha area which contribute 2.8 million tonnes production, but average productivity is very low as compared to potential yield. Moreover, potential morpho-physiological traits in plants viz., water use efficiency (WUE), deep root system, higher relative biomass and harvest index, osmotic adjustment of chickpea are advantageous under water scarce situation (Chaudhury *et al,* 2005). Despite all this, crop experiences terminal drought during seed development stage as it is invariably grown on residual soil moisture after a preceding rainy crop, thereby making the terminal moisture stress as the major constraint in achieving potential productivity of chickpea (Singh *et al,* 2010). Under such situations, photosynthetic activity of leaves is hampered for the want of nitrogen and thus, seed filling is affected (Davies *et al,* 2000). Therefore, a judicious management of available soil moisture through in-situ conservation a suitable

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land configuration *viz.*, furrow irrigated raised bed system (FIRBS) improves crop productivity (Panwar and Basu, 2003).

Raised bed planting technique has recently emerged as the most potential resource conserving technology in Indo-Gangetic plains of NW India under rice-wheat cropping system. Change over from growing crops in flat to ridge-furrow system of planting crops on raised bed alters the crop geometry and land configuration, offers more effective control over irrigation and drainage as well as their impacts on transport and transformations of nutrients, and rainwater management during the monsoon season. It is a method in which accommodating crop rows on both sides of furrow by increasing ridge spacing, thereby a common furrow is used for irrigation of two rows.

In recent years, FIRBS has proved to be one of the important components of low cost sustainable production system. This planting system facilitates mechanical weed control, increased water use efficiency, reduced crop lodging and has lower seed requirement (Sayre, 2000; Yadav *et al,* 2002). This method of planting has been experimented for crops like chickpea, green gram, black gram, groundnut and sunflower. In this system, water moves horizontally from the furrows into the beds (subbing) and is pulled upwards in the bed towards the soil surface by capillarity, evaporation and transpiration, and downwards largely by gravity. Raised bed planting of cereals, pulses and vegetables, on an average, increased yield by 24.2 per cent and saving of irrigation water by 31.2 per cent (Connor *et al,* 2003). The major concern of this system is to enhance the productivity and save the irrigation water. Potential agronomic advantages of beds include improved soil structure due to reduced compaction through controlled trafficking, reduced water logging and timely machinery operations due to better surface drainage. Beds also create the opportunity for mechanical weed control and improved fertilizer placement (Singh *et al,* 2002). Hence, the present investigation was, therefore conducted to study the performance of chickpea sown on different seed bed configurations in Malwa Region of Madhya Pradesh

MATERIALS AND METHODS

The field experiments were conducted at different villages of Dewas district of Madhya Pradesh *viz.* Narana, Nanadharakhedi and chidawad during the year 2013-14, 2014-15 and 2015-16 to evaluate the productive performance of chickpea under different land configurations. The village narana and nanadharakhedi situated in the block sonkutch, while chidawad is situated in tonk khurd block of the Dewas district. The climate of the region is tropical sub-humid receiving an annual rainfall of 1067 mm with maximum and minimum temperature of 45°C and 5°C, respectively. The soils of experiment sites were medium black soil with pH 7.5 to 7.8, organic carbon (OC, 0.28 to 0.40 %) at the time of initiation of field experiment. On soil fertility account, it was low in available N (178 kg/ha), medium in P (17.2 kg/ha) and K (340 kg/ha) and S (13.8 kg/ha).

The trials involved three seed bed configurations i.e. flat sowing (T1), raised bed with pair row of crop at 20 cm spacing on one bed and 40 cm furrow width (T2) and raised bed with pair row of crop at 30 cm spacing on one bed with 50 cm furrow width (T3) with 10 replication.

The field was prepared and trapezoidal shape raised beds were made mechanically by tractor driven furrow irrigated raised bed planter. The experiments were conducted at 10 farmers' field and area of each field was kept 4000 sq m. The width of bed was adjusted to 40 to 45 cm with two rows of chickpea on each raised bed. Recommended seed rate 80 kg/ha was used for sowing along with recommended package of practices including use of fertilizers and appropriate Rhizobium inoculation. First irrigation was applied at the time of branching (35-40 d after sowing) and second irrigation was at the stage of pod formation (90-95 d after sowing) through the furrow. Required plant protection measures were

Table 1. Growth parameters of chickpea as influenced by planting Methods.

Treatment	Number of nodules/ plant after 60 d	Length of root (cm) after 60 d	Plant height (cm) at the time of flowering	Root/ shoot ratio after 60 d	Number of branches/ plant (cm) after 60 d
T1	30.78	13.15	43.16	0.30	29.96
T2	35.49	17.71	47.67	0.37	34.71
T3	38.63	23.32	53.25	0.44	38.06
SEm±	0.34	0.43	0.45	0.007	0.422
CD (P=0.05)	1.73	2.17	2.28	NS	2.12

taken as and when found necessary. Nodulation and root growth were studied through destructive plant sampling at various growth stages. Data pertaining to crop growth, yield attributes and yield were collected at harvest and analyzed statistically. The B: C ratio was calculated based on the net return and cost of cultivation in each treatment.

RESULTS AND DISCUSSION

The average (3yr) nodulation, root length and root spread of chickpea plant extracted from soil were higher in raised bed furrow system as compared to flat sowing. Nodulation and root growth in chickpea at 60 DAS were significantly influenced by planting methods (Table 1). Average nodules/plant was maximum in T3 which were significantly higher than T2 and T3. On an average, treatment T3 recorded 25.5% and 8.89% more nodulation as compared to treatment T1 and T2 respectively. Raised bed planting also encouraged more root growth which was evident through significantly higher root height in the treatment T3. On an average 10.17 cm and 2.61 cm more root length recorded in treatment T3 as compared to treatments T1 and T2.

Similarly plant height was also found maximum in the treatment T3 than T2 and T1. Average plant height recorded in treatment T3 was 53.25 cm while in treatment T2 and T1 was 47.67 and 43.16 cm, respectively. It was 11 and 23 per cent more in treatment T3 compared to T2 and T1, respectively. Raised bed planting also encouraged more root growth at the initial stage which is evident through significantly higher root: shoot ratio at 60 DAS in T3. Though root: shoot ratio at flowering was higher with raised bed planting. Treatment T3 was also recorded 27% more branches over flat bed (T1) and 9.65% more over T2 .

The number of pods/plant were also maximum with raised bed planting of treatment T3 (106.5) which was significantly higher by 23% than flat bed T1 (86.6) and 14% than T2 (93.3). Different methods of sowing did not significantly influenced the weight of 100 seeds though it was highest in treatment T2 (21.32 g) followed by treatment T3 (21.26 g) and T1 (21.21 g). Grain yield, straw

Table 2.Effect of different methods of sowing on yield attributing character of chickpea.

Treatment	Number of pods/ plant	Weight of 100 seeds (g)	Grain yield (q/ ha)	Straw yield (q/ ha)	Biological yield (q/ha)	Harvest Index (%)
T1	86.6	21.21	14.91	25.135	40.04	37.22
T2	93.3	21.32	17.11	27.92	45.03	38.00
T3	106.5	21.26	19.35	30.445	49.795	38.86
SEm±	1.63	0.11	0.26	0.31	0.44	0.39
CD (P=0.05)	8.19	NS	1.29	1.56	2.21	1.97

Table 3. Effect of planting techniques on gross income, net return and benefit cost ratio.

Treatment	Cost of cultivation (Rs/ha)	Gross Return (Rs/ha)	Net Return (Rs/ha)	B:C Ratio
T1	29550	49742	20192	1.68
T2	30560	56914	26354	1.86
T3	30980	64139	33159	2.07

yield and biological yield was also significantly influenced by the different sowing methods and was found maximum (19.35, 30.45 and 49.80 q/ha respectively) by sowing of chick pea on raised bed with pair row of crop at 30 cm spacing on one bed with 50 cm furrow width (T3) followed by treatment T2 (17.11, 27.92 and 45.03 q/ha respectively) and T1 (14.91, 25.14 and 40.04 q/ha respectively). Harvest index was found maximum in T3 (38.86%) which was 2.26 and 4.41 per cent higher that T2 (38%) and T1 (37.22%), respectively.

The economic indicators depicted (Table 3) show that highest gross return (Rs 64139/-), net return (Rs 33159/-) and B:C ratio (2.07) were obtained in treatment T3 followed by treatment T2 (Rs 56914/-, Rs 26534/- and 1.86) and T1 (Rs 49742/-, Rs 20192/- and 1.68). Therefore, it was concluded that treatment T3 (raised bed with pair row of crop at 30 cm spacing on one bed with 50 cm furrow width) was economically feasible as compared to other methods of sowing of chick pea.

CONCLUSION

It was concluded from the study that crop planted on raised bed with proper production technology gives good yield as well as economically feasible as compared to other methods of sowing of chick pea.

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Received on 01/11/17 *Accepted on 30/12/17*