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ORIGINAL ARTICLE

Performance Evaluation of Tractor Operated Furrow Irrigated Raised Bed Seed Drill for Chickpea Production

Rajesh Gupta[1], G.S. Chundawat[2], R.C. Aswani[3] and Ajeet Sarathe[4]
[1]Scientist, RVSKVV-KVK, Mandsaur – 458002 (M.P.)
[2]Scientist, RVSKVV-KVK, Mandsaur – 458002 (M.P.)
[3]Scientist, RVSKVV-KVK, Mandsaur – 458002 (M.P.)
[4]Asst. Prof., Dept. of Agril. Engg., AKS University, Satna - 485001 (M.P)
Correspondence Author E-mail: rajeshgupta171@rediffmail.com

ABSTRACT
The field experiments were conducted during the two consecutive rabi seasons 2017-18 and 2018-19 at farmer's field in villages Amlawad and Setkhedi of Mandsaur district of Madhya Pradesh to assess the effect of furrow irrigated raised bed (FIRB) seed drill on the growth characters and yield parameters of chickpea cultivation. The experiments involved three seed bed configurations i.e., conventional sowing (T1), raised bed with pair row of crop on 20 cm spacing on one bed and 40 cm furrow width (T2) and raised bed with pair row of crop on 30 cm spacing on one bed with 50 cm furrow width (T3) with 13 replications. The FIRB seed drill with seed bed configuration T3 was found superior in terms of nodulation (37.93 nodules per plant), number of pods/plant (105.54), grain yield (19.14 q/ha), straw yield (30.23 q/ha) and biological yield (49.58 q/ha) as compared to seed bed configuration T1 and T2 . The highest B:C ratio of 2.23 was recorded for treatment T3 as compared to lower B:C ratio of 1.98 and 1.72 for treatment T2 and T1 respectively. The results revealed that treatment T3 (raised bed with pair row of crop on 30 cm spacing on one bed with 50 cm furrow width) was superior as compared to treatment T1 and T2 for chickpea production.
Keywords: *Chickpea, FIRB, conventional sowing, Grain yield, B:C ratio*

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INTRODUCTION

Mechanization of agriculture has assumed greater importance for increasing agricultural production and productivity by efficiently and effectively utilizing scarce resources and costly farm inputs improving timeliness factor, reducing labour cost and human drudgery etc. for soybean and chickpea cropping system. For improvement of agricultural productivity the package of improved implement, machines play important role, besides high yielding varieties, fertilizer, irrigation and plant protection practices. Chickpea is an important pulse crop grown and consumed all over the world, especially in the Afro-Asian countries. It is also one of the major pulse crops cultivated and consumed in India and also known as Bengal gram. In India, chickpea accounts for about 45% of total pulses production. Similar to the case of other pulses, India is the major chickpea producing country and contributing for over 75% of total world chickpea production.

Most of the farmers used conventional seed drill for sowing of chickpea on flat bed system which resulted to lower down the crop yield. The planting of crops on furrow irrigated raised bed have been found effective in mitigating the adverse effect of water stress and improvement in soil physical and biological environment [1]. Moreover, potential morpho-physiological traits in plants *viz*., water use efficiency, deep root system, higher relative biomass and harvest index, osmotic adjustment of chickpea are advantageous under water scarce situation [2]. The crop experiences terminal drought during seed development stage as it is invariably grown on residual soil moisture after a preceding rainy crop(s), thereby making the terminal moisture stress as the major constraint in achieving

potential productivity of chickpea [3]. Under such situations, photosynthetic activity of leaves is hampered for the want of nitrogen and thus, seed filling is affected [4]. Therefore, a judicious management of available soil moisture through *in-situ* conservation is required *viz*., furrow irrigated raised bed system (FIRBS) which improves the crop productivity [5]. This planting system facilitates mechanical weed control, increased water use efficiency, reduced crop lodging and has lower seed requirement [6]. In this system, water moves horizontally from the furrows into the beds 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% and saving of irrigation water by 31.2% [7]. The major concern of this system is to enhance the productivity and save the irrigation water. The higher biological yield, highest net and gross return from land configuration treatment as compared to conventional system [8]. Therefore, to save the crop from moisture stress during the crop growth period and to minimize the cost of cultivation without compromising with sustainability, a field experiment was conducted at farmer's fields to assess the effect of tractor operated furrow irrigated raised bed (FIRB) seed drill on the growth characters and yield of chickpea in Mandsaur district of Madhya Pradesh.

MATERIAL AND METHODS

The present study was carried out during two consecutive years Rabi 2017-18 and Rabi 2018-19 at farmer's field in the two adopted villages of Krishi Vigyan Kendra, Mandsaur namely, Amlawad and Setkhedi to assess the effect of furrow irrigated raised bed (FIRB) seed drill on the growth characters and yield parameters of chickpea cultivation. The experiment consists of three seed bed configurations i.e., conventional sowing on flat bed (T1), raised bed with pair row of crop on 20 cm spacing on one bed and 40 cm furrow width (T2) and raised bed with pair row of crop on 30 cm spacing on one bed with 50 cm furrow width (T3) with thirteen replications. The study area is situated in western part of Madhya Pradesh which falls under agro-climatic zone of Malwa plateau. Mandsaur belongs to sub-tropical climate having a mean temperature range of minimum 5^0C and maximum 44^0C in winter and summer, respectively. The topography of the experimental site was uniform and levelled. The soil is clayey in texture with 45 cm depth with pH 7.3 to 7.6, organic carbon 6.2 to 6.5 g/kg soil, EC 0.39 to 0.41 dS/m at the start of experiment. The area normally receives annual rainfall ranging from 750-800 mm per annum out of which about 90 per cent of is received between June and September.

A tractor drawn FIRB seed drill procured from Department of Agriculture Engineering, Mandsaur on custom hiring basis was used for sowing of chickpea crop in experimental plots under treatment T2 and T3 whereas conventional seed drill was used for treatment T1. Recommended seed rate 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 days after sowing) and second irrigation was at the stage of pod formation (90-95 days after sowing) through the furrows. Required plant protection measures were taken as and when found necessary.

The observations on number of nodules per plant, length of root, plant height, root/shoot ratio, number of branches, number of pods/plant, grain yield, straw yield, biological yield and harvest index were recorded for all the treatments and analyzed statistically. The technique of representative sample was adopted for recording the observations on various morphological characters in chickpea. The economics of the present study was also worked out for both the experimental years i.e., Rabi 2017-18 and Rabi 2018-19.

RESULTS AND DISCUSSION

The pooled data (2017-18 and Rabi 2018-19) on parameters related to crop growth and yield as influenced by different seed bed configurations in chickpea production are presented in Table 1. The statistical analysis showed that there was no significant difference ($P \geq 0.05$) on Root/shoot ratio after 60 DAS due to different treatments. The other crop growth and yield parameters were found higher in treatment T3 (raised bed with pair row of crop on 30 cm spacing on one bed with 50 cm furrow width) as compared to in treatment T2 (raised bed with pair row of crop on 20 cm spacing on one bed and 40 cm furrow width) and treatment T1 (conventional sowing on flat bed). The number of nodules per plant and root length after 60 DAS was found maximum in treatment T3 (37.93, 22.95 cm) followed by treatment T2 (34.76, 18.44 cm) and treatment T1 (39.84, 13.26 cm). The planting on raised bed encouraged more

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root growth which is evident through significantly higher root length in the treatment T3. The present findings are in close vicinity of Aggarwal and Goswami [9].

Table 1: Comparison of crop growth and yield parameters as influenced by different seed bed configurations in chickpea production

S. No.	Parameter	Treatment T1	Treatment T2	Treatment T3	SEm±	CD (P=0.05)
1.	Number of nodules per plant after 60 DAS	29.84	34.76	37.93	0.31	1.68
2.	Length of root after 60 DAS (cm)	13.26	18.44	22.95	0.53	2.36
3.	Plant height at flowering (cm)	42.75	46.63	52.47	0.49	2.45
4.	Root/shoot ratio after 60 DAS	0.31	0.38	0.45	0.008	NS
5.	Number of branches after 60 DAS	30.24	35.18	38.87	0.46	2.31
6.	Number of pods/plant	85.88	92.71	105.54	1.69	8.04
7.	Grain yield (q/ha)	14.25	16.87	19.14	0.31	1.36
8.	Straw yield (q/ha)	24.85	27.60	30.23	0.37	1.62
9.	Biological yield (q/ha)	39.76	44.71	49.58	0.41	0.38
10.	Harvest index	37.50	38.27	39.03	0.38	1.95

The plant height at flowering was found maximum in treatment T3 (52.47 cm) followed by treatment T2 (46.63 cm) and treatment T1 (42.75 cm). The increase in plant height was mainly due to better soil plant water relationship and soil physical condition in treatment T3. Similarly, other crop growth and yield parameters viz., root/shoot ratio after 60 DAS, number of branches after 60 DAS, number of pods per plant, grain yield, straw yield and harvest index were significantly influenced by different land configuration at all the growth stages and found maximum in treatment T3. The increased root/shoot ratio in treatment T3 (0.45) by 18.42% than treatment T2 (0.38) and 45.16% than treatment T1 (0.31) may be due to congenial soil environment and better soil depth. Raised bed also encourage initial root and shoot growth of plant [10].

The grain yield and straw yield were found maximum in treatment T3 (19.14 q/ha and 30.23 q/ha respectively) followed by treatment T2 (16.87 q/ha and 27.60 q/ha respectively) and treatment T1 (14.25 q/ha and 24.85 q/ha respectively). Superior yield with treatment T3 was mainly due to increased number of pods as the results of better plant growth under raised bed planting system. The significant improvement in grain yield of chickpea was also recorded by Jat *et al.* [11] and Mishra *et al.* [12 and 13] under raised bed planting system.

The economics of the present study was worked out as presented in Table 2. It is clear from Table 2 that the higher net return of 37954 Rs/ha with B:C ratio of 2.23 was recorded for chickpea cultivation under treatment T3 followed by treatment T2 (30082 Rs/ha and 1.98) and treatment T1 (21550 Rs/ha and 1.72). Similar findings in chickpea under raised bed planting system were also reported by Pramanik *et al.* [10].

Table 2: Comparison of Economics parameters as influenced by different seed bed configurations in chickpea production

S. No.	Parameter	Treatment T1	Treatment T2	Treatment T3
1.	Cost of Cultivation (Rs/ha)	29750	30650	30950
2.	Gross Return (Rs/ha)	51300	60732	68904
3.	Net Return (Rs/ha)	21550	30082	37954
4.	Benefit Cost Ratio (B:C)	1.72	1.98	2.23

CONCLUSION

It can be concluded that the practice of chickpea cultivation on raised seed bed configurations was found superior in comparison with flat bed method of sowing. The results of the study indicated that

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the higher productivity (19.14 q/ha) with maximum net return (39954 Rs/ha) of chickpea cultivation can be achieved by raised seed bed configurations as compared to flat bed method of sowing in Mandsaur district of Madhya Pradesh.

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