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# Evaluation of Chickpea (*Cicer Arietinum*) Varieties with Various Methods of Planting under Irrigated Conditions

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**Short Communication**

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## Short Communication

Chickpea or Bengal gram or gram (Cicer arietinum) is a cool season food legume crop grown on 10 million ha in 45 countries of the world. Average annual chickpea area is 16,000 ha in each of the 23 most important chickpea-growing countries. This is an important pulse crop of the semi-arid tropics, particularly in the rainfed ecology of the Indian subcontinent. The chickpea is a rich source of protein (21.1%), carbohydrate (61.5%) and fat (4.5 %). The gram is used as vegetable (chhole) and its flour (besan) is used in the preparation of various types of sweets. Chickpea also plays an important role in sustaining soil productivity by improving its physical, chemical and biological properties and trapping atmospheric nitrogen in their root nodules [1]. A good crop of chickpea could fix up to 141 kg N ha-1 which economizes nitrogen application for succeeding cereals to the tune of 56-58 kg N ha-1 [2]. There are two main types of chickpea cultivars desi or brown gram (microsperma, small seeded with yellow to brown testa) which constitute about 85 per cent of the total production and Kabuli (macrosperma, large seeded with Solomon white testa) with 15 per cent of the total production. Pulses have very low productivity due to several reasons. However, the obvious reasons are cultivation under energy starved conditions on marginal and sub-marginal lands with no or low input management, late sowing, higher degree of susceptibility to both abiotic and biotic stresses, unavailability of quality seeds of high yielding varieties, poor or no use of plant protection measures, improper management practices, lack of winter precipitation and inadequacy of stored soil moisture, etc [3]. Among different components of production, use of improved varieties and planting method may prove beneficial to improve productivity of chickpea. Sowing or planting method influences the crop architecture through altering the plant geometry. Bed planting may be proved better as it helps in better light interception, irrigation management, water use efficiency, root development and ultimately high yield. The yield of chickpea may increase with zero tillage over conventional tillage due to significant reduction of weeds under zero tillage over conventional tillage [4]. Therefore, zero or minimum tillage could be beneficial [5]. Establishment of crops in zero tillage not only eliminates the problems associated with creating an adequate seedbed but also the turnaround time and cultivation cost may be reduced [6]. Late planting is also one of the factors for low productivity of crop. The advance seeding of chickpea can be made possible by planting under zero tillage conditions on residual soil moisture after the harvest of rice. Studies have reported that grain yield of wheat increased significantly (7.7 per cent) with zero tillage over the conventional tillage under such situations [7]. In northern part of India, rice-chickpea is the predominant cropping system next to rice - wheat system. Inclusion of chickpea not only increases the overall productivity of the system but also improve physico-chemical properties of the soil due to N saving from fertilizer source and build up soil fertility through biological source of N [8]. Low productivity of chickpea is also due to infestation of weeds and their competitive effects at all the stages of crop growth. According to Blackshaw [9] cultivars for sustainable system should be high yielding and competitive against weeds.

Amongst pulses, chickpea though constitutes the major portion in area and production in country, yet cost - effective technologies are required to improve the quality of chickpea to compete in the international market which may be made possible by evaluation of different planting techniques [10]. Keeping in view the above points, the present investigation was undertaken to evaluate the chickpea varieties under different crop establishment methods under irrigated conditions to increase the crop as well as soil productivity with the objectives as to find out the suitable planting technique for higher productivity of chickpea and to evaluate

the high yielding varieties in relation to different planting techniques.

The present investigation "Evaluation of chickpea varieties under different planting techniques after rice" was carried out at Students' Research Farm, Department of Agronomy, Punjab Agricultural University, and Ludhiana during rabi season. The soil of the experimental field was sandy loam in texture and normal in reaction (pH 7.7-7.8). The soil tested medium in organic carbon (0.33-0.29 %), available nitrogen (313.6- 295.6 kg ha-1), available phosphorus (18.3 -16.5 kg ha-1) and available potassium (185.9 -180.9 kg ha-1) at 0-15 and 15-30 cm soil depth, respectively. A set of 24 treatment combinations including six planting techniques (zero tillage after removal of stubble, reduced tillage, bed planting, zero tillage with happy seeder, zero tillage with Pantnagar till drill and conventional tillage + straw incorporation) with four varieties of chickpea ( PBG 5, GPF 2, BG 1053 and L 550) were laid out in split plot design with three replications. Salient features of investigation are summarized under following heads.

## Effect of Planting Techniques

Highest emergence count (10.1) was observed in zero tillage crops sown with Pantnagar till drill and lowest in conventional tillage + straw incorporation. The plant height and dry matter accumulation at different interval starting from 30 and 60 days after sowing were non- significant under different planting techniques, respectively. However, plant height and dry matter accumulation at maturity were higher under zero tillage sown Pantnagar till drill. Phenological observations i.e. number of days taken to flower initiation, 50 per cent flowering, initiation of pod, maturity showed no significant difference among planting techniques but zero tillage with Pantnagar till drill took significantly lesser number of days to 50 per cent pod setting than bed planting and conventional tillage + straw incorporation. The various yield attributing characters like number of branches per plant, number of total flowers per plant, number of pods per plant, number of seeds per pod and 100- seed weight did not differ significantly among different planting techniques. However, these parameters were slightly higher under zero tillage crop sown with Pantnagar till drill.

Seed yield and straw yield of chickpea under zero tillage, reduced tillage, bed planting and conventional tillage + straw incorporation were statistically similar but it was highest under zero tillage with Pantnagar till drill [11]. Root mass density in surface layer in conventional tillage + straw incorporation (1580.5 g $cm^{-3}$) was more than other planting techniques. In zero tillage, root mass density confined up to 0-30 cm (86.8 to 90.3 per cent) whereas in bed planting, reduced tillage and conventional tillage + straw incorporation, it confined up to 0-60 cm (89.7, 92.6 and 95.3 per cent), respectively. Due to different planting techniques, there were slight differences in number of nodules per plant but these differences were non-significant.

A significantly higher nitrogen uptake in seed under zero tillage with Pantnagar till drill than bed planting and conventional tillage + straw incorporation but at par with zero tillage with happy seeder, zero tillage after removal of stubble and reduced tillage. A significantly higher nitrogen uptake in straw was observed under zero tillage with Pantnagar till drill. Different planting techniques remained at par in phosphorus uptake in seed. In case of straw, the crop sown with zero tillage had significantly higher phosphorus uptake than conventional tillage + straw incorporation and bed planting but statistically similar with reduced tillage. Potassium uptake in seed was highest in zero tillage crop sown with Pantnagar till drill which was significantly higher over other planting techniques. Potassium uptake in straw was recorded highest in zero tillage with Pantnagar till drill but it was statistically at par with zero tillage with happy seeder and significantly higher than all other planting techniques. Protein content in seed and straw under different planting techniques were statistically similar. However, numerical increase in protein content was observed under zero tillage Pantnagar till drill than other planting techniques.The number of annual weeds and their dry matter accumulation was less under conventional tillage + straw incorporation and maximum under zero tillage after removal of stubble at 60 and 140 days after sowing.

In top 0-15 cm soil layer bulk density values under conventional tillage (1.53 g $cm^{-3}$) was lower than zero tillage with Pantnagar till drill (1.54 g $cm^{-3}$), bed planting (1.55 g $cm^{-3}$), zero tillage after removal of stubble (1.55 g $cm^{-3}$), reduced (1.56 g $cm^{-3}$) and zero tillage with happy seeder (1.56 g $cm^{-3}$). However, in the second layer (15-30 cm) higher bulk density values were obtained under zero tillage with happy seeder, reduced tillage and zero tillage after removal of stubble (1.54 g $cm^{-3}$) as compared to other planting techniques. Cumulative water infiltration over 60 minutes was more in conventional tillage + straw incorporation (16.38 cm) plots than zero tillage, bed planting and reduced tillage at harvest. It was higher than the infiltration rate recorded before sowing of crop. Available nitrogen and phosphorus in soil was maximum in zero tillage sown with Pantnagar till drill and minimum in conventional tillage + straw incorporation. Available potassium was highest (175.5 kg $ha^{-1}$) in zero tillage with happy seeder and was lowest (174.0 kg $ha^{-1}$) in bed planting at 0-15 cm soil depth. At harvest, available potassium in soil was decreased as compared with recorded before sowing of crop. At 120 days after sowing, zero tillage with Pantnagar till drill intercepted significantly higher PAR interception (54.4 %) than zero tillage after removal of

stubble, reduced tillage, bed planting and conventional tillage + straw incorporation. At 135 and 150 days after sowing, zero tillage with Pantnagar till drill intercepted significantly higher PAR interception (52.4 and 49.4 %), respectively than reduced tillage, bed planting and conventional tillage + straw incorporation. The sowing of chickpea with zero tillage with happy seeder, zero tillage with Pantnagar till drill, zero tillage after removal of stubble and reduced tillage can be saved from 1400 to 2650 Rs $ha^{-1}$, time from 3.20 to 5.28 hr $ha^{-1}$ and diesel from 12.52 to 21.12 lit $ha^{-1}$ as compared to bed planting and conventional tillage.

## Effect of Varieties

Emergence count was significantly higher in variety 'PBG 5'. However, 'GPF 2', 'BG 1053' and 'L 550' varieties being at par with each other. At 30 and 120 days after sowing, plant height was significantly influenced by varieties but there were non- significant differences in plant height at 60, 90 DAS and at harvest under different varieties. The variety PBG 5 had significantly higher plant height as compared to other varieties at 30 and 60 days after sowing. However, GPF 2, BG 1053 and L 550 being at par with each other. At 60 days after sowing, dry matter accumulation was significantly influenced by varieties. 'PBG 5' as compared to other varieties but non- significant differences in dry matter accumulation was recorded at 90, 120 days after sowing and at maturity among different varieties. Phenological observations i.e. number of days taken to flower initiation, 50 per cent flowering, initiation of pod, 50 per cent pod setting and maturity showed significant variation among varieties. 'PBG 5' took significantly lesser number of days in all phonological characters than other varieties.

The various yield attributing characters like number of branches per plant, number of total flowers per plant, number of pods per plant, number of seeds per pod and 100- seed weight did not differ significantly among different varieties but numerical increased in these characters were recorded in PBG 5.Seed yield of chickpea was at par under different varieties but highest seed yield (20.9 q $ha^{-1}$) was recorded with the variety PBG 5. However, PBG 5 produced significantly higher straw yield (44.2 q $ha^{-1}$) as compared to other varieties. Due to different varieties, there were slight differences in number of nodules but these differences were non-significant.

The root mass density in the top layer of 0-15 cm ranged from 77.4 to 84.3 per cent under different varieties. It was higher in 'BG-1053' followed by 'PBG-5', 'L-550' and minimum in 'GPF-2'. However, the root mass density in 'PBG 5' (93.4 %), 'GPF 2' (91.2 %) and 'L 550' (93.6 %) was confined up to 0-60 cm whereas in 'BG 1053' (91.0%) was confined up to 0-30 cm soil depth. Among the varieties, 'PBG-5' recorded significantly higher nitrogen uptake by seed and straw. The maximum phosphorus and potassium uptake was observed in seed and straw in variety 'PBG-5' that was significantly higher than other varieties. Varieties did not influence the protein content in seed and straw. 'PBG 5' and 'BG 1053' resulted in higher protein content in seed and 'PBG 5' resulted in higher protein content in straw. Among the varieties, highest bulk density recorded in 'L 550' at all soil depths viz. 0-15, 15-30 and 30-45 cm as compared to other varieties. The maximum weed count and dry matter accumulation was recorded in 'L 550' at 60 and 140 days after sowing. Highest available nitrogen, phosphorus and potassium were recorded in the plots of variety 'PBG 5' and lowest in 'L 550'.At 120 days after sowing, variety 'PBG 5' intercepted significantly higher PAR interception (54.1 %) than other varieties. At 135 and 150 days after sowing, variety 'PBG 5' intercepted significantly more than 'L 550' and 'GPF 2' but at par with 'BG 1053'.

The results indicated that zero tillage after removal of stubble, zero tillage with Pantnagar till drill, Zero tillage with happy seeder, reduced tillage, conventional tillage and bed planted chickpea gave similar seed yield. Therefore, chickpea can be grown successfully under zero tillage with and without paddy straw and reduced tillage without any loss in seed yield in addition we can save 1400 to 2650 Rs $ha^{-1}$, time from 3.20 to 5.28 hr $ha^{-1}$ and diesel from 12.52 to 21. 12 lit $ha^{-1}$ over the bed planting and conventional tillage. Among the varieties of chickpea, it can conclude that variety 'PBG 5' and 'BG 1053' recorded higher yield and yield attributes than 'GPF 2 and L 550'. So on the basis of the results of present investigation, chickpea variety 'PBG 5' and 'BG 1053' can be grown with zero tillage with and without paddy straw and reduced tillage to ensure higher productivity and profitability.

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