

Effects of Planting Methods on Yield and Morphological Traits of Three Chickpea Cultivars in Rain Fed Conditions¹

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Abstract—In this study, effects of different planting methods on grain yield and other agronomic traits in three cultivars of pea (Hashem, Philip 9393 (Azad), and Gereet) which was based on randomized complete block design were studied. Experimental results showed that effect of cultivars on weight of 100 beans and the plant height were significant at 1% and 5% level, respectively. Results also indicated that method of planting affected the number of pods per bush and biological yield at and yield (grain) and number of beans per bush and number of branches at 1% and 5% level, respectively. The interaction of cultivar planting methods and number of pods per bush was significant at 1% level. Two mechanized planting treatments (the grain drill planter and pneumatic row planter) increased the average crop yield from traditional values (1753 kg/ha) to 2486 and 2379 kg/ha, respectively. Plants which were grown from a row planter had the highest number of beans on bush (53 beans) for all of cultivars.

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INTRODUCTION

Annual crop area (about 1.2 million hectares) can reach to a highly profitable crop in rain fed areas in west Asia using new planting methods [1]. Results of several researches conducted in farmers' fields during three years in the northeast Syria have shown that the grain drill planters increased grain yield significantly compared to the manual (hand spreading) methods [2]. These researches discussed on the importance of date of planting in heavy soil and positive effects of using the planters that have increased crop yield. In a research, the possibility of mechanized cultivation is investigated in the forms of grain drill and precision planter. Effects on some yield components in chickpea concluded that the number of seeds per unit area in grain drill was bigger than which in precision planter. Pea can be planted with a simple grain drill or precision planter which the second is appropriate for bigger pea planting [4]. Some researchers compared two chickpea planters (NARDI–200 and EYTCHYSON–116) and reported that EYTCHYSON–116 had better performance than another one considering the amount of percentage of damaged beans, placement in appropriate depth, plant depth control and usability in non-tillage agriculture [5].

In a study, performance of 5 different types of grain drill planter is compared in Orissa, India on millet [6]. They showed that the performance of the Gujarat

State combined grain drill planter (seed planting and fertilizer planting) was suitable for the Orissa, India. Another research compared the yield obtained with traditional methods and rain fed mechanized pea planting [7]. Results showed that planting with grain drill compared to seed metering device type, furrow opener and covering device had a good performance and can be recommended to planting using row crop planters with making changes in power transmission system from wheels to seed metering system.

A research team reported that the number of beans per pod has the most effects on crop yield [8]. Several researchers showed that high density planting basically have a reduction effect on growth of plants in lateral branches and therefore, it caused intensification of bush competition which ultimately reduced the number of branches [9–11]. A research did not observe any significant differences in grain weight for row distances of 30, 40 and 50 cm and 5, 7.5 and 10 cm distance between two crops adjustment in a row [12]. As mentioned in various sources, it is indicated that distribution and density in the field has effects on plant growth. Furthermore, environmental factors such as light, nutrients, soil condition determine the competition among different plants and component of each plant for environmental generation factors and grain yield on unit area.

This study aims to determine the appropriate method for obtaining maximum yield in rain fed planting and the suitable and compatible cultivars for

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Planting treatments and their interactions on yield components of chickpea

SOV	DOF	Grain yield	Biological yield, $\times 10^6$	Number of pods per bush	Number of beans per bush	Number of lateral branches	100 beans weight	Bush height
		mean squares						
Replication	2	387771.1 ^{ns}	3.26 ^{ns}	158.9 ^{ns}	136.1 ^{ns}	16.3 ^{ns}	14.7 ^{ns}	1651 ^{ns}
Cultivar	2	299367.6 ^{ns}	8.07 ^{ns}	345.3 ^{ns}	7.1 ^{ns}	69.4 ^{ns}	335.7 ^{**}	179.7 [*]
Planting method	2	1411415.1 [*]	11.65 ^{**}	758.3 ^{**}	1201.7 [*]	146.3 [*]	7.2 ^{ns}	2.7 ^{ns}
Cultivar \times Planting method	4	260003 ^{ns}	1.71 ^{ns}	382.8 [*]	98.0 ^{ns}	35.7 ^{ns}	44.7 ^{ns}	51.1 ^{ns}
Error	16	358417.4	1.69	104.2	205.8	35.6	11.1	44.7
CV, %		27.14	24.77	25.8	35.1	28.4	11.4	13.9

* Significant at 0.05 probability level.

** Significant at 0.01 probability level.

^{ns} Non-significant.

mechanized cultivation on rain fed areas as well as planting methods effects on yield and morphological characteristics of chickpea.

MATERIALS AND METHODS

To study the effects of planting methods on yield components and some phenological traits of rain fed chickpea, an experiment was carried out using factorial randomized complete block design with three replications at a research farm in agricultural research center located in Lorestan, Iran (33°39' N, 48°28' E) in 2012. Treatments including planting methods in three levels (a_1 : grain drill planter with 20 cm distance among the rows and 12 cm distance between two crops adjustment in a row, a_2 , planting with pneumatic row crop planter and 50 cm distance among the rows and 8 cm between two crops adjustment in a row, and a_3 : hand spreading method with the seed rate of 100 kg/ha) and three varieties of peas including b_1 : Hashem, b_2 : Philip 9393 (Azad) and b_3 : Gereet was considered. Prior to planting operations, soil sampling depths (0–30 cm) for determination of organic carbon soil salinity ratio (EC), acidity (pH), the percentage of nitrogen, phosphorus and potassium (NPK) and soil texture were controlled. The amount of fertilizers including nitrogen (30 kg/ha), phosphorus 70 (kg/ha) and potassium (50 kg/ha) were measured and controlled based on soil test results.

Operations such as field preparation including chisel plow with depth of 30 cm and two passes perpendicular disk to crush and soften lumps and leveling was done. Seeds of each cultivar had 99% purity and 96% GP, formerly surfaced with fungicides were used in this study. Cultivated area for each experimental plot was approximately 60 m². During the growth period, hand cultivation and chemical traits to remove

grass weeds in crop field. Other parameter such as number of days blooming and maturity, bush height (cm), number of branches main in lateral sides, number of beans per bush, number of pods per bush, beans per pod, biological yield (kg/ha), 100 beans weight (gr), grain weight (gr/bush), notes sampling were measured and used for analysis. Data analysis was performed using MSTAT–C program.

RESULTS AND DISCUSSION

The results of analysis of variance (ANOVA) showed that effects of cultivar on 100 beans weight at 1% level and bush height at 5% level were significant (table). Effects of planting methods on biological yield and number of pods per bush was significant at 1% level and for grain yield, number of beans per bush and number of branches per bush was significant at 5% level. Effect of planting method on 100 beans weight and bush height was not significant statistically. Furthermore, the interactions of planting method and cultivar were significant at 5% level just for number of pods per bush and effects on other traits were not significant.

Results showed that the performance of two methods: grain drill and rows crop planter were 2486 and 2376 kg/ha, respectively. These values were higher in comparison with traditional methods with 1753 kg/ha grain yield (Fig. 1). The use of a grain drill will result in decrement of row distances in compare with the pneumatic system, which has led to an increasing for plant growth performance. The use of grain drill system for distances less than the pneumatic system, ultimately led to increase the density and performance (Fig. 1). Authors of reference [7] compared traditional planting methods with mechanized method in rain fed pea planting. Type of crop planted width and furrow

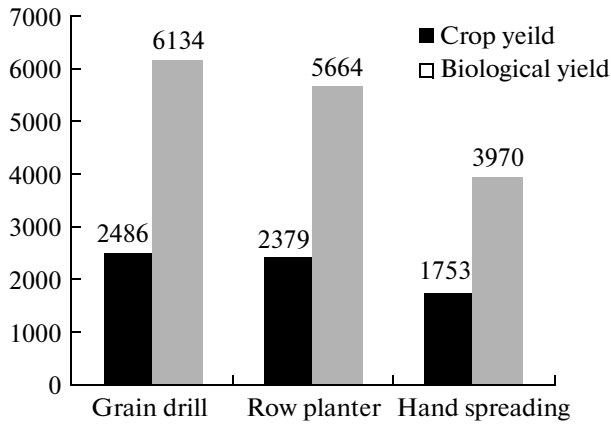


Fig. 1. Effects of planting method on grain yield and biological yield (kg/ha).

opener with minor cover amendments showed a good performance. In overall, their research suggests that both methods of grain drill and row planting with proper planting increases performance and in addition to ease of operation in compared to others.

Biological performance with grain drill (6134 kg/ha) had the highest value that it shows that the mechanized planting had better performance in the setting up, plant crops and eventually adjust the spacing between plant and soil biomass (Fig. 1).

Row crop planting with an average of 53.33 beans per bush had an appropriate performance compared with pneumatic planter and traditional planting due to better usage of row spacing and light absorption and photosynthesis (Fig. 2). Authors of reference [8] reported that the number of beans per bush has the most direct effect on grain yield.

Planting a row with average 44.5 pods per bush and planting with grain drill with 45.1 pods had a differ-

ence with hand spreading at 1% level (Fig. 2). By reducing the distance between rows of plants and changes in the density of planting, made the rectangle into a square and caused efficient use of resources (soil nutrients) by plants. The results of this study are similar with the results of some investigators.

Grain drill with average 25.56 branch shoots in most bushes and pneumatic planting with an average of 17.9 were observed during the study. Some researcher reported that planting with high densities is essentially associated to growth of side branches that be increased with competition between neighboring plants because it will eventually lead to a loss in the number of sub branches [9, 11] (Fig. 2).

Local varieties had the highest weight (35 g) in all of the planting methods. Probably the reason is adaptation in local varieties; therefore it increased producing the fat beans. In the literature, it is noted that there is no significant difference in the density of the plant and different row distances [12] (Fig. 3).

Maximum height of bush belonged to Hashem cultivar and it was averaged 51.22 cm. This cultivar which produced taller bushes had special conditions for mechanized harvesting operations and resistant to fall down and can be recommended as a suitable cultivar (Fig. 3).

The highest number of pods per bush related to local varieties and grain drill planting method and was measured 60.7 pods, and after that, Philip cultivars with row planting method had the highest number of pods per bush about 58.3 in all treatment groups (Fig. 4).

CONCLUSIONS

Generally, influence of planting methods on main traits of pea plants can be summarized as below:

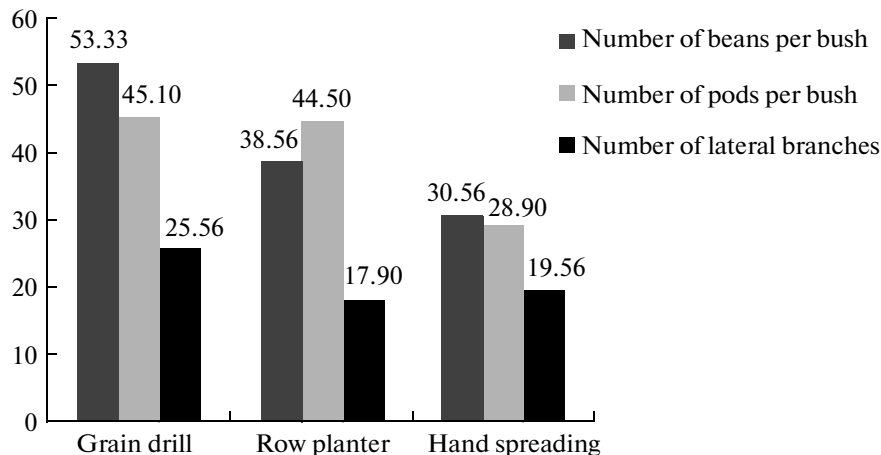


Fig. 2. Effects of planting methods on three agronomic yields.

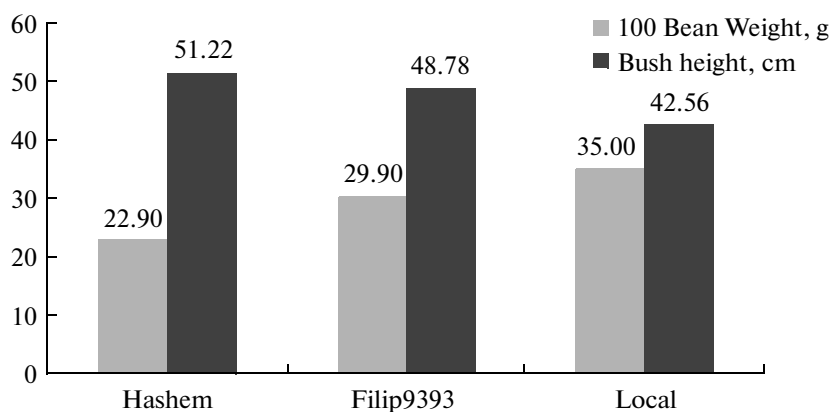


Fig. 3. Effects of cultivar on 100 bean weight (g) and bush height (cm).

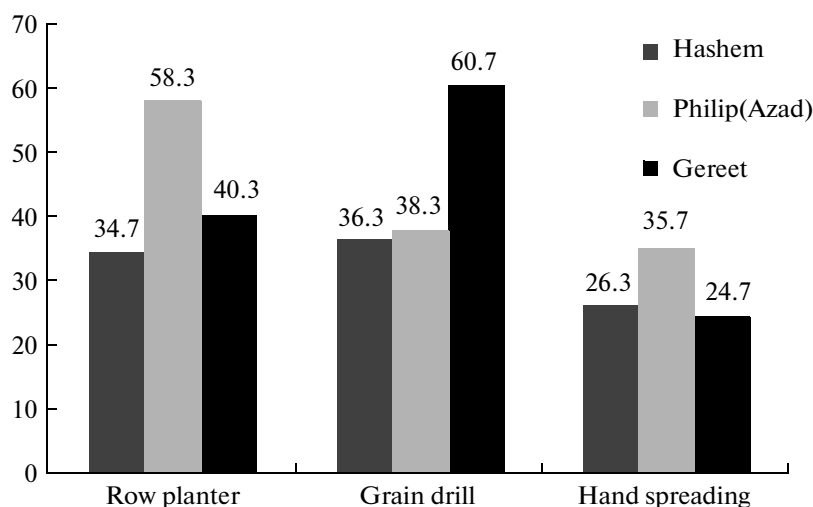


Fig. 4. Effects of interaction of planting methods and cultivars on number of pods per bush.

1—Compared to traditional mechanical methods, mechanized planting methods due to less congestion and reduced plant competition increased plant photosynthesis.

2—Planting with pneumatic row planter with 50 cm distance among the rows and 8 cm distance between two crops adjustment in a row increased the number of grains per bush of chickpea approximately 38%.

3—Both grain drill and row pneumatic planters increased yield per hectare by 36% compared to the traditional method.

4—The number of branches increased with pneumatic planter due to having enough space between the rows of plants.

5—Plant height in Philip and Hashem cultivars was 16% higher than the traditional cultivar (Gereet),

which makes the possibility of using machines to harvest crops in mechanized harvesting peas.

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