International Journal of Agricultural and Applied Sciences, December 2022, 3(2): 100-104
https://www.agetds.com/ijaas
ISSN: 2582-8053
https://doi.org/10.52804/ijaas2022.3218

Research Article

OPEN ACCESS

Effect of cultivation method on yield, yield attributes and economics attributes of Chickpea (*Cicer arietinum* L) the semi-arid Condition of Kandahar Afghanistan

Mirza Mohammad Modasir, Noor Mohammad Kakar and Habibullah Hamayoun
Afghanistan National Agricultural Science and Technology University, Afghanistan
Corresponding author e-mail: noormohammad.kakar@yahoo.com
(**Received:** 02/08/2022; **Revised:** 05/11/2022; **Accepted:** 20/11/2022)

ABSTRACT
An experiment was conducted at the Agronomy farm, Afghanistan National Agricultural Science and Technology University, during the period from 2 March to 12 June 2020 to study the effect of two types of cultivation methods such as raised bed and flatbed on the yield, yield attributes and economics attributes of chickpea. The experiment was laid out in a Split Plot design with three replications. All the nutrients were applied as basal on land preparation operation. Seeds were sown manually @ 30 kg ha^{-1} for a flatbed as well as @ 45cm x 10 cm spacing for a raised bed. Observations were recorded for various growth parameters and yield attributes at 30 DAS, 60 DAS and harvest. Statistical analysis of data was done online through OPSTAT software. Raised bed cultivation method significantly enhanced the growth parameters of chickpea *viz.,* plant height (4.44 cm, 8.40 cm and 25.45 cm at 30 DAS, 60 DAS and harvest), dry matter plant^{-1} (3.12 g, 5.26 g and 15.50 g at 30 DAS, 60 DAS and at harvest. Yield attributes *viz.,* number of pod plant^{-1} (20.15), number of grain pod^{-1} (1.38), and 1,000-grain weight (207.44 g) showed remarkable improvement with raised bed cultivation method Yield of chickpea *viz.,* grain yield (1.21 t ha^{-1}), Stover yield (1.33 t ha^{-1}) biological yield (3.44 t ha^{-1}) and harvest index (27.44 t ha^{-1}) were recorded significantly higher with raised bed cultivation method. Similarly, significantly higher economics attributes *viz.,* Cost of cultivation (26,989 AFN ha^{-1}), gross returns (104,795AFN ha^{-1}), net returns (76,854 AFN ha^{-1}), and benefit-cost ratio (2.78), recorded with raised bed cultivation method.
Keywords: Chickpea, Yield, Cultivation methods.

INTRODUCTION

Pulses occupy a unique position in every known system of farming all over the world. Among the pulse crops chickpea (*Cicer arietinum* L.) is a major pulse crop grown in Afghanistan for food and also used as a feed for animals. It is predominantly grown as irrigated and rain-fed in some parts of the country. Chickpea is mostly consumed in the form of processed whole seeds (boiled, roasted, parched, fried, steamed, sprouted, etc.). Chickpea is a good source of protein (18-22%), carbohydrate (52-70%), fat (4-10%), minerals (calcium, phosphorus, iron) and vitamins (Choudhary, 2014). Chickpea is not only a source of dietary protein but also helps in the maintenance of soil fertility due to their nitrogen-fixing capability. Despite its importance as a pulse and forage crop, the yield of chickpeas is low in Afghanistan compared to other countries of the world. Amongst the agronomic practices, land configurations and proper spacing are of great importance (Reddy et al., 2003). Several workers have reported a positive response in the seed yield of chickpeas to cultivation methods under protective of the semi-arid condition. So, there is a need to adopt a suitable management practice like a proper cultivation method for ensuring yield increment in chickpea in Madhya Pradesh. Therefore, the study was conducted to evaluate the different sowing methods on seed yield in chickpea cultivation method is one of the important agronomic practices which greatly affects the yield and profit of many crops including chickpea. It is, therefore, necessary to evaluate the need for judicious use of cultivation methods. The current research was conducted to find out the best cultivation method for chickpea for obtaining higher agronomic characteristics and yield in the Kandahar province situation.

MATERIALS AND METHODS

Experimental Site

The present investigation entitled "Effect of cultivation method on yield, yield attributes and economics attributes of chickpea. An experiment was conducted at the Agronomy farm, Afghanistan National Agricultural Science and Technology University, during the period from 2 March to 12 June 2020, Geographically, Kandahar is situated in the southern part of Afghanistan, with low-latitude semi-arid hot climate south of Afghanistan between latitude ranging from 310 30' north

and longitude from 650 50' east's and is located on an elevation of about 1010 meters above mean sea level.

Climate and soil

Kandahar has a subtropical steppe/low-latitude semi-arid hot climate. According to the Hold ridge life zones system of bioclimatic classification, Kandahar is situated in or near the warm temperate desert scrub biome. The annual mean temperature is 18.5 degrees Celsius. The average monthly temperature in Kandahar is 26.8 °C. The total annual average precipitation is 190.6 mm which is equivalent to 190.6 liters/m². On average there are 3464 sunshine hours per year. The average sunshine hours of the region ranged from 6:39 per day during February to 12:14 per day during August month. The mean relative humidity varies from 23% in June to 59% in February (http://www.kandahar.climatemps.com). During the crop growth period, the maximum temperature was 32 °C from (7-13 of May) and the minimum temperature was 0 °C from (1-7 of Jan). Moreover, the maximum relative humidity was 60.8% during 23-29 January and the minimum relative humidity was 15.3% on (7-13 May). The crop received a total 49.8 mm of water from rainfall on five rainy days during the crop growth period. The soil was having a texture of sandy clay loam. Organic matter of soil (0.69%) and PH (8.3) and available nitrogen (81.1 Kg/ ha), low in available phosphorus (8.97 kg/ ha) and available potassium (179.6 kg /ha. First irrigation was given at 18 days after sowing the four additional irrigations were given to the fulfilment of crop with 15 days intervals.

Experimental design and treatment

The experiment was laid out with two types of cultivation methods (Raised bed and flatbed) in Randomized Block Design (RBD). There were 8 treatments and each treatment was replicated 3 times. The plot size was 16 m2 (4.00 m×4.00 m), total No. of plots (24) and a variety of Kabuli chickpea. The blocks and unit plots were separated by 0.75 m and 0.5 m. Nitrogen, phosphorus and potassium were uniformly applied @ 35, 60 and 30 kg ha-1 in all plots as basal with the last land preparation operation in the form of Urea and potassium sulphate respectively

RESULTS AND DISCUSSION

Growth parameters

Data about the growth parameters of chickpea under the Cultivation method are over control at every stage of crop gr owth. At 30, 60 DAS and at harvest, the best method of cultivation was raised bed recorded significantly greater plant height (25.45 cm) compared to a flat bed. These results agree with the findings of K S Bhargav et al. (2018). The Dry matter per plant was maximum (15.50gr) when raised bed method which was significantly These results conform with the findings of Shashikumar et al. (2013) and S. K. Roy1 et al. (1995).

Yield parameter

Data concerning yield and yield attributes of chickpea as influenced by cultivation method are indicated in (Table 2). The number of pods per plant of chickpea improved positively due to the method of cultivation. The use of raised bed cultivation method resulted in the production of a maximum number of pods per plant (20.15) of chickpea. The raised bed remained statistically superior to the flatbed respectively. This increase in the number of pods per plant with the cultivation method has resulted from more pronounced growth of the plant which in turn had increased the number of pods per plant. Bhargav, K. S., et al. (2018) and Basir, A. et al. (2008) noticed that cultivation methods at higher levels resulted in increased pod per plant. The number of grains per pod increased positively due to different cultivation methods in chickpea. During the study of investigation, it was observed that the use of raised bed produced the highest number of grains per pod (1.38) which was statistically on par with a flat bed. Treatment having raised beds had significantly more grain per pod. These results are further supported by the findings of Hemat, M et al. (2017) and Islam et al. (2013).

Table 1. Effect of cultivation method on Plant height and Dry matter of chickpea in Kandahar province of Afghanistan

	Plant height			Dry matter		
Cultivation method	30 DAS	60 DAS	at harvest	30 DAS	60 DAS	at harvest
Raised bed	4.44	8.40	5.45	3.12	5.26	15.50
Flatbed	3.83	7.80	24.82	2.75	5.07	14.86
(S E m±)	0.09	0.09	0.08	0.06	0.02	0.09
CD (P=0.05)	0.59	0.61	0.54	0.40	0.19	0.64

That cultivation method at higher levels resulted in increased crop growth, a particularly positive impact was noted on branching, pods, seeds and increased seed yield. Results of the present study indicated that the 1000-grain weight of chickpea was considerably affected due to the cultivation method. The maximum thousand-grain weight of the chickpea (207.44 g) was recorded from the cultivation method of the raised bed. But it remained statistically at par with the method of a flat bed. Also, Tripathi, L. K. and Thomas, T (2013) observed in Iran, that grain yield, the number of seeds pod per plant and 1000 seed weight of chickpea were increased by cultivation method, similarly, Basir et al. (2008) were also recorded significantly maximum 1000 grain weight for raised bed method. The grain yield of chickpea improves remarkably due to different cultivation methods. The cultivation method of the raised bed resulted in the highest grain yield (1.21 t /ha-1) of chickpeas. This treatment was significantly better. but was at par with the flatbed method. Similar observations were also noted by Meena et al. (2010), Singh, V et al. (2017) and Singh, D et al. (2020), who reported that there was a significant increase in the seed yield of chickpea. The best cultivation method of raised

bed produced the highest straw yield (1.33 t ha-1) of chickpea. but it was statistically similar to flatbed. This may be due to the adequate supply of cultivation methods that played a vital role in physiological and developmental processes in plant life and the favourable effect of these important nutrients might have accelerated the growth processes that as result increased the stra w yield of the crop. These findings conform with the results of Kumar, P et al. (2017) and Roy, S. K. et al. (1995), who stated that the method increased dry matter production at various growth stages. The maximum biological yield (3.44 t ha-1) of chickpea was noted from raised bed method, but it was statistically similar with a flat bed. Similar results were also obtained by Bhargav, K. S et al. (2018) and Hemat et al. (2017), who revealed that the raised bed method increased the growth and yield parameters. The highest value of harvest index (27.44) was recorded raised bed method which was followed by flatbed. However, the harvest index was statistically identical under all cultivation methods. The harvest index determines the amount of photosynthesis being translocated to economically important parts of the plant and the productive efficiency of the crop is determined by the extent to which assimilates are accumulated in the desirable parts of the plant (Ghapari et al 2017). Thus, the physiological efficiency of a crop to partition the available photosynthesis between its seed and other seed parts is reflected in its harvest index.

Table 2. Effect of cultivation method on yield and yield attributes of chickpea in Kandahar province of Afghanistan

Treatment	Pod Plant -1	Grain pod-1	Test Weight (gr)	Grain yield (t ha-1)	Straw yield (t ha-1)	Biological yield (t ha-1)	Harvest index
Cultivation method							
Raised bed	20.15	1.38	207.44	1.21	1.33	3.44	27.44
Flatbed	19.72	1.16	206.83	1.06	1.16	2.83	26.83
SE m ±	0.06	0.02	0.07	0.01	0.02	0.09	0.09
CD(P=0.05)	0.43	0.16	0.51	0.11	0.16	0.59	0.59

Table 3. Effect of cultivation method on economics attributes of chickpea in Kandahar province of Afghanistan

Treatment	Cost of cultivation (AFN ha-1)	Grass returns (AFN ha-1)	Net returns (AFN ha-1)	Benefit: Cost ratio
Cultivation method				
Raised bed	26989	104795	76854	2.78
Flatbed	26793	102980	76400	2.75
SE m ±	-	3626.83	3562.23	0.28
CD(P=0.05)	-	11498.81	11312.15	0.41

Economics attributes

Data about the cost of cultivation, gross returns, net returns and benefit-cost ratio have been presented in Table 2 Cost of cultivation (AFN ha-1) was worked out treatment-wise. The common cost of cultivation for all treatments was added to the respective additional cost involved in each treatment. Cost of cultivation was different sowing methods for chickpea. The maximum cost of cultivation (26989AFN ha-1) was recorded at the cultivation method of the raised bed. Whereas, the minimum cost of cultivation (26793 AFN ha-1) was recorded at the flatbed method. Bhargav, K. S., et al. (2018) and Basir, A. et al. (2008) noticed that the cultivation method at higher levels resulted in increased cost of the cultivation raised bed method. Gross returns (AFN ha-1) were calculated plot-wise. For this purpose, grain yield was converted into AFN ha-1 at a prevailing market price of chickpea grain and straw. The sum was used for statistical analysis.

Gross returns enhanced remarkably due to the cultivation method of chickpea. The maximum gross returns (104795 AFN) of chickpea were recorded with the cultivation method of the raised bed. Similar results were also obtained by Bhargav, K. S et al. (2018) and Hemat et al. (2017), who revealed that the raises bed method increased the Gross returns. Gross returns (AFN ha-1) = Economic yield × market price of produce. For obtaining the net returns (AFN ha-1), the cost of cultivation was reduced from the gross returns of each plot. Net returns followed almost the same trend as gross returns and were positively influenced due to different sowing methods. The highest net returns (76854AFN) of chickpea were obtained from the cultivation method of the raised bed, this had a significant correlation (Ghapari et al 2017). Net returns (AFN ha-1) = Gross returns – the cost of cultivation. For the calculation of the benefit-cost ratio, the gross return was divided by the cost of cultivation. The value obtained was considered as the benefit-cost ratio. Benefit: cost ratio improved markedly due to various sowing methods. The highest benefit: cost ratio (2.78) of chickpea was recorded with the cultivation method of raised bed this had significant These finding

conform with the results of Kumar, P et al. (2017) and Roy, S. K. et al. (1995), who stated that method increased benefit: cost ratio.

CONCLUSION

It was concluded from the study that crop planted on a raised bed with pro per production technology gives good yield as well as economically feasible as compared to other methods of sowing of chickpea. Thus, the overall performance of chickpea was superior in furrow irrigated raised beds (FIRB) over other planting systems.

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Citation: Modasir, M.M.; Kakar, N.M. and Hamayoun, H. 2022. Effect of cultivation method on yield, yield attributes and economics attributes of Chickpea (*Cicer arietinum* L) the semi-arid Condition of Kandahar Afghanistan. *International Journal of Agricultural and Applied Sciences*, 3(2): 100-104. https://doi.org/10.52804/ijaas2022.3218