Original Research Article

Effect of medium type of varieties and organic sources of nutrients on growth, yield and economics of Kabuli Chickpea (*Cicer kabulium L.*) under Bundelkhand region

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ABSTRACT

Back ground - The present investigation entitled **"Effect of medium type of varieties and organic sources of nutrients on growth, yield and economics of Kabuli Chickpea (Cicer kabulium L.) under Bundelkhand region''** was carried out at the Organic Research Farm at Karguaji, Institute of Agricultural Sciences Bundelkhand University, Jhansi U.P. India, during Rabi season of the year 2020-21.

Method - The experiment was laid out in a factorial randomized block design with three organic sources of nutrients such as, Farm yard manure, Vermicompost and Poultry manure and comprising three varieties viz Pusa-1053, Shubhra and Ujjaval replicated thrice. All the organic sources and sowing methods significantly influence the all parameters like growth parameters viz., plant height, root length, number of primary branches, number of secondary branches per plant at 30, 60 and 90 days after sowing and at maturity, fresh shoot weight, fresh root weight, dry shoot weight and dry root weight per plan, crop growth rate g/m2 /day-1 and moisture % were noticed at 30, 60 and 90 days after sowing.

Result - The nutrients management through organic source and different varieties significantly influenced the entire yield attributes viz, number of pod plant^{-1}, pod weight plant^{-1}, grain weight plant^{-1} and 100 seed weight were recorded with V1- PUSA-1053 and Nutrient sources M2- Vermicompost while M1- FYM and V2- Shubhra variety recorded lowest in all the parameters. Maximum seed yield per hector were also obtained through higher seed yield (25.43kg/ha) was recorded in variety 1– (Pusa 1053) and higher seed yield (22.12kg/ha) was found in M2 (Vermicompost application), respectively. From the present investigation, it can be concluded that above nutrients management through organic manures

(vermicompost) and varieties PUSA-1053 resulted in better growth, higher yield attributes and better yield besides enhanced soil health as evident by post-harvest soil fertility status. It can be suggested as a cost effective combination for getting higher yield with greater quality of kabuli chickpea on organic farming system for the farmer's Bundelkhand region of Uttar Pradesh.

Keywords: Kabuli chickpea, Organic farming, Organic manure, Pusa- 1053, and yield.

Introduction

Chickpea [*Cicer arietinum L.*] belongs to genus Cicer, tribe Cicereae, family Fabaceae, and subfamily Papilionaceae. It originated in south-eastern Turkey (Ladizinsk *et al*. 1975). Chickpea is also called garbanzo (Spanish), pois chiche (French), kichar or chicher (German), chana (Hindi), and gram or Bengal gram (English). India is the largest producer of chickpea and contributes 70% of world's chickpea production (Muhlbaur and Sarkar, 2017). In India, chickpea is grown in 22 states and two union territories and accounts for 35 % of total area under pulses and 45 % of total pulse production in India (Singh, 2014). Although area under this crop has seen a gradual increase from 7.57 million hectares in 1950-51 to 9.93 million hectares in 2013-14 with a productivity rise from 4.82 q ha^{-1} to 9.60 q ha^{-1} in this period (FAOSTAT, 2018), the seed replacement rate of chickpea is still very low (23.3%) (Singh *et al*. 2014). Against a requirement of 6.3 million quintals of chickpeas seeds each season, only 1.25 million quintals of quality seed is available to the farmers (Singh *et al*. 2014). Chickpea crop is recognized for its resilience under restricted water availability. Chickpea seeds are large in size, salmon-white in colour and contain high levels of carbohydrate (41.1–47.4%) and protein (21. -23.4%). The protein content (22.9–24.8%) of chickpeas was much higher than that of cereals (wheat and maize) and comparable to other legumes (Wood J.A. and Grusak M.A. (2007). Protein concentration generally varies by only a small magnitude between desi and kabuli market classes. Chickpea protein concentration ranges from 160 to 300g kg^{-1} and from 120 to 290g kg^{-1} for desi and kabuli market classes, respectively. Chickpeas are a healthy source of both protein and carbohydrates. together constituting about 80% of the total dry seed mass (Chakrabarti, N. *et al*., 2003),in comparison with other pulses. Chickpea is consumed as whole seed, dhal (decorticated split cotyledons) or dhal flou. In organic farms, chickpea plays an extremely important role in

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crop rotation because it has the ability to live in symbiosis with rhizobia that fix free atmospheric nitrogen (Poeiejawaska *et al*, 2013). The use of chickpeas in an organic farm is justified by its ability to fix atmospheric nitrogen. Kabuli chickpea is one of the two types of chickpea (desi and kabuli) which has cream-coloured large seed with a thin seed coat, in contrast to desi type which has darker-coloured small-sized seed with a thick seed coat. In Kabuli chickpea, a plant population of 40-45 plants M2 provides high grain yields (Gan *et al*., 2003). Inadequate plant population is one of the important factors responsible for poor grain yields of chickpea (Nagarajaiah *et al*., 2005). Poor plant stand could be due to use of low seed rate, poor quality seed, insufficient moisture at sowing, plant mortality due to various diseases or salinity or moisture stress, etc. Adequate plant population may be maintained by using good quality optimum seed rate. However, seed is a costly input and need to be used judiciously as it involves lot of money. Further, as chickpea is generally grown under one or the other stress conditions on marginal soils, the risk of the crop failure discourages farmers to use costly inputs including the use of high seed rate. The objective of this work to estimate the effect of different organic management on growth and yield attributes of chickpea in Bundelkhand region U.P. India.

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MATERIALS AND METHODS

A field experiment was carried at Organic Research Farm, Karguaji, Institute of Agricultural Sciences, Bundelkhand University, Jhansi district in Uttar Predesh,to study the effect of medium type of varieties and organic sources of nutrients on growth, yield and economics of Kabuli chickpea (*Cicer kabulium L*.) under Bundelkhand region of Uttar Predesh" during *Rabi* season of 2020-2021. The climatic condition under Jhansi district of Uttar Pradesh is subtropical. The total rainfall received during the crop-growing period was 128 mm (Fig-1). The weekly maximum and minimum temperature during the experimental period ranged from 21.0°C to 35.1°C and 5.2°C to 15.1°C, respectively. The soil of the experimental plot was sandy clay loam with low organic carbon (0.45%), low in available nitrogen (164 kg ha^{-1}) and available potassium (235 kg/ha) but high in available phosphorus (28.5 kg/ha). The soil reaction of the experimental field was nearly neutral (*p*H 7.2) with an electrical conductivity of 0.26 ds/m.

The experiment was laid out in factorial randomized block design, with 3 kabuli chickpea varieties PUSA-1053, Subhra and Ujjaval and 3 organic sources of nutrients 100 % N through FYM, 100 % N through vermicompost, 100 % N through poultry manure. The chickpea seeds were treated with rhizobium culture and sown in well-prepared land by dibbling method with seed rates of 80 kg ha^{-1}. A spacing of 30 x 10 was adopted. Nitrogen was applied at the rate of 20 kg ha^{-1} FYM 0.5 per cent N, vermicompost, poultry content is 3.03 per cent The crop was grown under rainfed condition with one pre-sowing irrigation was applied to the crop 7 days before sowing and only one lifesaving irrigation was applied. Weeding was done with the help of dryland weeder between the crop rows at 30 days and 45 days after sowing. Crops was harvested manually with sickle and tied in bundles with tags from each plot and left for sun drying. Threshing operations were also performed treatment wise manually. The growth parameters, *viz.* plant height (cm), fresh weight/plant (g/plant), dry matter/plant (g/plant) and crop growth rate at the 30, 60 and 90 days after sowing of chickpea Various yield parameter, *viz*. seed yield (kg/ha), stover yield (kg/ha) and harvest index and equivalent yield at the time of harvesting of chickpea. The data on various parameters were statistically analysed by using CPCS-1 method (D.F., 1958).

RESULTS AND DISCUSSION

Growth and growth attributes of Chickpea

Plant height (cm), primary and secondary branches:

The plant height, primary and secondary branches of Variety-V1 - Pusa-1053 were significantly higher as compared to the other varieties, plant height of chickpea was maximum (Table-2) between 60 to 90 days after sowing while minimum, between 90 days after sowing to maturity stage, primary and secondary branches representing at 30, 60, 90 days after sowing and at maturity stage. Which was significantly higher than V2 (Subhra) and V3 (Ujjal). Application of organic manures significantly influenced plant height, the number of primary and secondary branches per plant at all stages (Table-2). The interaction effect of different varieties and application of organic sources was found to be non-significant. Increase in plant height is due to genetic potential while primary and secondary branches could be attributed to the higher production of plant growth promoting factors by beneficial microbial inoculants present in

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organic manures which might have resulted in more intense root system and increased shoot growth by enhanced nutrient uptake (Singh *et al*, 2014).

Fresh weight and Dry weight (g) shoot and root per plant

It is apparent from the data that the significantly higher fresh weight and dry weight of shoot (g) and root per plant were recorded with the variety V1-(Pusa-1053), (20.21g) compared to V3 – (Ujjaval), (19.79 g) and V2- (Subhra), (19.46 g) at 60 days after sowing (Table -3). It might be due to the to genetic potential which led to higher photosynthetic assimilation and as a result plant growth improved and led to a higher accumulation of dry matter. A similar result was find by Maleki *et al*. (2010).

Crop growth rate (g/m^2 /day)

The maximum crop growth rate (g/m2 /day) was recorded with the variety V1 - Pusa-1053, (5.75 and 3.59 g/m2 /day) followed by V3 - Ujjaval, representing (5.51 and 3.43 g/m2 /day), respectively at 60 and 90 DAS. It was minimum with the variety V2 -Subhra, presented (5.31 and 3.26 g/m2 /day) at 60 and 90 DAS (Table-3). The difference between varieties was found significant. application of organic source of nutrients significantly influenced crop growth rate (g/m2 /day) per plant at all the stages and showed maximum with M2- Vermicompost, representing (5.61 and 3.48 g/m2 /day) followed by M3- Poultry manure, representing (5.52 and 3.41 g/m2 /day) respectively at 60 and 90 DAS. Minimum were recorded under M1- FYM representing (5.44 and 3.36 g/m2 /day), respectively at 60 and 90 DAS. All the differences between organic sources of nutrients were found significant. Interaction effect of different varieties and application of organic manures found to be non- significant .

Yield attributes and yield

The variety V1 (Pusa- 1053) resulted in significantly more number of pods/plant (35.58), Seeds/pod (1.43) grain weight/plant (14.96) and 100 seed weight (18.55), (Table - 4), Over variety V3 (Ujjaval) and V2- (Subhra). The differences between verities were found significant. Whereas in case of organic manure M2- (Vermicompost) resulted in significantly more number of pods/plant (31.88), Seeds/pod (1.36) grain weight/plant (14.74) and 100 seed weight (18.34), which was at par with M3- Poultry manure representing, and M1- FYM. (Singh *et al*, 2014),

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reported that application of vermicompost resulted in more pods per plant. Interaction effect of different varieties and application of organic manures was found to be non- significant.

The yield attributes was found to be significant maximum biological yield, seed yield (q/ha), straw yield (q/ha) and harvest index was recorded with the variety V1 – (Pusa 1053) which was statistically superior over V3 –(Ujjaval,) (19.85 kg/ha). And V2 –(Subhra), (15.14 kg/ha). All the differences between verities were found significant. Whereas in case of organic manure it is clear from the (Table-4) that significantly higher biological yield, seed yield (q/ha), straw yield (q/ha) was recorded nutrient in M2- (vermicompost) compared to farm yard manure, which was at par with Poultry manure (20.39 kg/ha). The interaction effect of different varieties and application of organic manures were found to be non-significant. This increase in yield occurred due to an increase in growth and development of chickpea crops with the application of vermicompost or it might be due to the better availability of nutrients throughout the crop growth that ultimately improved the growth and yield contributing characteristics of chickpea and hence resulted in higher seed yield (Jat RS and Ahlaw at IPS, 2004).

Economics of treatments

Table-4, shows that maximum cost of cultivation (Rs. 44512 ha^{-1}) was recorded under the M2 (vermicompost) treatment combination along with agronomic practices for organic nutrient management and the minimum total cost of cultivation (Rs 43512 ha^{-1}) was recorded in the M3(Poultry manure) treatment combination. The cross income evident that nutrient management through organic sources (Farm yard manure, poultry manure and vermicompost) of kabuli chickpea varieties in organic management increased the maximum gross income (Rs. 136500 ha^{-1}) was obtained from the treatment combination of V1 M2- (PUSA-1053 + vermicompost) and minimum gross income (Rs. 73500 ha^{-1}) was recorded in the treatment combination of V2 M1- (Subhra + Farm yard manure) along with agronomic practices for organic nutrient management. Whereas net return in nutrient management through organic sources (FYM, Poultry manure and Vermicompost) of kabuli chickpea in organic management increased the maximum net returns (Rs. 91988 ha^{-1}) was obtained from the treatment combination of V1 M2- (PUSA-1053 + Vermicompost) with compaired with net returns (Rs 29488 ha^{-1}) was recorded in the treatment combination V2 M1- (Subhra + FYM) along with agronomic practices for organic nutrient management. The data on B: C ratio (Rs. $rupee^{-1}$ invested) indicates that organic sources (FYM,

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Poultry manure and Vermicompost) of kabuli chickpea varieties in organic management increased the maximum B: C ratio (2.07) was obtained from the treatment V_1 M_2- PUSA-1053 + vermicompost and minimum B: C ratio (0.66) was recorded in the treatment V_2 M_1-(Subhra + Farm yard manure) along with agronomic practices for organic nutrient management.

Conclusion

The findings of this study indicate that kabuli chickpea varieties can successfully can be grown by using vermicompost. variety- Pusa-1053 and the use of vermicompost as source nutrients can be suggested as a cost-effective combination for getting higher yield of Kabuli chickpea in the Bundelkhand region of Uttar Pradesh, India.

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Table 1: Cost of cultivation, Gross return, and Net return

Cost of cultivation (Rs. ha^{-1})	**Gross return (Rs. ha^{-1})**	**Net return (Rs. ha^{-1})**	**B:C Ratio**
44012	117050.00	73038.00	1.66
44512	136500.00	91988.00	2.07
43512	127900.00	84388.00	1.94
44012	73500.00	29488.00	0.66
44512	74550.00	30038.00	0.68
43512	79050.00	35538.00	0.81
44012	94000.00	49988.00	1.14
44512	104750.00	60238.00	1.35
43512	98950.00	55438.00	1.27

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Table 2: Effect of Organic sources of nutrients on growth attributes of Kabuli Chickpea

Treatment	Plant height (cm)				No. of primary branches				No. of secondary branches			
	30 DAS	60 DAS	90 DAS	Maturity	30 DAS	60 DAS	90 DAS	Maturity	30 DAS	60 DAS	90 DAS	Maturity
Varieties												
V1-Pusa-1053	12.17	27.91	45.81	54.25	1.37	3.92	4.34	4.42	2.18	6.35	6.87	6.97
V2-Subhra	10.53	25.26	41.83	50.16	1.22	3.51	3.64	3.77	2.42	5.77	6.34	6.46
V3-Ujjaval	11.74	27.76	43.84	52.39	1.29	3.71	3.94	4.04	2.65	6.03	6.58	6.74
SE (m)±	0.13	0.20	0.38	0.51	0.01	0.02	0.02	0.04	0.03	0.06	0.06	0.07
CD at 5%	0.40	0.59	1.15	1.51	0.04	0.07	0.06	0.12	0.09	0.18	0.19	0.22
Organic sources of nutrients												
M1-FYM	11.06	26.07	43.24	51.76	1.27	3.64	3.89	3.97	2.59	5.96	6.52	6.63
M2-Vermicompost	11.68	27.17	44.39	52.87	1.32	3.78	4.09	4.18	2.70	6.14	6.68	6.81
M3-Poultry manure	11.43	26.72	43.86	52.16	1.29	3.70	4.00	4.07	2.64	6.05	6.59	6.73
SE (m)±	0.12	0.19	0.37	0.50	0.01	0.02	0.02	0.03	0.02	0.05	0.06	0.07
CD at 5%	0.38	0.57	1.13	1.50	0.03	0.06	0.05	0.15	0.07	0.15	0.18	0.20
Interaction V×M												
SE (m)±	0.22	0.34	0.66	0.87	0.02	0.04	0.03	0.07	0.05	0.09	0.11	0.12
CD at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S	N.S.	N.S.	N.S.

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Table 3 : Effect of different Treatment and Biomass accumulation (g) per plant of Kabuli Chickpea

Treatment	Biomass accumulation (g) per plant at 60 DAS				Crop growth rate (g/m^2 /day)	
	Fresh weight of shoot	Fresh weight of root	Dry weight of shoot	Dry weight of root	30-60 DAS	60-90 DAS
Varities						
V_1-Pusa-1053	79.67	19.74	20.21	3.71	5.75	3.56
V2-Subhra	68.82	18.91	19.46	3.37	5.31	3.26
V3-Ujjaval	75.73	19.45	19.79	3.54	5.51	3.41
SE (m)±	0.52	0.12	0.14	0.03	0.05	0.03
CD at 5%	1.56	0.39	0.42	0.09	0.15	0.09
Organic sources of nutrients						
M_1-FYM	73.11	18.26	19.70	3.49	5.44	3.36

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M_2-Vermicompost	76.77	19.46	19.95	3.59	5.61	3.48
M_3-Poultry manure	74.33	19.37	19.81	3.54	5.52	3.41
SE (m)±	0.51	0.12	0.13	0.02	0.04	0.02
CD at 5%	1.54	0.35	0.38	0.07	0.13	0.07
Interaction V×M						
SE (m)±	0.89	0.22	0.25	0.06	0.08	0.05
CD at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

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Table 4: Treatment and Yield Attributes of Kabuli Chickpea

Treatment	Yield attributes			
	No of pods/plant	No of seed/pod	Grain weight/ plant	100 seed weight
Varieties				
V_1-Pusa-1053	35.58	1.43	14.96	18.55
V_2-Subhra	26.41	1.24	14.29	17.42
V_3-Ujjaval	30.47	1.32	14.29	18.21
SE (m)±	0.22	0.01	0.13	0.17
CD at 5%	0.66	0.03	0.39	0.51
Organic source of nutrients				
M_1-FYM	29.67	1.30	14.52	18.04
M_2-Vermicompost	31.88	1.36	14.74	18.34
M_3-Poultry manure	30.91	1.33	14.73	18.18
SE (m)±	0.21	0.01	0.10	0.12
CD at 5%	0.64	0.02	0.31	0.34
Interaction V×M				

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SE (m)±	0.37	0.2	0.22	0.29
CD at 5%	N.S.	N.S.	N.S.	NS

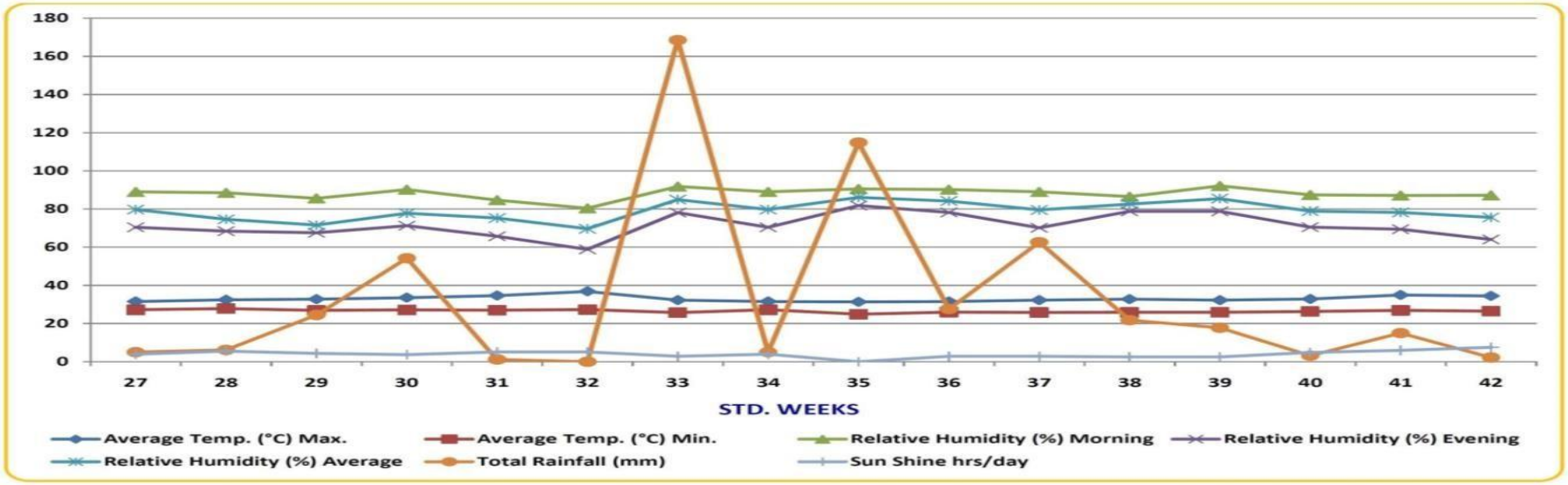

Fig- 1: Metrological data during cropping period 2020-21.

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