The Pharma Innovation

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Agronomic evaluation of chickpea (*Cicer arietinum* L.) varieties for organic farming in Bundelkhand

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Abstract
A field experiment was conducted for agronomic evaluation of Chickpea (*Cicerarietinum* L.) varieties under organic management during the winter season of 2018-19 at the Organic Agriculture Farm, Karguaji, Institute of Agricultural Sciences, Bundelkhand University, Jhansi, Uttar Pradesh. The experiment was laid out in Randomized Block Design (RBD) with eight treatments and three replications. Among varieties evaluated, JG-16 exhibited the highest seed yield 3501 kg/ha[1] and it was significantly better than the rest while lowest seed yield 2760 kg/ha[-1] was obtained with variety JAKI-9218. The highest yield in JG-16 was characterized by more number of pods per unit area and higher dry matter accumulation. Therefore, it is the best option to grow in organic farming during winter season in the agro-climatic condition of Bundelkhand Region.

Keywords: Chickpea, organic, varieties, growth, yield attributes and yield

Introduction
Chickpea is the premier pulse crop of Indian sub- continent. India is the largest chickpea producer as well as consumer in the world. The chickpea is second most important winter season pulse crop after Pigeonpea having extensive geographical distribution in the world for human diet and other uses. It is also the third most important grain legume in the world after dry beans and dry peas. In India, chickpea is grown on about 8.32m ha producing 7.58mt of grain with productivity of 912kg ha^{-1}. Chickpea is the important *Rabi* season pulse crop in U.P. However, its area under cultivation has decreased compared to vegetables, wheat and summer rice with increasing irrigation facilities. Chickpea is an economical source of quality protein and a versatile source of nutrients for man, animals and soil. It forms a balanced diet when supplemented with cereals. It leaves substantial amount of residual nitrogen for subsequent crop and adds plenty of organic matter to maintain and improve soil health. The Bundelkhand region of Uttar Pradesh is considered as potential area for promotion of organic farming with focus on pulses being the pulse bowl of the state. But, no systematic research did on organic farming in Bundelkhand. Varieties play an important role in increasing the production. Selection of proper variety for a set of agro-climatic condition is very important to achieve maximum yield potential because of differential growth and development behavior. Therefore, present attempt was made to evaluate some important varieties of chickpea under organic management for Bundelkhand.

Material and Methods
The field experiment was laid out at Organic Agriculture Research Farm, Bundelkhand University, Jhansi, Uttar Pradesh, India during *rabi* (winter) season of 2018-19.This farm is situated behind the Bundelkhand University in foot hills of Kamashin Mata Temple; Jhansi at $25^0\,27'$ North latitude and $78^0\,37'$ east longitudes with altitude level of 271 m above mean sea level. Experimental site is characterized by semi-arid and sub-tropical climate representing Bundelkhand region. Total rainfall received during the cropping season was 368.2 mm with total 03 rainy days, while maximum and minimum temperature was 35.6^0C and 04.8^0C respectively. Soil of the experimental field was sandy loam in texture, low in organic carbon, available nitrogen, very low in available phosphorous and medium in available potassium and neutral (P^H 7.1) in reaction. The treatments comprised of eight varieties Radhey (V_1),Janki - 9218 (V_2), JG - 16 (V_3),RSG - 902 (V_4), JG - 63 (V_5), JG - 322 (V_6), GNG - 1581 (V_7) and Pusa - 362 (T_8)evaluated in RBD with three replications. Sowing was done in furrow method at spacing of 30cm between rows and 10cm between plants with in the row using 65kgseed/ha. Basal dose of 20kg ha^{-1} nitrogen through vermin-compost was applied uniformly to all plots at

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the time of sowing. Thinning was carried out 15 days after sowing (DAS); healthy plants were spaced at10cm. Two hoeing were done at 25 and 40 DAS. For enhancing proliferation of the branches and avoiding unnecessary apical growth of the plants, nipping of apical portion of the shoot was carried out at 40 DAS. Two post sowing irrigations were applied, one at pre-flowering stage and second at pod development stages as per local recommendation prescribed for chickpea crop in the region. Plant protection measures adopted using organic or bio-pesticides (*viz.* neem oil and trichoderma). Harvesting of chickpea was done at maturity by manual labors with the help of hand sickles. Harvested plants from sample row of each plot were taken for various studies. Various observations *on* the growth attributes, yield attributes and yields were recorded as per the standard protocol under which three labeled plants in each plot were cut from ground level and shifted to field laboratory for taking observations on growth and yield attributes. The data were statistically analyzed by using M-STAT software (1978) and the C.D. at 5% level of probability.

Results and Discussion
Growth & Growth attributes
The observations on different growth attributes of chickpea indicated that different varieties have influenced these parameters significantly (Table. 1) at 30,60 and 90 days after sowing. The fresh weight (g) plant^{-1} was found statistically significant at all the stages. VarietyJG-16 (06.53g), Radhey (24.86g) and JAKI- 9218 (94.16g) gained significantly higher fresh plant weight (g) plant^{-1} at 30, 60 and 90 DAS respectively compared to other varieties. The dry weight per plant continuously increased up to maturity. Among the varieties, RSG-902 (02.33g), JG-16 (06.03g) and Radhey (13.73g) obtained highest dry weight plant^{-1}compared to other varieties. Fresh root weight of plant^{-1} at 30, 60 and 90 DAS was observed significantly higher in variety JAKI-9218 (0.62g, 03.26g & 08.63g) respectively while the dry weight of root plant^{-1}at 30 DAS was significantly greater in PUSA-362 (0.14). But, at 60 DAS all varieties were at par while at 90

days of sowing, JG-16 (2.43g) weight was observed significantly higher than other varieties. The data pertaining to length of plant^{-1} (cm) at 30, 60, 90 days after sowing of varieties reveal that PUSA-362 (20.36&33.66cm) and RSG-902 (64.63cm) showed significantly higher length at 30,60 and 90 days after sowing. Similar observations had been supported by Alihan Cokkizgin (2012) [1], Jasinska and Kotecki (1995) [3] and Khoiwal *et al.* (2017) [5]. The numbers of pair of nodules were counted significantly higher in variety Jaki-9218 (12.78, 14.45 and 15.31) after 30, 60 and 90 days of sowing respectively. Khoiwal *et al.* (2017) [5] also confirmed these findings. The numbers of branches (plant^{-1}) were found statistically significant at 60 and 90 days after of sowing. Variety JG-16 produced significantly highest number of branches plant^{-1}(11.3 and 11.6 at 60 and 90 DAS). Similar results were reported by Khoiwal *et al.* (2017) [5].

Yields and Yield attributes
The observations on different yield attributes and yield of chickpea indicated that different varieties have influenced these parameters significantly (Table 2).The data related to days to flower initiation found non-significant among the varieties. Among the varieties, JG-16 resulted in significantly highest number of pods plant^{-1} (111.1 No), pod weight plant^{-1} (88.96 g), number of seed splant^{-1} (217.33) and seed yield plant^{-1} (36.03 g) compared to other varieties. Bahl and Jain (1997) [2] also reported that seed yield was positively correlated with number of branches and pods plant^{-1}, 100 seeds weight (29.13 g) and seed yield (35.01 q ha^{-1}),Singh and Kurmvanshi (1997) [4] also reported that the yield is associated with higher number of branches and pods plant^{-1}and increased 100 seeds weight, husk yield and Biological yield. Increase in yield attributes and yield of variety JG-16 of chickpea was due the optimum growth and development of the plants owing to the optimum availability of resources like water, nutrient and solar radiation that led to the proper translocation and assimilation of food to the sink of the plants (Ram, *et al.*, 2018). Saraf *et al.,* (1972) also reported that out of eight varieties of gram JG-16 was superior to all varieties.

Table 1: Growth attributes of chickpea varieties at 30, 60 and 90 days after sowing (DAS) under organic management

Treatments	Plant weight (g)						Root weight (g)						Plant Height (cm)			Nodules/plant (Nos)			Branches/plant (Nos)		
	Fresh			Dry			Fresh			Dry											
	30	60	90	30	60	90	30	60	90	30	60	90	30	60	90	30	60	90	30	60	90
V$_1$ - Radhey	5.16	24.86	74.76	1.60	3.43	13.73	0.54	2.20	4.40	0.12	0.43	1.23	19.70	27.70	59.86	12.66	13.31	14.18	5.10	09.16	09.01
V$_2$- JAKI - 9218	4.93	20.30	94.16	1.56	4.16	13.36	0.62	3.26	8.63	0.12	0.37	1.73	18.26	32.20	55.26	12.78	14.45	15.31	6.73	08.00	13.82
V$_3$- JG - 16	6.53	14.86	92.26	1.60	2.56	13.40	0.50	2.33	7.46	0.11	0.40	2.43	18.90	18.26	52.13	12.74	14.44	15.28	6.30	11.03	13.90
V$_4$- RSG - 902	3.73	20.26	89.63	2.33	3.46	16.36	0.42	2.20	6.33	0.11	0.20	1.66	20.70	32.16	64.63	10.50	13.96	14.15	6.46	10.00	13.76
V$_5$- JG - 63	4.66	24.50	88.00	1.60	6.03	13.26	0.37	1.66	4.60	0.09	0.26	1.16	19.80	33.40	59.16	12.63	11.35	12.00	5.30	09.26	13.53
V$_6$- JG - 322	6.10	19.66	56.03	1.73	3.40	11.00	0.42	2.56	8.50	0.09	0.30	1.30	20.06	29.63	46.20	10.40	12.90	14.15	5.63	10.40	12.20
V$_7$- GNG - 1581	3.46	20.03	57.70	1.53	2.60	12.43	0.24	1.40	2.26	0.07	0.23	1.60	18.70	29.16	55.70	12.70	14.13	15.10	5.63	10.90	09.79
V$_8$- PUSA - 362	5.40	19.20	67.60	2.26	3.40	12.50	0.63	2.80	6.46	0.14	0.46	1.60	20.36	33.66	55.30	11.71	12.65	14.05	5.40	09.43	12.43
C.D. at 5%	1.45	3.69	5.32	0.52	0.42	2.71	0.04	0.38	0.99	0.02	0.14	0.38	N.S.	4.19	3.01	0.04	1.60	0.08	NS	1.62	0.31

*NS: Non Significant

Table 2: Effect of different varieties of chickpea on yield attributes and yield.

Treatments	Pods plant^{-1} (NO)	Weight of pods plant^{-1} (g)	Seeds plant^{-1}(nos)	Seed yield plant^{-1}(g)	Seed Index	Seed yield (q/ha^{-1})	Husk yield (q/ha^{-1})	Biological yield (q/ha^{-1})
V$_1$ - Radhey	107.44	72.43	214.74	34.50	27.33	29.08	54.29	86.63
V$_2$ - JAKI - 9218	103.66	79.80	208.98	35.10	27.33	27.60	56.00	83.63
V$_3$ - JG - 16	111.33	88.96	217.33	36.03	29.13	35.01	56.91	92.00
V$_4$ - RSG - 902	107.00	64.96	215.66	32.47	23.93	28.71	54.17	82.76
V$_5$ - JG - 63	106.33	68.36	212.66	34.23	24.20	28.04	56.83	84.89
V$_6$ - JG - 322	106.33	62.50	214.97	34.20	22.20	30.07	47.38	82.41
V$_7$ - GNG - 1581	108.10	62.50	211.54	33.27	21.67	28.71	43.04	71.76

V$_8$ - PUSA - 362	109.66	69.76	212.32	34.80	28.13	29.20	52.70	79.92
C.D. at 5%	2.46	3.39	3.08	1.08	1.53	3.71	8.91	7.38

Conclusion
The comparative performance of chickpea revealed that the growth, yield attributes and yield were found better in variety JG-16 compared to other varieties and identified to be the best choice for realizing higher yield of chickpea in organic farming in Bundelkhand.

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