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Effect of sowing methods and integrated nutrient management through FYM, VC and PM on growth of chickpea (2018-19) for organic farming in Bundelkhand

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Abstract

The investigation was undertaken at the Department of Agronomy, Institute of Agriculture Sciences, Bundelkhand University, and Jhansi (UP) in 2018-19. The experiment was laid out 3×3 factorial in Randomised Block Design (RBD) with nine treatment and three replications. The material used in the experiment was three organic manure viz., FYM, Vermicompost and poultry manure and their different combination with sowing methods viz., cross sowing, line sowing and broad bed. . All of the growth characters viz. plant height, number of primary branches, fresh weight, dry weight at harvest and yield attributes i.e. number of pods plant-1, number of seeds plant-1 and number of seeds pod-1 were found to be significantly maximum in application of 100% organic source from. The finding, it is significantly observed that the T₉ (FYM 50% + PM 50%+ Cross Sowing) gave maximum grain yield 30.46 q/ha.

Keywords: Integrated nutrient management, sowing method, chickpea, growth and yield

Introduction

Pulses are an integral part of Indian agriculture. Chickpea (*Cicer Arietinum* L.) commonly known as gram is one of the most important Rabi season pulse crop grown in India for their economic importance and beside soil fertility. Most important pulse crop of India contributing about 30% of total pulse acreage and about 40% of total pulse production of the nation. It is mainly consumed as 'Dal' (split cotyledons) and chhole. Many attractive dishes viz. – sweets, snacks and namkeen are also prepared from its floor called besan. Also eaten as whole fried or boiled and salted. Fresh green leaves (sag) are used as vegetables and green grains as hare chhole or chholia. Straw of gram is an excellent fodder while both husk and bits of 'Dal' are valuable cattle feed. Leaves consist of mallic and citric acid and are very useful for stomach ailments and blood purifier. (<http://dpd.dacnet.nic.in>)

The total production of pulses was 56.6 mt. India is the world's major producer of food grain legumes. Chickpea ranks third in the worlds among pulses after pea and common bean with an area of 48.67 million hectares. The FAOSTAT, (2018) data indicates a chickpea production of 11.23 MT in India, while the world's chickpea production is 14.78 MT indicating that India contributes to 65% of world's chickpea production (FAOSTAT database, <http://faostat.fao.org/site/567/default.aspx>, 2018). However, the supply in terms of production pulses imports is not keeping abreast of the increase in demand due to demographic growth. Import reached 6 mt in by year 2017 (www.grainlegumes.com). Despite its economic importance and strong national and international breeding programs, the productivity of chickpea has not improved considerably over the years. Major constraints in realization of the full yield potential of chickpea are various a biotic and biotic factor.

Method and Material

The experiment was laid out on Organic Research Farm, Kargunaji, Bundelkhand University, Jhansi during Rabi seasons of 2018-19. The high warmer month is June 26⁰-44⁰ C and coldest month is January 7⁰-24⁰ C. The soil of the experimental site was clayey in texture with bulk density of 1.27 g / cc, pH of 7.40, OC of 0.60%. The soil is low in available N (214.00 kg/ha) and P₂ O₅ (15.90 kg/ha), and medium in available K₂O (102 kg/ha). The experiment was laid out 3×3 factorial in Randomised Block Design (RBD) with nine treatment and three replications.

The material used in the experiment was three organic manure viz., FYM, Vermicompost and poultry manure and their different combination with sowing methods viz., cross sowing, line sowing and broad bed. The crop chickpea variety JG-14 duration of 110 to 120 days was sown on 08-11-2018 with a spacing of 30 cm x 10 cm. All of the growth characters viz. plant height, number of primary branches, fresh weight, dry weight at harvest and yield attributes i.e. number of pods plant-1, number of seeds plant-1 and number of seeds pod-1 were found to be significantly maximum in application of 100% organic source from.

Result and Discussion

The present study was conducted to find out the "Effect of sowing methods and integrated nutrient management through FYM, VC and PM on growth of Chickpea (2018-19) for organic farming in Bundelkhand" following the layout of Randomized Block Design with 9 treatment and 3 replications. To evaluate treatment effect, observations were recorded on Germination (%), Number of branches at different days, Plant weight, Root fresh and dry weight, Number of Nodules/plant, Days to flowering, Days to pod formation, Number of pod/plant, Number of grain/pod, Yield/plant (g), Grain yield (q/ha), Straw yield (q/ha), and Biomass yield(q/ha) of chickpea.

Germination

It was recorded at 15 days after sowing of seed on completion germination (%) and data on germination count. The result furnished in on germination indicated that germination (%) of chickpea was highest (91.3) in T₆ (VC 50% + FYM 50% + cross sowing), it while minimum (80.2) in T₄ (PM 50% + FYM 50% + line sowing).

Fresh weight of per plant

Data recorded on fresh plant weight in at 30 DAS indicated that out of all tested combinations for sowing method and organic sources, the application of FYM 50% + PM 50% and cross sowing method (T₉) yielded maximum fresh plant weight of chickpea (8.8 g) while minimum fresh plant weight (4.7 g) of chickpea was recorded with application of VC 50% + FYM 50% and sowing on broad beds.

Contrary to the above results, maximum fresh plant weight (58.5 g) of chickpea plant was recorded at 60 DAS FYM 50% + PM 50%+ with cross sowing method (T₉) while least fresh plant weight (48.3 g) of chickpea was determined in combination of VC 50% + PM 50% with cross sowing(T₃).

On final measurement of fresh plant weight of chickpea at 90 DAS after sowing indicated that out of all combination of sowing methods and organic supplements(FYM, Vermicompost and poultry manure) used to grow chickpea crop in micro plot of experimental trial , T₉ involving combination of FYM 50% + PM 50% with cross sowing enabled to produce maximum fresh plant weight (137.84 g) of chickpea followed by T₂ (123.89 g), T₁ (122.63 g), T₇ (121.95 g), T₅ (121.61 g), T₄ (120.72 g), T₆ (120.42 g), T₃ (116.77 g) and T₈ (114.26 g) as data represent in.

Fresh root weight per plant

Data recorded on fresh root weight at 30 DAS indicated that out of all tested combinations of sowing method and organic supplements given the combination of FYM 50% + PM 50% with cross sowing applied (T₉) yielded maximum fresh root weight of chickpea (1.01g) while minimum fresh root weight

(0.65g) of chickpea in combination of FYM 50% + VC 50% with Line sowing (T₁).

At 60 DAS the maximum fresh root weight (2.96g) of chickpea plant was recorded when FYM 50% + PM 50% with cross sowing method (T₉) while least fresh root weight (1.57 g) of chickpea was determined in combination of FYM with sowing on broad bed (T₂).

On final measurement of root fresh weight of chickpea at 90 DAS after sowing indicated that out of all combination of sowing methods and organic supplements(FYM, Vermicompost and poultry manure) used to grow chickpea crop in micro plot of experimental trial , T₉ involving combination of FYM 50% + PM 50% with cross sowing method enabled to produce maximum root fresh weight (5.08g) of chickpea plant followed by T₁ (3.18 g), T₄ (2.99 g), T₈ (2.93 g), T₅ (2.76 g), T₆ (2.75g), T₃ (2.73 g), T₇ (2.54 g) and T₂ (2.40 g).

Dry plant weight per plant

Data recorded on dry plant weight in at 30 DAS indicated that out of all tested combinations sowing method and organic supplements given to soil showed that application of FYM 50% + PM 50% and cross sowing method (T₉) yielded maximum plant dry weight of chickpea (1.01g) while minimum dry plant weight (0.62g) of chickpea was recorded with application of VC 50% + PM 50% with cross sowing (T₃).

Contrary to the above results, maximum dry plant weight (15.78g) of chickpea plant was recorded when RDF application through cross sowing method adopted (T₉) while least dry plant weight (10.50g) of chickpea was determined in combination of VC 50% + PM 50% with line sowing (T₇).

On final measurement of plant dry weight of chickpea at 90 DAS after sowing indicated that out of all combinations of sowing methods and organic supplements(FYM, Vermicompost and poultry manure) used to grow chickpea crop in micro plot of experimental trial, combinations of FYM 50% + PM 50% with cross sowing method (T₉) enabled to produce maximum plant dry weight (37.85g) of chickpea plant followed by T₂ (23.90g), T₁ (22.63g), T₇ (21.95g), T₅ (21.61g), T₆ (21.43g), T₄ (20.72g), T₃ (19.67g) and T₈ (17.60g).

Root dry weight

Data recorded on root dry weight in 30 DAS indicated that out of all tested combinations of sowing method and organic supplements given to soil showed that application of FYM 50% + PM 50% with cross sowing method (T₉) yielded maximum root dry weight of chickpea (0.27g) while minimum dry plant weight (0.13g) of chickpea the combinations of FYM 50% + VC 50% with sowing on broad bed (T₈).

Contrary to the above results, maximum root dry weight (0.72g) of chickpea plant was recorded when FYM 50% + VC 50% with cross sowing method was adopted (T₉) while least root dry weight (0.51g) of chickpea was determined in combinations of vermicompost with line sowing (T₄).

On final measurement of root dry weight of chickpea at 90 DAS after sowing indicated that out of all combinations of sowing methods and organic supplements (FYM, Vermicompost and poultry manure) used to grow chickpea crop in micro plot of experimental trial , T₉ combinations of FYM 50% + PM 50% with cross sowing was enabled to produce maximum dry plant weight (1.150g) of chickpea

plant followed by T₆ (1.007g), T₃ (1.000g), T₁ (0.927g), T₈ (0.907g), T₇ (0.897g), T₅ (0.893g), T₄ (0.883g) and T₂ (0.843g).

Number of branches per plant

Data recorded on number of branches per plant at 30 DAS indicated that application of FYM 50% + PM 50% with cross sowing applied in T₉ yielded maximum number of branches per plant of chickpea (2.78) while minimum branches per plant (1.55) when RDF applied through VC 50% + PM 50% with sowing on broad bed (T₅).

At 60 DAS maximum number of branches per plant (3.22) in was observed when RDF applied through FYM 50% + PM 50% with cross sowing method was adopted (T₉) while least number of branches per plant (2.33) of chickpea was determined when RDF through VC 50% + PM 50% with cross sowing (T₃).

The number of branches per plant of chickpea at 90 DAS indicated that sowing methods and organic supplements (FYM, Vermicompost and poultry manure) used to grow chickpea crop in micro plot of experimental trial treatment T₉ involving application of RDF through FYM 50% + PM 50% and cross sowing method enabled to produce maximum number of branches per plant (4.44) of chickpea plant followed by T₁(3.66), T₆ (3.44), T₇ (3.33), T₅ (3.11), T₄ (3.00), T₈ (3.00), T₂ (3.00) and T₃ (2.78).

Number of lateral branches per plant

Data recorded on number of lateral branches per plant at 30 DAS indicated that out of all tested treatments combinations of sowing method and organic supplements given to soil showed that combinations of FYM 50% + PM 50% with cross sowing method applied in (T₉) yielded maximum number of lateral branches per plant of chickpea (32.33) while lowest number of lateral branches per plant (21.11) of chickpea the combinations of FYM 50% + PM 50% with line sowing (T₄).

At 60 DAS the maximum number of lateral branches per plant (60.00) of chickpea were recorded in combinations of FYM 50% + PM 50% with cross sowing method (T₉) while least number of lateral branches per plant (44.0) of chickpea was determined in combination of VC 50% + PM 50% with cross sowing (T₃).

On final measurement at 90 DAS number of lateral branches per plant of chickpea the combinations of FYM 50% + PM 50% with cross sowing was enabled to produce maximum no of Lateral branch per plant (113.7) of chickpea followed by T₆ (92.5), T₃ (92.4), T₅ (91.3), T₇ (90.3), T₁ (88.8), T₄ (88.3), T₈

(87.7) and T₂(83.0).

Number of nodules per plant

Data recorded on number of nodules per plant at 30 DAS indicated that out of all tested combinations of sowing method and organic supplements given to soil showed that combinations of FYM 50% + PM 50% with cross sowing methods T₉ resulted maximum number of nodules per plant of chickpea (28.33) while minimum number in the combination of VC 50% + PM 50% with Cross sowing (T₃).

At 60DAS maximum number of nodules per plant (34.00) of chickpea plant were recorded in the combination of FYM 50% + PM 50% with cross sowing method (T₉) while least number of nodules per plant (26.44) of chickpea was determined in combination of FYM 50% + PM 50% with line sowing (T₄).

At 90DAS the number of nodules per plant of chickpea indicated that out of all combinations of sowing methods and organic supplements (FYM, Vermicompost and poultry manure) used to grow chickpea crop in micro plot of experimental trial , combinations of FYM 50% + PM 50% with cross sowing (T₉) enabled to produce maximum number of nodules per plant (47.67) of chickpea followed by T₃(42.45), T₅ (41.89), T₁ (41.67), T₇ (40.78), T₄ (40.00), T₂ (39.78), T₆(38.67) and T₈(38.67).

Days to flowering

The canting of days to flowering in different treatment revealed that the delay of 3 days was observed in treatment (T₈) combinations of FYM 50% + VC 50% with sowing on broad bed was adopted when compared to treatment T₇ VC 50% + PM 50% + line sowing.

Days to pod formation and maturity

The canting of days to pod formation indicated that involving T₉ combination of FYM 50% + PM 50% with cross sowing method maximum number of days (80.0) were observed in treatment.

The canting of days to crop maturity indicated that out of all combinations of sowing methods and organic supplements (FYM, Vermicompost and poultry manure) used to grow chickpea crop in micro plot of experimental trial maximum number days to crop maturity (118) were observed in treatment T₉ involving application of FYM 50% + PM 50% and cross sowing method while lowest number days (111) recorded when FYM 50% + VC 50% applied with line sowing.

Treatment combinations	Seed germination (%)	Fresh plant weight (g) at			Fresh root weight (g) at			Plant dry weight (g) at		
	15 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
FYM 50% + VC 50% + Line Sowing	82.4	4.9	53.9	122.63	0.65	1.73	3.18	0.84	11.67	22.63
FYM 50% + PM 50% + Sowing on Broad bed	86.1	5.7	49.2	123.89	0.79	1.57	2.40	0.72	12.19	23.90
VC 50% + PM 50% + Cross Sowing	85.4	5.4	48.3	116.77	0.74	1.70	2.73	0.62	12.05	19.67
FYM 50% + PM 50%+ Line Sowing	80.2	5.1	51.3	120.72	0.75	1.63	2.99	0.69	11.59	20.72
VC 50% + PM 50% + Sowing on Broad bed	85.9	5.8	48.6	121.61	0.78	1.65	2.76	0.68	12.72	21.61
FYM 50% + VC 50% + Cross Sowing	91.3	5.7	52.7	120.42	0.73	1.72	2.75	0.86	11.84	21.43
VC 50% + PM 50% + Line Sowing	83.3	6.0	48.7	121.95	0.76	1.80	2.54	0.70	10.50	21.95
FYM 50% + VC 50% + Sowing on Broad bed	85.2	4.7	51.6	114.26	0.66	1.67	2.93	0.78	11.85	17.60
FYM 50% + PM 50%+ Cross Sowing	85.2	8.8	58.5	137.84	1.01	2.96	5.08	1.01	15.78	37.85
Se(m)±	0.602	1.008	0.607	3.695	0.073	0.098	0.225	0.037	0.610	3.293
C.D.at 5%	1.819	N/S	1.837	11.171	N/S	0.297	0.681	0.111	1.303	9.956

Symbols	Treatment combinations	Root dry	Number of branches	Number of lateral
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		weight (g) at			per plant			branch per plant		
		30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
T ₁	FYM 50% + VC 50% + Line Sowing	0.170	0.637	0.927	2.33	2.78	3.67	27.11	50.00	88.67
T ₂	FYM 50% + PM 50% + Sowing on Broad bed	0.180	0.577	0.843	2.11	2.67	3.00	21.67	48.00	83.00
T ₃	VC 50% + PM 50% + Cross Sowing	0.163	0.590	1.000	1.89	2.33	2.78	26.78	44.00	92.44
T ₄	FYM 50% + PM 50% + Line Sowing	0.157	0.510	0.883	1.78	2.56	3.03	21.11	50.00	88.33
T ₅	VC 50% + PM 50% + Sowing on Broad bed	0.157	0.613	0.893	1.55	2.78	3.11	21.66	46.33	91.33
T ₆	FYM 50% + VC 50% + Cross Sowing	0.150	0.643	1.007	1.88	2.33	3.44	21.45	50.33	92.54
T ₇	VC 50% + PM 50% + Line Sowing	0.137	0.627	0.897	2.11	3.00	3.33	25.00	51.33	90.00
T ₈	FYM 50% + VC 50% + Sowing on Broad bed	0.133	0.570	0.907	2.00	2.89	3.03	24.11	50.78	87.67
T ₉	FYM 50% + PM 50% + Cross Sowing	0.270	0.717	1.150	2.78	3.22	4.44	32.33	60.00	113.67
	SE(m) ±	0.026	0.015	0.021	0.306	0.187	0.297	0.888	0.809	2.785
	CD at 5%	N/S	0.047	0.065	N/S	N/S	0.898	2.685	2.446	8.420

Symbols	Treatment combinations	No. nodules per plant at			Days to flowering (Nos)		Days to pod formation and maturity	
		30 DAS	60 DAS	90 DAS	Initiation	Flowering	Pod formation	Crop Maturity
T ₁	FYM 50% + VC 50% + Line Sowing	19.67	28.56	41.67	45.00	61.67	76.33	111.00
T ₂	FYM 50% + PM 50% + Sowing on Broad bed	17.33	27.11	39.78	44.67	62.67	76.00	117.00
T ₃	VC 50% + PM 50% + Cross Sowing	15.67	27.78	42.45	45.00	61.67	77.00	115.33
T ₄	FYM 50% + PM 50% + Line Sowing	17.89	26.44	40.00	45.00	64.00	76.00	114.33
T ₅	VC 50% + PM 50% + Sowing on Broad bed	20.89	28.11	41.89	45.00	61.33	76.33	112.67
T ₆	FYM 50% + VC 50% + Cross Sowing	21.45	28.44	38.67	45.00	62.33	76.00	114.67
T ₇	VC 50% + PM 50% + Line Sowing	19.11	28.67	40.78	45.00	61.00	76.33	115.67
T ₈	FYM 50% + VC 50% + Sowing on Broad bed	19.11	26.67	38.67	45.00	64.33	76.00	115.00
T ₉	FYM 50% + PM 50% + Cross Sowing	28.33	34.00	47.67	45.33	63.00	80.00	118.00
	SE(m) ±	3.423	0.832	0.785	0.61	0.64	0.723	1.132
	CD at 5%	N/S	2.516	2.375	N/S	1.92	2.187	3.422

Conclusion

- Chickpea variety 'JG-14' responded favorably to the application of FYM 50% + PM 50% + cross sowing (T₉) for maximum growth of chickpea as reflected in growth attributes.
- In Bundelkhand region of U.P., nutrient application through FYM 50% + PM 50% + cross sowing (T₉) was found best for obtaining maximum yield (30.46 q/ha) under organic farming.
- Application of nutrients through the poultry manure and FYM with cross sowing method (T₉) was found to be better for obtaining higher net return while application of vermicompost with cross sowing for obtaining higher returns and benefit: cost ratio in Bundelkhand region for practicing organic farming.

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