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Effect of phosphorus management and liquid organic manures on growth and yield of chickpea (*Cicer arietinum* L.)

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Abstract

A field experiment was carried out during *rabi* season of 2020-21 and 2021-22 on laomy sand soil to find out the effect of phosphorus management and liquid organic manures on growth and yield of chickpea (*Cicer arietinum* L.) at College of Agriculture, Lalsot in Dausa district of Rajasthan. Revealed that application of 25% RDP + 75% P through PROM recorded significantly higher plant height, branches/plant, dry matter accumulation and grain (1802 kg/ha), straw (3097 kg/ha) and biological yield (4898 kg/ha) compared to other organic manure treatments. Further revealed that twice foliar sprays of 3% panchgavya at 30 and 50 DAS recorded the maximum improvement in most of the growth and yields of chickpea among all the liquid organic manures. The maximum grain (1767 kg/ha), straw (2977 kg/ha) and biological (4743 kg/ha) yield were recorded under in this treatment.

Keywords: Chickpea, PROM, liquid organic manure, seed yield

Introduction

Pulses play an important role in Indian agriculture for sustainable production, improvement in soil health and environment safety. India is the largest producer and also consumer of pulses in the world and found that it is a cheaper source of protein to overcome malnutrition among human beings. Pulses contain high percentage of quality protein nearly three times as much as cereals (Umadevi and Ganedan, 2007) ^[15]. Chickpea (*Cicer arietinum* L.) is one of the major pulses of the World as well as in India. It is a cool season legume crop and grown in several countries worldwide as a food source. Chickpea seed is the main edible part of the plant and it is a good source of carbohydrates (64%) and protein (22%) and protein quality is considered to be better than other pulses. Chickpea has significant amount of all the essential amino acids except sulphur-containing amino acids, which can be complemented by adding cereals to the daily diet. Being a leguminous crop, chickpea meets 80% of its N requirement from symbiotic-N fixation and can fix up to 140 kg N/ha. It is cultivated largely under marginal sub-marginal lands characterized by poor fertility, moisture stress and energy starved conditions. In India, chickpea was grown on 9.59 m ha area during 2023-24 and production was 11.04 mt with productivity of 1151 kg/ha. In our country, 98.13% area and 98.39% production of chickpea is confined to the states of Maharashtra, Madhya Pradesh, Rajasthan, Karnataka, Gujarat, Uttar Pradesh, Andhra Pradesh, Chhattisgarh, Jharkhand and Telangana. The maximum production comes from Madhya Pradesh (26.40%), followed by Maharashtra (25.69%), Rajasthan (17.39%) and Gujarat (9.66%). Rajasthan ranks third in area and production after Maharashtra and Madhya Pradesh (Anonymous, 2024) ^[1]. In Rajasthan, chickpea is grown on 1.94 m ha area and production is 1.81 mt with productivity of 934 kg/ha. It is mainly grown in arid and semi-arid districts of Ajmer, Jaipur, Jaisalmer, Bhilwara, Chittorgarh, Pali, Bikaner, etc. (Anonymous, 2022-23) ^[2]. Despite of being such a high yield potential and advantageous crop, the productivity of the crop is low indicating great scope in improving productivity using suitable measures like, nutrient management particularly the use of phosphorus and liquid manures. Application of inorganic fertilizers has no doubt increased the production but deteriorated soil health and environmental

Quality. Low cost nutrient sources in the form of integrated nutrient supply system involving PROM in conjunction with nominal quantity of inorganic fertilizers can be useful to supplement phosphate as an integrated approach. The use of fermented organic manures such as panchagavya, vermiwash, jeevamrit, beejamrit, cow urine, etc. is becoming popular for sustaining the crop production and maintaining soil health. The plants can absorb the nutrients about 20 times faster through leaves than applied through the soil, hence liquid manures are better option to overcome temporary nutrient shortages. Hence, it was felt to scrutinize the possible agronomical, economical and ecological significance of organic fertilizers and fermented organic manures in comparison to chemical fertilizers to chickpea.

Materials and Methods

This field experiment was carried out during *Rabi* season of the year 2020-21 and 2021-22 at College of Agriculture, Lalsot located at 26°55' North latitude and 76°32' East longitude and at an altitude of 298 metres above mean sea level. The region falls under Agroclimatic zone IIIa (Semi-arid Eastern Plain Zone) of Rajasthan state. The experiment comprised of twenty four treatment combinations involving six treatments of phosphorus management viz., control, 100% RDP, 75% RDP + 25% P through PROM, 50% RDP + 50% P through PROM, 25% RDP + 75% P through PROM and 100% P through PROM assigned to main plots and four treatments of liquid organic manures viz., control, two sprays of 3% panchgavya at 30 and 50 DAS, two sprays of 3% Jeevamrit at 30 and 50 DAS and two sprays of 10% cow urine at 30 and 50 DAS in sub plots that were laid down in split plot design and replicated three times to determine the effect of phosphorus management and liquid organic manures on growth and yield of chickpea. The soil was loamy sand in texture with reaction 7.92 pH. Soil was low in organic carbon (0.17%), and available nitrogen (139.7 kg/ha), medium in available phosphorus (18.63 kg/ha) and potassium (151.25 kg/ha). Recommended dose of phosphorus (40 kg/ha) was applied in furrow either through SSP or PROM/combination of the both as per treatments. A uniform dose of 20 kg N was applied as basal through urea at the time of sowing. Line sowing method was adopted with 30 cm X 10 cm planting geometry and seed rate 80 kg/ha. The observations were recorded on plant height, number of branches/plant, dry matter accumulation per metre row length, grain yield, straw yield and biological yield at the time of harvesting and the observation recorded were statistically analysed by Fisher's 'Analysis of Variance' technique (Fisher, 1950). Appropriate standard error for each of the factor was worked out. Significance of differences among treatment effects was tested by "F" test as described by Panse and Sukhatme (1985)^[9] for split plot design.

Results and Discussion

Plant Height:

Phosphorus Management: Data presented in the table 1.1 indicated that different growth parameters of chickpea was significantly influenced due to different phosphorus management treatments. The maximum plant height of 11.6, 39.6 and 52.5 cm was obtained at 35, 70 DAS and at harvest stage, respectively under the treatment of 50% RDP + 50% P through PROM. Thus, its registered mean increases of 10.5, 5.3 and 6.1 per cent in plant height over 75% RDP + 25% P through PROM, 14.9, 9.7 and 11.5 per cent over 100% RDP and 24.7, 23.0 and 20.1 per cent over control at 35 DAS, 70 DAS and at harvest stages, respectively. Remaining at par with each other,

application of 25% RDP + 75% P through PROM and 100% P through PROM also witnessed statistical equivalence with 50% RDP + 50% P through PROM in improving plant height at all the stages during both years of study. These treatments increased the plant height of chickpea by margin of 23.7 and 20.4 per cent at 35 DAS, 21.1 and 18.0 per cent at 70 DAS and 16.9 and 15.6 per cent at harvest stage, respectively over control.

Liquid Organic Manures

Close examination of data further revealed that plant height of chickpea at 35 DAS stage remained uninfluenced due to foliar spray of different liquid organic manures. However, at later stages of 70 DAS and at harvest, foliar spray of different liquid organic manures had significant effect on plant height (Table 1.1). Results showed that two sprays of 3% panchgavya at 30 and 50 DAS exhibited the maximum plant height of 38.6 cm at 70 DAS stage and 52.2 cm at harvest which was 3.5 and 5.5 per cent more than obtained under 10% cow urine spray and 11.2 and 16.5 per cent than control, respectively at these two stages. Foliar spray of 3% jeevamrit twice at 30 and 50 DAS also enhanced the plant height by 8.6 and 10.9 per cent at these stages, respectively over control and thus showed statistical equivalence with panchgavya treatment. The extent of increase in plant height due to 10% cow urine spray on crop was 7.5 and 10.5 per cent than control.

Total Number Branches/Plant

Phosphorus Management: Results in table 1.1 showed that maximum number of branched/plant among all the treatments were observed under the treatment 25% RDP + 75% P through PROM. It recorded the average number of 8.49 and 10.96 branches/plant at 70 DAS and at harvest stages, respectively, thereby increasing it to the extent of 6.0, 11.6 and 33.5 per cent at 70 DAS and 6.4, 13.2 and 24.1 per cent at harvest stage over P₂, P₁ and control, respectively. However, it showed statistical equivalence with 50% RDP + 50% P through PROM and 100% P through PROM. These two treatments increased the number of branches/plant to the tune of 30.0 and 28.6 per cent at 70 DAS and 21.0 and 18.9 per cent at harvest stage, respectively as compared to control. The magnitude of increase in branches/plant done to 75% RDP + 25% P through PROM and 100% RDP was over control was to the tune of 25.9 and 19.7 per cent at 70 DAS and 16.6 and 9.6 per cent at harvest stages, respectively.

Liquid Organic Manures: It is also evident from the data given in table 1.1 that foliar spray of all the liquid organic manures significantly enhanced the number of branches/plant at both the stages observation. The highest number of 8.85 branches/plant at 70 DAS and 11.08 branches/plant at harvest in pooled analysis were observed when two foliar spray of 3% panchgavya were done twice at 30 and 50 DAS. In this way, it increased the number of branches by 10.1, 14.6 and 32.7 per cent at 70 DAS and 6.7, 9.6 and 22.3 per cent at harvest stage over jeevamrit, cow urine and control, respectively. Foliar spray of 3% jeevamrit and 10% cow urine also registered 20.5 and 15.7 per cent increase in branches/plant at 70 DAS and 14.6 and 11.6 per cent at harvest than control and were thus found as the next better and equally effective treatments in improving this growth attribute of chickpea.

Dry Matter Accumulation

Application of 25% RDP + 75% P through PROM also recorded the highest crop dry matter of 12.4, 62.0 and 140.00 g/m row

length at 35 DAS, 70 DAS and at harvest stages in pooled analysis, indicating a significant increase of 5.1, 6.3 and 11.3 per cent over P₂, 18.1, 13.8 and 20.0 per cent over P₁ and 30.5, 27.0 and 39.6 per cent over control at 35 DAS, 70 DAS and at harvest stages, respectively. However, it showed statistical similarity with application of 50% RDP + 50% P through PROM and 100% P through PROM treatments. Remaining at par with each other, these two treatments also increased the dry matter accumulation to the extent of 18.1 and 12.4 per cent at 35 DAS; 9.0 and 7.7 per cent at 70 DAS and 15.8 and 12.6 per cent at harvest stage over 100% RDP and 30.5 and 24.2 per cent at 35 DAS, 21.7 and 20.3 per cent at 70 DAS and 34.7 and 31.0 per cent over control in pooled analysis, respectively. Application of 75% RDP + 25% P through PROM and 100% RDP were noted as the next superior treatments in improving dry matter of the chickpea crop.

Liquid Organic Manures: Critical analysis of data further revealed that dry matter accumulation of crop at 70 DAS and at harvest stages was significantly improved due to foliar spray of all the liquid organic manures during the study in pooled analysis. But it remained unaffected at 35 DAS stage. Foliar spray of 3% panchgavya twice at 30 and 50 DAS recorded the highest mean dry matter of 59.7 and 133.6 g/m row length at 70 DAS and at harvest indicating a significant increase of 4.7 and 6.7 per cent over 10% cow urine and 11.4 and 17.2 per cent over control, respectively at these two stages. Foliar spray of 3% jeevamrit also increased the dry matter accumulation by margin of 0.9 and 7.3 per cent at 70 DAS and 1.2 and 11.1 per cent at harvest over 10% cow urine and control, respectively and thus was found statistically at par with panchgavya treatment. It was also found at par with 10% cow urine spray wherein, 6.3 and 9.8 per cent higher crop dry matter was obtained at these two stages than control, respectively.

This might be attributed to the beneficial effect of joint use of fertilizers and PROM, where PROM improved the physico-chemical properties of soil and enhanced microbial activity in the root zone of plant which ultimately resulted in more absorption of nutrients from the soil and supported mean vegetative growth as reported by Duraisami *et al.* (2001) [5]. Shaktawat *et al.*, (2004) [11] also reported similar results of significant improvement in vegetative growth of crop due to application of phosphate fertilizers and PROM in greengram. Yadav *et al.* (2017a) [16] also found that SSP + phosphocompost (PROM) recorded significantly higher plant height, dry matter accumulation/plant, number of branches/plant, number of total and effective nodules/plant, total chlorophyll content and LAI in mungbean in comparison to control, SSP and phosphocompost, alone. Khangarot *et al.* (2022) [7] results showed that values of growth attributing characters of mungbean viz., plant height, number of branches/plant and dry matter accumulation at all the stages, number and weight of root nodules/plant, CGR, LAI and chlorophyll content increased significantly under application of PROM and microbial inoculation treatments applied either alone or in different combinations. Combined application of PROM + PSB + VAM + PF resulted in the maximum values of most of the growth attributes.

Significant influence of panchgavya on increasing yield of chickpea might be also due to the fact that panchgavya contains ample amount of IAA and GA. When it was applied as foliar spray, it might have improved synthesis of growth promoting substances which in turn helped in enhancing growth and yield attributing characters and ultimately the seed yield (Kumar *et al.*, 2011) [8]. The results of the present study are in cognizance with the finding of Yadav *et al.* (2017b) [17] in chickpea and Bana (2025) [3] in groundnut.

Grain Yield

Phosphorus Management: Data on grain yield of chickpea as influenced due to different treatments of phosphorus management are given in table 1.2. Results showed that all the phosphorus management treatments involving varying combinations of PROM and SSP for supplying, 100% RDP, resulted in significant improvement in grain yield of chickpea in comparison to control. Pooled results showed that application of 25% RDP + 75% P through PROM produced the maximum grain yield of 1802 kg/ha indicating a significant increase of 6.9, 14.2, 25.6 and 48.4 per cent over 100% P through PROM, 75% RDP + 25% P through PROM, 100% RDP and control, respectively. However, it showed statistical equivalence with 50% RDP + 50% P through PROM, wherein, a corresponding increase of 2.9, 10.0, 20.9 and 42.9 per cent in grain yield was recorded. Application of 100% P through PROM and 75% RDP + 25% P through PROM produced the grain yield of 1686 and 1578 kg/ha and noted to be the next better and equally productive treatments. These treatments resulted in a quantum increase of 472 and 364 kg/ha, respectively over control. The extent of increase in grain yield due to application of 100% RDP over control was 18.2 per cent wherein the lower grain yield of 1214 kg/ha was obtained.

Liquid Organic Manures: Data presented in table 1.2 further indicated that all the liquid organic manures improved the grain yield of chickpea on their foliar application over control. Two foliar sprays of 3% panchgavya done at 30 and 50 DAS were the most effective and provided the highest grain yield during both the years as well as in pooled analysis. It gave a mean grain yield of 1767 kg/ha indicating a significant increase of 9.3, 12.7 and 30.9 per cent over 3% jeevamrit, 10% cow urine and control, respectively. Being at par with each other, two foliar sprays of 3% jeevamrit and 10% cow urine also registered significant increases of 19.7 and 16.2 per cent over control, respectively.

Straw Yield

Phosphorus Management: It can be inferred from the data presented in table 1.2 that straw yield of chickpea was also influenced in the same manner due to different phosphorus management treatments as was noted under grain yield. Every addition in proportion of PROM from 25% to 75% with RDP recorded significantly higher straw yield of chickpea than lower levels. Pooled results showed that application of 25% RDP + 75% P through PROM produced the maximum straw yield of 3097 kg/ha indicating a significant increase of 8.7, 13.2, 25.3 and 45.1 per cent over 100% P through PROM, 75% RDP + 25% P through PROM, 100% RDP and control, respectively. Application of 50% RDP + 50% P through PROM also registered a corresponding increase of 3.8, 8.2, 19.8 and 38.6 per cent in comparison to control and thus showed statistical equivalence with this treatment. Being at par with each other, application of 100% P through PROM (2850 kg/ha) and 75% RDP + 25% P through PROM (2735 kg/ha) resulted in a quantum increase of 715 and 600 kg/ha in straw yield over control and thus noted to be the next superior treatments in this regard. The extent of increase in straw yield due to 100% RDP was 15.7 per cent over control.

Liquid Organic Manures: Perusal of data presented in table 1.2 further showed that all the treatments of foliar spray of different liquid organic manures significantly improved the straw yield of chickpea than control. Two foliar sprays of 3% panchgavya done at 30 and 50 DAS provided the maximum straw yield of 2977 kg/ha in pooled analysis indicating a significant increase of 10.5 and 24.1 per cent over 10% cow urine and control, respectively.

However, it was found statistically at par with two spray of 3% jeevamrit (2762 kg/ha); wherein, a corresponding increase of 2.5 and 15.1 per cent was observed. Being at par with 3% jeevamrit, foliar spray of 10% cow urine also increased the straw yield by magnitude of 295 kg/ha over control.

Biological Yield

Phosphorus Management: It is obvious from data that biological yield of chickpea also followed the same trend due to different phosphorus management treatments as was noticed under grain and straw yield (Table 1.2). All the phosphorus management treatments resulted in significantly higher biological yield of crop in comparison to control in pooled analysis. The highest biological yield of 4898 kg/ha was obtained under application of 25% RDP + 75% P through PROM which was closely accompanied by 50% RDP + 50% P through PROM (4694 kg/ha). Remaining at par with each other, these two treatments improved the biological by magnitude of 13.5 and 8.8 per cent over P₂; 25.4 and 20.2 per cent over P₁ and 46.3 and 40.2 per cent over control, respectively. The application of 100% P through PROM and 75% RDP + 25% P through PROM also quantitatively increased the biological yield by margin of 1187 and 965 kg/ha over control in pooled analysis and thus were noted to be the next superior and equally productive treatments. Application of 100% RDP produced the biological yield of 3906 kg/ha which was higher by 16.6 per cent over control, wherein, the lowest biological yield of 3349 kg/ha was obtained.

Liquid Organic Manure: Further examination of the data (1.2) revealed that grain yield of chickpea was significantly increased due to foliar spray of all the liquid organic manures during both years of investigation and as well as pooled mean. The maximum biological yield of 4743 kg/ha was obtained under two foliar spray of 3% panchgavya treatment which was 8.3, 11.3 and 26.6 per cent more than recorded under 3% jeevamrit, 10% cow urine spray and control, respectively. Foliar application of 3% jeevamrit and 10% cow urine also enhanced the biological yield by 16.8 and 13.7 per cent, respectively over control and thus found as the next better and equally effective treatments in this regard.

The combined use of PROM and phosphate fertilizer might have enhanced nutrient availability by promoting micro faunal activity, which facilitates nutrient transformation. The greater availability of phosphorus under these situations might have also increased N-uptake due to synergistic relationship, leading to

enhanced growth and yield determining characters of the crop. Greater partitioning of assimilates, along with the efficient supply and translocation of metabolites towards reproductive structures (sink), encouraged optimal growth and development, ultimately improving yield-related traits in chickpea. Moreover, the favorable nutrient supply under judicious combination of PROM and inorganic fertilizer also stimulated chlorophyll synthesis in plant, thereby increasing carbohydrate metabolism. This positive effect resulted increased translocation of photosynthetic production towards sink of economic importance (seed), which resulted in formation of bold grains Rath *et al.* (2000) [10] in groundnut. The higher grain yield due to conjunctive application of PROM and phosphate fertilizer (SSP) can be attributed to the cumulative effects of growth and yield attributing traits like number of pods/plant, number of grains/pod and seed index. Significant and positive correlation existed between grain yield and important yield determining characters as discussed in preceding paragraph leads further support for higher grain yield recorded under to application of PROM. These results are in accordance with the findings of Srividya *et al.*, (2009) [13] in chickpea and Singh (2010) [12] in mungbean.

Liquid organic manures are increasing yield of chickpea might be also due to the fact that panchgavya contains ample amount of IAA and GA. When it was applied as foliar spray, it might have improved synthesis of growth promoting substances which in turn helped in enhancing growth and yield attributing characters and ultimately the seed yield (Kumar *et al.*, 2011) [8]. Patil (2012) have also reported positive effect of panchgavya on yield attributes and yield in chickpea. Further, foliar spray of other liquid manures like jeevamrit, cow urine in the present study also resulted significant increase in yield of chickpea over control. Increase in grain and straw yield due to application of liquid manures like panchgavya, jeevamrit and cow urine spray might be owing to the presence of growth promoting hormones and nutrients. Cow dung in panchgavya acts as a medium for growth of beneficial microbes and cow urine provides nitrogen which is essential for crop growth upon fermentation with other ingredients in panchgavya has beneficial effect on growth and yield (De Britto and Girija, 2006) [4]. Sutar *et al.*, (2019) [14] reported that Jeevamrit can release the nutrients in a more synchronized manner as per the requirement the crops, which helps in utilization of nutrients by plants resulting in better growth and yield in groundnut. The results of the present study are incognizance with the finding of Yadav *et al* (2017b) [17] in chickpea and Bana (2025) [3].

Table 1.1: Effect of phosphorus management and liquid organic manures on plant height, dry mater accumulation and number of branches per plant of chickpea at different stages (pooled data of two year)

Treatments	Plant height (cm)			Dry matter accumulation (g/m row length)			Number of branches/plant	
	35 DAS	70 DAS	At harvest	35 DAS	70 DAS	At harvest	70 DAS	At harvest
Phosphorus management								
P ₀ - Control	9.3	32.2	43.7	9.5	48.8	100.3	6.36	8.83
P ₁ - 100% RDP	10.1	36.1	47.1	10.5	54.5	116.7	7.61	9.68
P ₂ - 75% RDP + 25% P through PROM	10.5	37.6	49.5	11.8	58.3	125.8	8.01	10.30
P ₃ - 50% RDP + 50% P through PROM	11.6	39.6	52.5	12.4	59.4	135.1	8.27	10.68
P ₄ - 25% RDP + 75% P through PROM	11.5	39.0	51.1	12.4	62.0	140.0	8.49	10.96
P ₅ - 100% P through PROM	11.2	38.0	50.5	11.8	58.7	131.4	8.18	10.50
SEm ±	0.2	0.7	1.0	0.2	1.1	2.0	0.14	0.17
CD (P = 0.05)	0.6	2.0	2.8	0.6	3.4	6.0	0.42	0.49
Liquid organic manures								
L ₀ - Control	10.4	34.7	44.8	11.1	53.6	114.0	6.67	9.06
L ₁ - Cow urine	10.7	37.3	49.5	11.4	57.0	125.2	7.72	10.11
L ₂ - Panchgavya	10.9	38.6	52.2	11.7	59.7	133.6	8.85	11.08
L ₃ - Jeevamrit	10.8	37.7	49.7	11.5	57.5	126.7	8.04	10.38
SEm ±	0.2	0.5	0.7	0.2	0.8	1.8	0.12	0.14
CD (P = 0.05)	NS	1.5	2.0	NS	2.3	5.0	0.34	0.40

Table 1.2: Effect of phosphorus management and liquid organic manures on grain, straw and biological yield of chickpea and harvest index

Treatments	Grain yield (kg/ha)			Straw yield (kg/ha)			Biological yield (kg/ha)			Harvest index (%)		
	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled
Phosphorus management												
P ₀ - Control	1182	1246	1214	2097	2172	2135	3280	3418	3349	36.02	36.41	36.22
P ₁ - 100% RDP	1368	1502	1435	2372	2570	2471	3740	4072	3906	36.55	36.84	36.69
P ₂ - 75% RDP + 25% P through PROM	1504	1652	1578	2624	2846	2735	4128	4499	4314	36.41	36.68	36.54
P ₃ - 50% RDP + 50% P through PROM	1656	1814	1735	2848	3070	2959	4504	4883	4694	36.75	37.09	36.92
P ₄ - 25% RDP + 75% P through PROM	1719	1884	1802	2982	3212	3097	4701	5096	4898	36.54	36.92	36.73
P ₅ - 100% P through PROM	1606	1766	1686	2732	2968	2850	4339	4734	4536	36.99	37.26	37.12
SEm ±	40	41	29	65	73	49	113	128	85	0.98	0.89	0.66
CD (P = 0.05)	127	131	85	203	230	144	357	403	252	NS	NS	NS
CV (%)	9.29	8.74	-	8.57	9.01	-	9.54	9.95	-	9.27	8.39	-
Liquid organic manures												
L ₀ - Control	1324	1375	1350	2355	2442	2399	3679	3817	3748	35.96	36.00	35.98
L ₁ - Cow urine	1495	1641	1568	2599	2789	2694	4094	4430	4262	36.49	37.02	36.75
L ₂ - Panchgavya	1664	1869	1767	2828	3125	2977	4492	4994	4743	37.02	37.40	37.21
L ₃ - Jeevamrit	1541	1691	1616	2655	2869	2762	4196	4560	4378	36.70	37.06	36.88
SEm ±	26	29	23	48	53	42	76	86	68	0.72	0.69	0.57
CD (P = 0.05)	74	84	65	139	153	116	217	246	190	NS	NS	NS
CV (%)	7.22	7.51	-	7.85	8.04	-	7.79	8.16	-	8.36	7.93	-

Conclusion

Application of 25% RDP + 75% P through PROM was found as the most effective phosphorus management practice in chickpea wherein, the maximum grain yield (1802 kg/ha), straw yield (3097 kg/ha) and net returns (₹ 65100 /ha) was obtained. Application of 50% RDP + 50% P through PROM was found equally effective and the next better phosphorus management option. Two foliar spray of 3% panchgavya done at 30 and 50 DAS was found as the most productive and remunerative liquid organic manure treatment which was obtained highest grain (1767 kg/ha) and straw yield (2977 kg/ha) of chickpea and maximizing the net returns (₹ 62524/ha) than other treatments.

References

- Anonymous. Agricultural statistics at a glance 2024. New Delhi: Ministry of Agriculture and Farmers Welfare, Government of India; 2024. Available from: [www.agriwelfare.gov.in](http://desagri.gov.in/latest2024); <http://desagri.gov.in/latest2024>
- Anonymous. Rajasthan agriculture statistics at a glance 2022-23. Jaipur: Commissionerate of Agriculture, Rajasthan; 2023. p. 1-84.
- Bana RC. Response of groundnut (*Arachis hypogaea* L.) to integrated phosphorus management and liquid organic manures [PhD thesis]. Jobner: S.K.N. College of Agriculture, Sri Karan Narendra Agriculture University; 2025.
- De Britto JA, Girija SL. Investigation on the effect of organic and inorganic farming methods on blackgram and greengram. Indian Journal of Agricultural Research. 2006;40(3):204-207.
- Duraisami VP, Mani AK, Thilagavathi T. Effect of sources and levels of phosphorus and P solubilizers on yield and nutrient uptake in rainfed greengram. Annals of Arid Zone. 2001;40(1):43-48.
- Fisher RA. Statistical methods for research workers. Edinburgh (UK): Oliver and Boyd; 1950. p. 57-63.
- Khargarot AK, Yadav SS, Shyanabhoga SP, Verma RS, Jakhar R, Bhawariya A. Effect of RPOM and microbial inoculants on growth, yield and nutrient uptake of mungbean [*Vigna radiata* (L.) Wilczek]. Legume Research. 2022;45(6):756-761.
- Kumar RS, Ganesh P, Tharmaraj K, Saranraj P. Growth and development of blackgram (*Vigna mungo*) under foliar application of panchagavya as organic source of nutrient. Journal of Current Botany. 2011;2(3):9-11.
- Panse VG, Sukhatme PV. Statistical methods for agricultural workers. 4th ed. New Delhi: Indian Council of Agricultural Research; 1985. p. 14-33.
- Rath BS, Paikera RK, Barik KL. Response of rabi groundnut to sources and levels of phosphorus in red and lateritic soils of inland district of Orissa. Legume Research. 2000;23(3):167-169.
- Shaktawat MS, Verma A, Mathur V. Response of greengram to PROM on farmers' field. In: PROM Review 2004. Udaipur: Phosphate Research and Development Centre, Rajasthan State Mines and Minerals Limited; 2004. p. 41-46.
- Singh K. Response of mungbean to different sources and levels of phosphorus under rainfed condition [MSc thesis]. Bikaner: Swami Keshwanand Rajasthan Agricultural University; 2010.
- Srividya S, Prasad PVN, Srinivas RV, Veeraraghuviah R. Influence of alternate source of phosphorus to conventional sources on the yield attributes and yield of chickpea. Legume Research. 2009;32(3):218-219.
- Sutar R, Sujith GM, Devakumar N. Growth and yield of cowpea (*Vigna unguiculata* L. Walp.) as influenced by jeevamrit and panchagavya application. Legume Research. 2019;42(6):824-828.
- Umadevi M, Ganesan NM. Analysis for yield and quality characters in blackgram (*Vigna mungo*). Legume Research. 2007;30(3):197-200.
- Yadav JK, Sharma M, Yadav RN, Yadav SK, Yadav S. Effect of different organic manures on growth and yield of chickpea (*Cicer arietinum* L.). Journal of Pharmacognosy and Phytochemistry. 2017;6(5):1857-1860.
- Yadav KR, Manohar RS, Kumawat SR, Yadav VK. Effect of phosphorus sources and phosphorus solubilizing microorganism on growth and yield of mungbean (*Vigna radiata* L. Wilczek). Chemical Science Review and Letters. 2017;6(22):1152-1155.