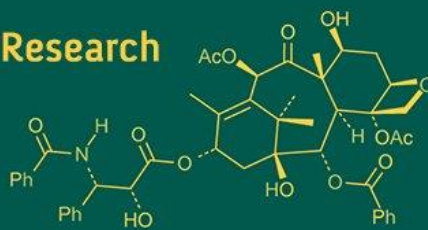


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Effect of phosphorus management on productivity of chickpea (*Cicer arietinum* L.)

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Abstract

A field experiment entitled “Effect of phosphorus management on productivity of chickpea (*Cicer arietinum* L.)” conducted during Rabi 2025-26 at Agriculture farm, Suresh Gyan Vihar University, Jaipur on sandy loam soil. Application of 75% SSP + 25% through PROM significantly influenced the, number of pods per plant, number of seeds per pod, seed, straw & biological yield as compared to No phosphorus and Recommended dose of phosphorus through SSP and remained statistically at par with 50% SSP + 50% through PROM, 100% through PROM, 25% SSP + 75% through PROM, Nano DAP foliar spray 2% at 30 DAS, Nano DAP foliar spray 2% at 30 & 45 DAS, 50% SSP + 2% Nano DAP foliar spray and 50% SSP + 2% Nano DAP foliar spray at 30 & 45 DAS. Application of 75% SSP + 25% through PROM recorded the highest gross return (Rs. 146059/ha) and net return (Rs. 117219/ha).

Keywords: Gram, pod, phosphorus, seed, yield

Introduction

Pulses are the major source of protein for the predominantly vegetarian society of India. Chickpea (*Cicer arietinum*), often referred to as the queen of pulses, is a key crop grown worldwide due to its nutritional value and environmental benefits. Beyond its nutritional value, chickpea plays a vital role in crop rotation and sustainable agriculture by fixing nitrogen in the soil, thus improving soil fertility (Thakur *et al.*, 2021) [10]. India is the world's largest producer of chickpeas, which are cultivated across the world. It is cultivated in an area of 9.63 million ha around the world, with a total production of 11.37 million tons and annual production of 1180 kg/ha (DA&FW 2024-25). In Rajasthan total production of chickpea (2023-24) was 2.01 million tons from 1.82 million ha area with an annual production 1104 kg/ha (DES 2024-25, MOAF&W, GoI).

The application of conventional phosphatic fertilizer such as DAP and SSP is quite popular. However, some drawback is the application of DAP and SSP as a phosphatic fertilizers. These fertilizers contain P_2O_5 in water soluble form because of which plants can take up P readily. After application P is fixed in soil and become unavailable in presence of Fe, Al and Mn ions in acidic soils (pH below 5.5) and Ca and Mg ions in alkaline soils (pH below 7.0). With the development of technology to produce Phosphate Rich Organic Manure (PROM) has been increased in many folds and has made cheap, ecofriendly, and equally effective as water soluble sources of phosphorus, irrespective of soil types. Phosphate Rich Organic Manure (PROM) is a value-added product prepared from co-compositing of high-grade rock phosphate (34/74) with organic matter collected from various sources such as FYM, straw of paddy or wheat, press mud, karanj cake or waste from fruit industries and distillery etc. To enhancing the microbial activity and improve the efficiency of PROM, Phosphate Solubilizing Bacteria (PSB) and nitrogen fixing bacteria are added. Phosphate-rich organic manure (PROM) has emerged as a promising alternative, enhancing soil fertility and phosphorus availability while reducing reliance on synthetic fertilizers (Singh *et al.* 2025) [7].

Methods and Materials

A field experiment entitled “Effect of phosphorus management on productivity of chickpea (*Cicer arietinum* L.)” conducted during Rabi 2025-26 at Agriculture farm, Suresh Gyan

Vihar University, Jaipur on sandy loam soil. A field experiment entitled Performance of the Wheat-Based Intercropping System In Different Irrigation Scheduling conducted during Rabi 2025-26 at Agriculture farm, Suresh Gyan Vihar University, Jaipur on sandy loam soil. Geographically, the study area is located at 75°48'84" E longitude and 26°82'47" N latitude and this region falls under agro-climatic zone III A (Semi-arid Eastern Plain Zone) of Rajasthan. The experiment consisting ten treatments i.e. No phosphorus, Recommended dose of phosphorus through SSP, 50% SSP + 50% through PROM, 100% through PROM, 25% SSP + 75% through PROM, 75% SSP + 25% through PROM, Nano DAP foliar spray 2% at 30 DAS, Nano DAP foliar spray 2% at 30 & 45 DAS, 50% SSP + 2% Nano DAP foliar spray and 50% SSP + 2% Nano DAP foliar spray at 30 & 45 DAS. The total ten treatment combinations were tested in randomized block design with three replications.

Results and Discussion

The maximum number of pods per plant and seeds per pod were recorded with 75% SSP + 25% through PROM (40.33), which was significantly superior to No phosphorus and Recommended dose of phosphorus through SSP, and remained statistically at par with 50% SSP + 50% through PROM, 100% through PROM, 25% SSP + 75% through PROM, Nano DAP foliar spray 2% at 30 DAS, Nano DAP foliar spray 2% at 30 & 45 DAS, 50% SSP + 2% Nano DAP foliar spray and 50% SSP + 2% Nano DAP foliar spray at 30 & 45 DAS. Similar results were reported by Reddy and Umesha (2022). The maximum seed, straw and biological yield was recorded with 75% SSP + 25% through PROM (2222 kg/ha), which was significantly superior to No phosphorus and Recommended dose of phosphorus through SSP and remained statistically at par with 50% SSP + 50% through PROM, 100% through PROM, 25% SSP + 75% through PROM, Nano DAP foliar spray 2% at 30 DAS, Nano DAP foliar spray 2% at 30 & 45 DAS, 50% SSP + 2% Nano DAP foliar spray and 50% SSP + 2% Nano DAP foliar spray at 30 & 45 DAS. A perusal of the data indicated that stover yield varied significantly among the treatments. Yield of chickpea is primarily function of cumulative effect of various yield attributing traits like number of pods per plant and seed per pod, the higher value of these attributes can be assigned as the most probable reason for significantly higher seed yields. The maximum grain yield per plant as well as per hectare with optimum phosphorus rates was attributable to better nodulation and efficient functioning of nodule bacteria for fixation of nitrogen to be utilized by plants during seed development stage in the synthesis of protein which in turn led to increase in seed yield. These results confirm the earlier findings of Singh *et al.* (2018) [8] and Kumawat *et al.* (2020) [3] and Pushpalata *et al.* (2025) [5].

Application of 75% SSP + 25% through PROM recorded the highest gross return (Rs. 146059/ha) and net return (Rs. 117219/ha) superior to No phosphorus and Recommended dose of phosphorus through SSP, while it remained statistically at par with 50% SSP + 50% through PROM, 100% through PROM, 25% SSP + 75% through PROM, Nano DAP foliar spray 2% at 30 DAS, Nano DAP foliar spray 2% at 30 & 45 DAS, 50% SSP + 2% Nano DAP foliar spray and 50% SSP + 2% Nano DAP foliar spray at 30 & 45 DAS. The improvement in B:C ratio under 75% SSP + 25%

through PROM, 50% SSP + 50% through PROM and 25% SSP + 75% through PROM over No phosphorus was to the extent of 158.60, 142.68 and 87.26 percent, respectively. This was due to lower cost incurred for 75% SSP + 25% through PROM and higher yield recorded under respective treatment ultimately reflected into higher net return and benefit cost ratio. Similar results were also reported by Sivamurugan *et al.* (2018) [9] and Parasher and Sharma (2024) [4].

Table 1: Effect of phosphorus management on yield attributes

Treatments	No. of pods/plant	No. of seeds/pod
No phosphorus	30.33	1.11
Recommended dose of phosphorus through SSP	35.00	1.33
50% SSP + 50% through PROM	39.00	1.66
100% through PROM	38.00	1.55
25% SSP + 75% through PROM	39.33	1.44
75% SSP + 25% through PROM	40.33	1.89
Nano DAP foliar spray 2% at 30 DAS	38.00	1.33
Nano DAP foliar spray 2% at 30 & 45 DAS	38.67	1.55
50% SSP + 2% Nano DAP foliar spray	36.67	1.44
50% SSP + 2% Nano DAP foliar spray at 30 & 45 DAS	37.67	1.55
SEm±	1.17	0.10
CD (P 0.05%)	3.47	0.29

Table 2: Effect of phosphorus management on yields (kg/ha)

Treatments	Seed yield	Stover yield	Biological yield
No phosphorus	1100	1600	2700
Recommended dose of phosphorus through SSP	1563	2378	3942
50% SSP + 50% through PROM	2118	3007	5125
100% through PROM	1783	2642	4425
25% SSP + 75% through PROM	1733	2600	4333
75% SSP + 25% through PROM	2222	3099	5322
Nano DAP foliar spray 2% at 30 DAS	1583	2375	3958
Nano DAP foliar spray 2% at 30 & 45 DAS	1650	2475	4125
50% SSP + 2% Nano DAP foliar spray	1915	2873	4788
50% SSP + 2% Nano DAP foliar spray at 30 & 45 DAS	2024	3036	5059
SEm±	63	96	154
CD (P 0.05%)	188	287	458

Table 3: Effect of phosphorus management on economics (Rs/ha)

Treatments	Economics (Rs/ha)		
	Gross return	Net return	B: C
No phosphorus	72625	44375	1.57
Recommended dose of phosphorus through SSP	103738	74928	2.60
50% SSP + 50% through PROM	139450	110440	3.81
100% through PROM	117979	88729	3.03
25% SSP + 75% through PROM	114833	85703	2.94
75% SSP + 25% through PROM	146059	117219	4.06
Nano DAP foliar spray 2% at 30 DAS	104896	73646	2.36
Nano DAP foliar spray 2% at 30 & 45 DAS	109313	75063	2.19
50% SSP + 2% Nano DAP foliar spray	126891	95381	3.03
50% SSP + 2% Nano DAP foliar spray at 30 & 45 DAS	134068	111061	3.22
SEm±	4133	4462	0.14
CD (P 0.05%)	12279	13257	0.43

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