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Sakshi Shinde

M.Sc. Student, Department of Soil
Science, Dr. P. D. K. V., Akola,
Maharashtra, India

Mohammad Sajid

Assistant Professor, Soil Science
Section, College of Agriculture, Dr.
P. D. K. V., Akola, Maharashtra,
India

SM Bhoyar

Associate Dean, College of
Agriculture, Dr. P. D. K. V.,
Akola, Maharashtra, India

BA Sonune

Assistant Professor, Department of
Soil Science, Dr. P. D. K. V.,
Akola, Maharashtra, India

Effect of application of nano phosphorus on growth characters of soybean (*Glycine max* L.)

Sakshi Shinde, Mohammad Sajid, SM Bhoyar and BA Sonune

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Abstract

A field experiment entitled “Influence of nano phosphorus on growth and yield of soybean” was conducted during Kharif 2025–26 at the Research Farm of the Department of Soil Science, Dr. PDKV, Akola. Nano phosphorus was synthesized through a biogenic approach. The synthesized Nano P was used for seed treatment and foliar application in the field experiment. The experiment comprised eleven treatments, replicated three times in a randomized block design. The results indicated that Nano P application improved plant height, number of branches and leaves plant⁻¹, dry matter accumulation, leaf area, chlorophyll content, number of pods plant⁻¹, number of nodules plant⁻¹ and nodule dry weight. Among the treatments, T₁₁ recorded superior growth and nodule count, whereas T₁ recorded the lowest values for most parameters. The improved performance under combined Nano P application may be attributed to enhanced phosphorus availability, nutrient uptake and photosynthetic activity.

Keywords: Soybean, RDF, nano phosphorus, nano DAP, foliar application, dry matter accumulation.

Introduction

Oilseed crops are an important group of agricultural plants cultivated primarily for their seeds, which are rich in edible oils and proteins. Soybean (*Glycine max*) belongs to the *Fabaceae* family which is a legume crop. Its nutritive values have been considered utmost as it contains protein (37%–48%) and oil (16%–21%) depending upon the variety and agronomic practices during production. It is grown mainly as kharif season rainfed crop. In India, soybean is predominantly cultivated in the states of Madhya Pradesh, Maharashtra, Rajasthan, Karnataka, Telangana, and Gujarat. Among these, Madhya Pradesh occupies the largest area under soybean cultivation, followed by Maharashtra and Rajasthan. According to the Second Advance Estimates of the Ministry of Agriculture and Farmers Welfare, Government of India, soybean production during 2025–26 is projected at 127.20 lakh tonnes, which is lower than the 151.80 lakh tonnes recorded in 2024–25 (Anonymous, 2026).

Nanotechnology is an emerging and rapidly advancing field of science that offers immense opportunities in agriculture and biotechnology. Nano-fertilizers have emerged as a promising tool for sustainable agriculture as they improve nutrient use efficiency and reduce nutrient losses (Siddiqui *et al.*, 2015) [13]. Conventional soil application of fertilizers often faces limitations due to nutrient fixation in the soil and losses through leaching, which decrease nutrient availability to plants (Alshaal and El-Ramady, 2017) [1]. In addition, restricted root growth can further limit nutrient uptake by crops (Trobisch and Schilling, 1970) [14].

Phosphorus (P) is an essential macronutrient involved in energy transfer, nucleic acid synthesis, membrane formation, root development, flowering, and seed production. However, conventional P fertilizers have low use efficiency because applied P is rapidly immobilized in soil, with only about 15–30% generally taken up by crops in the first season. The remaining P becomes unavailable through fixation by calcium, iron, and aluminium, while excess P losses can contribute to eutrophication. Phosphorus nano-fertilizers (P-nFs) improve phosphorus availability and use efficiency due to their small particle size, high surface area, and controlled nutrient release. They can enhance P uptake, reduce fixation, leaching, and runoff, and provide sustained nutrient availability to crops.

Corresponding Author:

Sakshi Shinde

M.Sc. Student, Department of Soil
Science, Dr. P. D. K. V., Akola,
Maharashtra, India

Foliar application of nano-fertilizers helps overcome these constraints by providing rapid nutrient absorption and quick correction of nutrient deficiencies, thereby improving crop yield and quality (Roemheld and El-Fouly, 1999) [9]. By supplying nutrients directly to the leaves, foliar nutrition reduces nutrient losses caused by soil fixation and leaching and improves nutrient availability to plants. The use of smaller quantities of fertilizers through foliar application not only enhances nutrient uptake efficiency but also minimizes environmental hazards such as groundwater pollution and eutrophication.

Materials and Methods

Experimental details

The field experiment was conducted during the Kharif season of 2025-2026 at the Research Farm of the Department of Soil Science, Dr. PDKV, Akola. The experiment was conducted in a Randomized Block Design (RBD) with three replications and comprised eleven treatments viz, T₁: Control (absolute control), T₂: RDF (30:60:30), T₃: seed treatment with Nano P with 4 ml kg⁻¹ seed + foliar spray with IFFCO Nano DAP with 4 ml L⁻¹ at 30 and 60 DAS, T₄: seed treatment with Nano P with 4 ml kg⁻¹ seed, T₅: seed treatment with Nano P with 6 ml kg⁻¹ seed, T₆: foliar spray with Nano P with 4 ml L⁻¹ at 30 and 60 DAS, T₇: foliar spray with Nano P with 6 ml L⁻¹ at 30 and 60 DAS, T₈: seed treatment with Nano P with 4 ml kg⁻¹ seed + foliar spray with Nano P with 4 ml L⁻¹ at 30 and 60 DAS, T₉: seed treatment with Nano P with 4 ml kg⁻¹ seed + foliar spray with Nano P with 6 ml L⁻¹ at 30 and 60 DAS, T₁₀: seed treatment with Nano P with 6 ml kg⁻¹ seed + foliar spray with Nano P with 4 ml L⁻¹ at 30 and 60 DAS, and T₁₁: seed treatment with Nano P with 6 ml kg⁻¹ seed + foliar spray with Nano P with 6 ml L⁻¹ at 30 and 60 DAS, respectively were laid out in plots of 4.20 X 2.25 m² replicated thrice. The experimental soil was alkaline in reaction (pH 8.41) and non-saline, with an electrical conductivity of 0.18 d S m⁻¹. The soil was low in organic carbon (4.26 g kg⁻¹) and available nitrogen (211 kg ha⁻¹), medium in available phosphorus (14.30 kg ha⁻¹), high in available potassium (326 kg ha⁻¹), and deficient in available sulphur (7.35 mg kg⁻¹). The available micronutrient status of the soil was 0.62 mg kg⁻¹ Zn, 5.69 mg kg⁻¹ Fe, 7.72 mg kg⁻¹ Mn, and 2.46 mg kg⁻¹ Cu. The recommended dose of fertilizer (RDF) was 30:60:30 kg NPK kg ha⁻¹. Phosphorus was supplied through Nano P in all treatments except the absolute control and RDF treatment. The recommended doses of nitrogen and potassium were applied to treatments T₃ to T₁₁ along with the respective Nano P treatments. Soybean variety PDKV Amba was sown on 01 July 2025 at a spacing of 45 × 10 cm. Growth parameters, including plant height, number of branches, number of leaves, dry matter accumulation, leaf area, Chlorophyll content and number of pods plant⁻¹, were recorded at 30, 45 and 60 DAS and at harvest.

Results and Discussion

Plant height per plant

The data on plant height at different growth stages are presented in Table 1. At 30 DAS, the maximum plant height (18.40 cm) was recorded with seed treatment with Nano P @ 6 ml kg⁻¹ seed + foliar spray with Nano P @ 6 ml L⁻¹ at 30 and 60 DAS, which was statistically at par with the recommended dose of fertilizer (RDF) @ 30:60:30 NPK kg ha⁻¹ (18.23 cm), while the minimum plant height (15.53 cm) was recorded under the absolute control. At 45 DAS, the highest plant height (27.38 cm) was recorded with seed treatment with Nano P @ 6 ml kg⁻¹ seed + foliar spray with Nano P @ 6 ml L⁻¹ at 30 and 60 DAS, followed by RDF @ 30:60:30 kg ha⁻¹ (26.85 cm), whereas the lowest plant height (19.62 cm) was observed under the absolute control. At 60 DAS,

plant height ranged from 23.63 to 31.10 cm, with the maximum (31.10 cm) recorded with seed treatment with Nano P @ 6 ml kg⁻¹ seed + foliar spray with Nano P @ 6 ml L⁻¹ at 30 and 60 DAS, followed by RDF @ 30:60:30 kg ha⁻¹ (30.45 cm), while the minimum (23.63 cm) was recorded under the absolute control. The higher plant height under combined seed and foliar application of Nano P may be attributed to improved phosphorus availability, enhanced nutrient uptake and greater photosynthetic activity, which promoted vegetative growth. Similar findings were reported by Shaikh *et al.* (2024) [11] and Rashmi and Prakash (2018) [8].

Number of branches per plant

The data pertaining to the number of branches per plant at different growth stages are presented in Table 2. At 30 DAS, the number of branches per plant did not differ significantly among the treatments. The maximum number of branches (2.10 plant⁻¹) was recorded under T₁₁ (seed treatment with Nano P @ 6 ml kg⁻¹ seed + foliar application of Nano P @ 6 ml L⁻¹ at 30 and 60 DAS), followed by T₁₀ and T₈ (2.01 plant⁻¹ each), whereas the minimum (1.63 plant⁻¹) was observed under T₁ (absolute control). At 45 DAS, the significantly highest number of branches (3.24 plant⁻¹) was recorded under T₁₁, which was statistically at par with T₂ (RDF: 30:60:30 kg N₂P₂O₅ ha⁻¹) (3.08 plant⁻¹). A similar trend was observed at 60 DAS, where T₁₁ recorded the maximum number of branches (3.61 plant⁻¹), followed by T₂ (3.42 plant⁻¹), whereas the minimum (2.19 plant⁻¹) was recorded under T₅. The increased number of branches under T₁₁ may be attributed to improved phosphorus availability through combined seed treatment and foliar application, which promoted root development, nutrient uptake and vegetative growth, resulting in greater branch formation. The present findings are in agreement with Gondhale *et al.* (2024) [4].

Number of leaves per plant

The results pertaining to the number of leaves per plant at different growth stages are presented in Table 3. At 30 DAS, the highest number of leaves (7.87 plant⁻¹) was recorded under T₁₁ (seed treatment with Nano P @ 6 ml kg⁻¹ seed + foliar application of Nano P @ 6 ml L⁻¹ at 30 and 60 DAS), whereas the lowest (6.37 plant⁻¹) was observed under T₇; however, the differences were non-significant. At 45 DAS, T₁₁ recorded the significantly highest number of leaves (14.53 plant⁻¹), which was statistically at par with T₂ (RDF: 30:60:30 kg N₂O₅O ha⁻¹) (14.43 plant⁻¹), while the lowest (10.00 plant⁻¹) was recorded under T₁ (absolute control). Similarly, at 60 DAS, the maximum number of leaves was recorded under T₁₁ (23.80 plant⁻¹), followed by T₂ (23.73 plant⁻¹), whereas the minimum (17.87 plant⁻¹) was observed under T₁. The higher leaf production under T₁₁ may be attributed to improved phosphorus availability, nutrient uptake, photosynthetic activity and vegetative growth. Similar findings were reported by Prakash *et al.* (2023) [7].

Leaf area (cm²) per plant

The data on leaf area at different growth stages are presented in Table 4. At 30 DAS, leaf area was not significantly influenced by the different Nano P treatments and ranged from 21.73 to 28.13 cm² plant⁻¹. The maximum leaf area (28.13 cm² plant⁻¹) was recorded under T₁₁ (seed treatment with Nano P @ 6 ml kg⁻¹ seed + foliar application of Nano P @ 6 ml L⁻¹ at 30 and 60 DAS), whereas the minimum (21.73 cm² plant⁻¹) was observed under T₇. At 45 DAS, T₁₁ recorded the significantly highest leaf area (34.15 cm² plant⁻¹), which was statistically at par with T₂ (RDF: 30:60:30 kg N₂O₅O ha⁻¹) (33.48 cm² plant⁻¹), while the lowest (25.84 cm² plant⁻¹) was recorded under T₁ (absolute control). A similar trend

was observed at 60 DAS, where T₁₁ recorded the maximum leaf area (37.07 cm² plant⁻¹), followed by T₂ (36.53 cm² plant⁻¹), whereas the minimum (29.20 cm² plant⁻¹) was observed under T₁. The higher leaf area under T₁₁ may be attributed to efficient utilization of phosphorus supplied through both seed treatment and foliar application, which promoted leaf expansion and photosynthetic activity. Similar findings were reported by Rteba (2026) ^[10].

Chlorophyll content per plant

The data on chlorophyll content at different growth stages are presented in Table 5. At 30 DAS, chlorophyll content was not significantly influenced by the Nano P treatments. The highest value (35.52) was recorded under T₁₁ (seed treatment with Nano P @ 6 ml kg⁻¹ seed + foliar application of Nano P @ 6 ml L⁻¹ at 30 and 60 DAS), followed by T₂ (35.01), while the lowest (28.60) was observed under T₁ (absolute control). At 45 DAS, T₁₁ recorded the significantly highest chlorophyll content (36.57), which was statistically at par with T₂ (35.61). Similarly, at 60 DAS, the maximum chlorophyll content was recorded under T₁₁ (42.61), followed by T₂ (41.73), whereas the minimum (35.20) was observed under T₁. The higher chlorophyll content under T₁₁ may be attributed to improved phosphorus availability through combined seed treatment and foliar application, resulting in better nutrient uptake and photosynthetic activity. Similar findings were reported by Shivu *et al.* (2026) ^[12].

Dry matter accumulation

The data on dry matter accumulation per plant at different growth stages are presented in Table 6. At 30 DAS, dry matter accumulation varied from 2.09 to 3.38 g plant⁻¹. The highest accumulation was recorded under T₁₁ (seed treatment with Nano P @ 6 ml kg⁻¹ seed + foliar application of Nano P @ 6 ml L⁻¹ at 30 and 60 DAS) (3.38 g plant⁻¹), followed by T₂ (3.23 g plant⁻¹);

however, the differences among treatments were non-significant. At 45 DAS, T₁₁ recorded the significantly highest dry matter accumulation (5.95 g plant⁻¹) and remained statistically at par with T₂, T₄, T₇, T₈ and T₁₀, whereas the lowest value was observed under T₁ (absolute control) (3.49 g plant⁻¹). The same trend continued at 60 DAS and harvest, where T₁₁ recorded the highest dry matter accumulation of 10.54 and 15.54 g plant⁻¹, respectively, and remained at par with several treatments, including T₂. In contrast, the absolute control consistently recorded the lowest dry matter accumulation. The greater biomass production under T₁₁ could be associated with the combined effect of early phosphorus availability through seed treatment and its subsequent supply through foliar application, which may have supported root development, photosynthesis and translocation of assimilates, ultimately resulting in greater dry matter production. Similar results were reported by Devi and Meena (2023) ^[3] and Jaybhay *et al.* (2021) ^[5].

Number of pods per plant

The number of pods per plant was significantly influenced by different nano phosphorus treatments. The significantly highest number of pods per plant (31.47) was recorded under T₁₁ (seed treatment with nano phosphorus @ 6 ml kg⁻¹ seed + foliar spray @ 6 ml L⁻¹ at 30 and 60 DAS), which was statistically at par with T₂ (RDF: 30:60:30 kg N:P₂O₅: K₂O ha⁻¹), recording 29.27 pods plant⁻¹. The lowest number of pods per plant (21.04) was recorded under the absolute control (T₁). This might be due to continuous supply of phosphorus through seed treatment and foliar application, which promoted better flowering, pod setting and reduced flower shedding. Improved phosphorus nutrition also enhanced photosynthetic activity and efficient translocation of photosynthates to developing reproductive organs, resulting in higher pod formation. Similar results were reported by Nget *et al.* (2022) ^[6].

Table 1: Effect of nano phosphorus on plant height of soybean

Tr. No.	Treatments	Plant height plant ⁻¹ (cm)		
		30 DAS	45 DAS	60 DAS
1	Control	15.53	19.62	23.63
2	RDF (30:60:30)	18.23	26.85	30.30
3	Seed treatment with 4ml per kg of seed and foliar spray with 4 ml Iffco Nano DAP per lit. at 30 and 60 DAS	16.37	22.74	27.17
4	Seed treatments with 4 ml nano P kg ⁻¹ of seed	16.63	22.48	26.83
5	Seed treatments with 6 ml nano P kg ⁻¹ of seed	15.77	21.53	25.77
6	Foliar spray with 4 ml nano P lit ⁻¹ at 30 and 60 DAS	16.67	22.30	26.63
7	Foliar spray with 6 ml nano P lit ⁻¹ at 30 and 60 DAS	15.90	23.05	27.50
8	Seed treatment with 4 ml kg ⁻¹ of seed and foliar spray with 4 ml nano P lit ⁻¹ at 30 and 60 DAS	16.80	22.90	26.93
9	Seed treatment with 4ml kg ⁻¹ of seed and foliar spray with 6 ml nano P lit ⁻¹ at 30 and 60 DAS	16.60	22.81	27.20
10	Seed treatment with 6 ml kg ⁻¹ of seed and foliar spray with 4 ml nano P lit ⁻¹ at 30 and 60 DAS	16.17	22.16	26.37
11	Seed treatment with 6 ml kg ⁻¹ of seed and foliar spray with 6ml nano P lit ⁻¹ at 30 and 60 DAS	18.40	27.38	31.10
	SE (m) ±	0.53	0.96	1.19
	CD5%	1.55	2.82	3.50

Table 2: Effect of nano phosphorus on No. of branches of soybean

Tr. No.	Treatments	No. of branches plant ⁻¹		
		30 DAS	45 DAS	60 DAS
1	Control	1.63	2.08	2.61
2	RDF (30:60:30)	1.95	3.08	3.42
3	Seed treatment with 4ml per kg of seed and foliar spray with 4 ml Iffco Nano DAP per lit. at 30 and 60 DAS	1.71	2.26	2.57
4	Seed treatments with 4 ml nano P kg ⁻¹ of seed	1.78	2.52	2.35
5	Seed treatments with 6 ml nano P kg ⁻¹ of seed	1.64	2.18	2.19
6	Foliar spray with 4 ml nano P lit ⁻¹ at 30 and 60 DAS	1.80	2.47	2.39
7	Foliar spray with 6 ml nano P lit ⁻¹ at 30 and 60 DAS	1.99	2.69	2.61
8	Seed treatment with 4 ml kg ⁻¹ of seed and foliar spray with 4 ml nano P lit ⁻¹ at 30 and 60 DAS	2.01	2.74	2.50
9	Seed treatment with 4ml kg ⁻¹ of seed and foliar spray with 6 ml nano P lit ⁻¹ at 30 and 60 DAS	1.92	2.58	2.43
10	Seed treatment with 6 ml kg ⁻¹ of seed and foliar spray with 4 ml nano P lit ⁻¹ at 30 and 60 DAS	2.01	2.71	2.40
11	Seed treatment with 6 ml kg ⁻¹ of seed and foliar spray with 6ml nano P lit ⁻¹ at 30 and 60 DAS	2.10	3.24	3.61
	SE (m) ±	0.13	0.15	0.17
	CD5%	NS	0.44	0.51

Table 3: Effect of nano phosphorus on No. of leaves of soybean

Tr. No.	Treatments	No. of leaves plant ⁻¹		
		30 DAS	45 DAS	60 DAS
1	Control	7.57	10.00	17.87
2	RDF (30:60:30)	7.80	14.43	23.73
3	Seed treatment with 4ml per kg of seed and foliar spray with 4 ml Iffco Nano DAP per lit. at 30 and 60 DAS	7.63	12.47	20.73
4	Seed treatments with 4 ml nano P kg ⁻¹ of seed	7.80	13.07	20.97
5	Seed treatments with 6 ml nano P kg ⁻¹ of seed	7.53	12.93	20.77
6	Foliar spray with 4 ml nano P lit ⁻¹ at 30 and 60 DAS	7.67	13.17	21.10
7	Foliar spray with 6 ml nano P lit ⁻¹ at 30 and 60 DAS	6.37	11.83	21.30
8	Seed treatment with 4 ml kg ⁻¹ of seed and foliar spray with 4 ml nano P lit ⁻¹ at 30 and 60 DAS	7.00	12.97	21.50
9	Seed treatment with 4ml kg ⁻¹ of seed and foliar spray with 6 ml nano P lit ⁻¹ at 30 and 60 DAS	7.63	13.18	21.33
10	Seed treatment with 6 ml kg ⁻¹ of seed and foliar spray with 4 ml nano P lit ⁻¹ at 30 and 60 DAS	7.20	13.17	20.90
11	Seed treatment with 6 ml kg ⁻¹ of seed and foliar spray with 6ml nano P lit ⁻¹ at 30 and 60 DAS	7.87	14.53	23.80
	SE (m) ±	0.29	0.45	0.72
	CD5%	NS	1.33	2.13

Table 4: Effect of nano phosphorus on leaf area of soybean

Tr. No.	Treatments	Leaf area (cm ²)		
		30 DAS	45 DAS	60 DAS
1	Control	23.93	25.84	29.20
2	RDF (30:60:30)	27.37	33.48	36.53
3	Seed treatment with 4ml per kg of seed and foliar spray with 4 ml Iffco Nano DAP per lit. at 30 and 60 DAS	25.17	28.63	30.70
4	Seed treatments with 4 ml nano P kg ⁻¹ of seed	26.43	30.27	31.63
5	Seed treatments with 6 ml nano P kg ⁻¹ of seed	26.93	30.06	30.53
6	Foliar spray with 4 ml nano P lit ⁻¹ at 30 and 60 DAS	25.80	29.41	31.07
7	Foliar spray with 6 ml nano P lit ⁻¹ at 30 and 60 DAS	21.73	29.78	31.57
8	Seed treatment with 4 ml kg ⁻¹ of seed and foliar spray with 4 ml nano P lit ⁻¹ at 30 and 60 DAS	26.10	30.84	31.40
9	Seed treatment with 4ml kg ⁻¹ of seed and foliar spray with 6 ml nano P lit ⁻¹ at 30 and 60 DAS	26.67	30.46	30.87
10	Seed treatment with 6 ml kg ⁻¹ of seed and foliar spray with 4 ml nano P lit ⁻¹ at 30 and 60 DAS	23.93	29.65	31.10
11	Seed treatment with 6 ml kg ⁻¹ of seed and foliar spray with 6ml nano P lit ⁻¹ at 30 and 60 DAS	28.13	34.15	37.07
	SE (m) ±	1.30	1.48	1.72
	CD5%	NS	4.37	5.09

Table 5: Effect of nano phosphorus on chlorophyll content of soybean

Tr. No.	Treatments	Chlorophyll content		
		30 DAS	45 DAS	60 DAS
1	Control	28.60	29.12	35.20
2	RDF (30:60:30)	35.01	35.61	41.73
3	Seed treatment with 4ml per kg of seed and foliar spray with 4 ml Iffco Nano DAP per lit. at 30 and 60 DAS	32.35	32.41	38.77
4	Seed treatments with 4 ml nano P kg ⁻¹ of seed	33.82	34.21	40.58
5	Seed treatments with 6 ml nano P kg ⁻¹ of seed	32.14	32.26	38.83
6	Foliar spray with 4 ml nano P lit ⁻¹ at 30 and 60 DAS	32.57	32.73	40.25
7	Foliar spray with 6 ml nano P lit ⁻¹ at 30 and 60 DAS	33.47	33.90	40.57
8	Seed treatment with 4 ml kg ⁻¹ of seed and foliar spray with 4 ml nano P lit ⁻¹ at 30 and 60 DAS	33.47	33.78	40.34
9	Seed treatment with 4ml kg ⁻¹ of seed and foliar spray with 6 ml nano P lit ⁻¹ at 30 and 60 DAS	32.48	32.95	39.24
10	Seed treatment with 6 ml kg ⁻¹ of seed and foliar spray with 4 ml nano P lit ⁻¹ at 30 and 60 DAS	32.77	33.62	40.61
11	Seed treatment with 6 ml kg ⁻¹ of seed and foliar spray with 6ml nano P lit ⁻¹ at 30 and 60 DAS	35.52	36.57	42.61
	SE (m) ±	1.20	1.21	1.26
	CD5%	NS	3.59	3.72

Table 6: Effect of nano phosphorus on dry matter accumulation of soybean

Tr. No.	Treatments	Dry matter accumulation (g) plant ⁻¹			
		30 DAS	45 DAS	60 DAS	At Harvest
1	Control	2.09	3.49	7.57	11.04
2	RDF (30:60:30)	3.23	5.19	9.73	14.73
3	Seed treatment with 4ml per kg of seed and foliar spray with 4 ml Iffco Nano DAP per lit. at 30 and 60 DAS	2.56	3.91	8.38	13.16
4	Seed treatments with 4 ml nano P kg ⁻¹ of seed	3.11	4.96	9.39	13.95
5	Seed treatments with 6 ml nano P kg ⁻¹ of seed	2.55	3.83	8.26	12.95
6	Foliar spray with 4 ml nano P lit ⁻¹ at 30 and 60 DAS	2.75	4.64	8.67	13.56
7	Foliar spray with 6 ml nano P lit ⁻¹ at 30 and 60 DAS	3.08	4.86	9.23	13.83
8	Seed treatment with 4 ml kg ⁻¹ of seed and foliar spray with 4 ml nano P lit ⁻¹ at 30 and 60 DAS	2.92	4.8	9.17	13.74
9	Seed treatment with 4ml kg ⁻¹ of seed and foliar spray with 6 ml nano P lit ⁻¹ at 30 and 60 DAS	2.67	4.52	8.53	13.53
10	Seed treatment with 6 ml kg ⁻¹ of seed and foliar spray with 4 ml nano P lit ⁻¹ at 30 and 60 DAS	2.87	4.79	8.71	13.60
11	Seed treatment with 6 ml kg ⁻¹ of seed and foliar spray with 6ml nano P lit ⁻¹ at 30 and 60 DAS	3.38	5.95	10.54	15.54
	SE (m) ±	0.29	0.32	0.45	0.70
	CD5%	NS	0.95	1.34	2.06

Table 7: Effect of nano phosphorus on No. of pods of soybean

Tr. No.	Treatments	No. of pods plant ⁻¹
1	Control	21.04
2	RDF (30:60:30)	29.27
3	Seed treatment with 4ml per kg of seed and foliar spray with 4 ml Iffco Nano DAP per lit. at 30 and 60 DAS	25.38
4	Seed treatments with 4 ml nano P kg ⁻¹ of seed	21.53
5	Seed treatments with 6 ml nano P kg ⁻¹ of seed	24.13
6	Foliar spray with 4 ml nano P lit ⁻¹ at 30 and 60 DAS	23.47
7	Foliar spray with 6 ml nano P lit ⁻¹ at 30 and 60 DAS	23.50
8	Seed treatment with 4 ml kg ⁻¹ of seed and foliar spray with 4 ml nano P lit ⁻¹ at 30 and 60 DAS	24.53
9	Seed treatment with 4ml kg ⁻¹ of seed and foliar spray with 6 ml nano P lit ⁻¹ at 30 and 60 DAS	21.60
10	Seed treatment with 6 ml kg ⁻¹ of seed and foliar spray with 4 ml nano P lit ⁻¹ at 30 and 60 DAS	24.50
11	Seed treatment with 6 ml kg ⁻¹ of seed and foliar spray with 6ml nano P lit ⁻¹ at 30 and 60 DAS	31.47
	SE (m) ±	2.04
	CD@5%	6.03

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