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STUDIES ON THE INFLUENCE OF PHOSPHATE RICH ORGANIC MANURE ON GROWTH, YIELD AND ECONOMICS OF SOYBEAN

KEYWORDS: Growth attributes, yield, Phosphate rich organic manure, nutrient uptake and Economics.

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ABSTRACT *An agronomic investigation to study influence of phosphate rich organic manure on growth and yield of soybean was conducted at the Agronomy Farm of Dr. Panjabrao DeshmukhKrishiVidyapeeth, Akola in randomized block design with seven treatments and three replications during kharif season of the year- 2013.The growth parameters such as plant height, Number of branches and Dry matter per plant were significantly improved with the treatment of 100% P (DAP) and 100% P (SSP).Significantly higher values of yield attributes viz. number of pods per plant, seed yield per plant and test weight were registered with the treatment 100% P (DAP) which was closely followed by treatment 100% P (SSP). Highest seed yield (27.81 q/ha) and straw yield (36.21) of soybean and maximum gross return (Rs113420 /-) and net return (Rs84210 /-) were also recorded in treatment of 100% P (DAP) with highest B:C ratio of 3.88. It was also found responsible for highest uptake of N, P and K by soybean crop.*

Introduction

India has made spectacular breakthrough in production and consumption of fertilizers during the last four decades. But consumption of renewable form of energy (chemical fertilizers) will be quite a limiting factor for increasing agriculture production in future. Because of escalating energy cost, chemical fertilizers are not available at affordable prices to the farmers. Moreover, the unbalanced and continuous use of chemical fertilizers is leading to a reduction in the crop yields and results in imbalance of nutrients in the soil which has adverse effects on soil health.

Although, NPK chemical fertilizers are playing a crucial role to meet the nutrient requirement of the crop, persistent nutrient depletion is posing a greater threat to sustainable agriculture. Therefore, there is an urgent need to reduce the usage of NPK chemical fertilizers and in turn increase the usage of organics. Use of organic manure alone or in combination with chemical fertilizers, helps in improving physico-chemical properties of the soil, improves the efficient utilization of applied fertilizers resulted in higher seed yield and quality. Legumes may be able to liberate more P from rock phosphate with rhizosphere acidification during N_2 fixation, converting it in to available forms in the soil as well as incorporating it as biomass (Vanlauwe *et al.*, 2000). Phosphocompost are phosphorous-enriched composts, made with rock phosphate and a range of organic materials. Phosphocompost have been

shown to be an effective way to incorporate rock phosphate with various organic nitrogen sources

while improving soil structure. The mineralization of insoluble P forms by organic acids is the major advantage of composting rock phosphate.

In this study different sources of phosphorous such as SSP, DAP along with phosphate rich organic manure are used to meet phosphorous requirement of the crop.

Materials and Methods

A field experiment was conducted at Agronomy Farm of Dr.Panjabrao Deshmukh KrishiVidyapeeth, Akola in *kharif* season of the year 2013 in randomized block design with seven treatments replicated thrice. The experimental site was located at 77^0 02' E longitudes and $20^0$42' N latitude with average annual rainfall of 950 mm. The soil of experimental field was clayey and slightly alkaline in reaction with pH 7.8 with low available N (175 kg/ha), medium P (15.98 kg/ha) and high in K (360.25 kg/ha).The gross and net plot sizes were 4.5 m x 5.4 m and 3.6 m x 4.5 m, respectively. The soybean variety *'JS- 335'* was sown at 45cm X 5cm spacing on 28th June of year 2013.Treatment consist of application of phosphorous through three sources viz., SSP, DAP and PROM and their combinations alongwith the common dose of nitrogen and potassium through urea and MOP. Application of100% P (SSP), 100% P (DAP) 100% P (PROM), 75% P (PROM) + 25% P (DAP), 75% P (PROM) + 25% P (SSP), 50% P (PROM) + 50% P (DAP) and 50% P (PROM) + 50% P (SSP).Soybean crop was fertilized with 30: 75: 30 NPK kg ha^{-1}. The dose of nitrogen and potassium was applied treatment wise at the time of sowing through urea and murriate of potash. Phosphorous application was done as per the treatments at the time of sowing through the three sources namely single super phosphate (SSP), diammonium phosphate (DAP) and PROM (swadesh phosphate).Protective irrigations were given to crop whenever dry spells appeared during the crop growth. Other plant protection practices for disease and pest control were also applied in similar manner for all the treatments. Data collected was statistically analysed by adopting standard procedure of analysis of variance by Panse and Sukhatme (1971). Regular biometric observations were recorded at regular interval during the crop growth.

Results and Discussion

Effect on growth and yield attributing characters, yield and economics

Different treatments were found to be significantly affecting to various growth and yield attributing characters in soybean. Treatment T2 (100% P (DAP)) and T1 (100% P (SSP)) recorded significantly higher plant height as compared to other phosphate management treatments at all

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the growth stages might be due to the more availability of phosphorous through chemical fertilizers. The increase in plant height can reasonably be attributed to increased cell division and their elongation stimulated by adequate phosphorous availability. Similar results were reported by Nagendra Kumar (2005), Mahesh Babu (2007). The increase in dry matter came through better root development, which resulted in healthy crop growth and higher photosynthetic area due to increased leaf area. Also, the phosphorous supply augments nitrogen supply at critical growth stages like flowering and pod development through symbiotically fixed nitrogen which results better vegetative growth as well as pod development. These results corroborate the findings of Prasad et al. (1991). Treatment T2-100% P (DAP) was recorded highest pods per plant, seed per pod ,seed per plant ,Test weight ,seed yield ,straw yield per hectare ,gross return, net return and B:C ratio as compared with other treatment. The improvement in yield and yield attributes due to phosphorous in soybean was also reported by earlier workers. Umale et al. (2002), Sharma et al. (2002), Mahesh Babu et al. (2008), Kale et al. (2010).

Nutrient Uptake by crop

Highest uptake of N, P and K per hectare by soybean crop was observed with application of 100% P (DAP)however it was on par withtreatment 100% P (SSP).The lowest N, P and K per hectare was observed with treatment 100% P (PROM).

Table 1.Effect of different weed control treatments on various growth and yield attributing characters, yield and economics of soybean

Treatment	Plant height at 60 DAS (cm)	Plant dry matter at 60 DAS (g)	Number of pods plant-1	Number of seeds pod-1	Seed yield (g) plant-1	Test wt (g)	Seed yield (q ha-1)	Straw yield (q ha-1)	Cost of cultivation (Rs ha-1)	Gross monetary returns(Rs ha-1)	NMR (Rs ha-1)	B:C ratio
T_1 - 100% P (SSP)	43.93	14.72	50.27	2.74	8.88	15.80	27.17	34.09	27908	105939	78031	3.80
T_2 - 100% P (DAP)	45.97	14.93	56.20	2.92	9.04	15.90	27.81	36.21	29210	113420	84210	3.88
T_3 - 100% P (PROM)	40.04	13.54	42.73	2.01	4.37	13.63	20.18	28.37	36632	82844	46211	2.26
T_4 - 75% P (PROM) + 25% P (DAP)	40.22	13.82	49.00	2.62	6.64	14.20	22.42	32.69	34776	94628	59852	2.72
T_5 - 75% P (PROM) + 25% P (SSP)	40.44	13.59	44.60	2.39	5.74	14.34	20.24	31.33	34352	83117	48764	2.42
T_6 - 50% P (PROM) + 50% P (DAP)	42.67	14.10	50.00	2.73	7.19	15.80	27.01	33.86	33043	105600	72556	3.20
T_7 - 50% P (PROM) + 50% P (SSP)	43.75	14.16	47.53	2.64	7.36	14.30	25.45	33.78	32171	104937	72765	3.26
SEm ±	1.05	0.28	2.30	0.43	0.51	0.57	1.51	1.94	-	6884	6298	-
CD (P = 0.05)	3.23	0.85	7.04	NS	1.59	1.76	4.63	5.97	-	21123	19325	-

Table 2.Nitrogen uptake by crop (kg ha^{-1}) as influenced by different treatments

Treatment	Total nitrogen uptake (kg ha-1)	Total phosphorus uptake (kg ha-1)	Total potassium uptake (kg ha-1)
T_1 - 100% P (SSP)	163.12	26.32	77.59
T_2 - 100% P (DAP)	177.06	28.81	82.70
T_3 - 100% P (PROM)	113.32	16.36	55.31
T_4 - 75% P (PROM) + 25% P (DAP)	135.18	20.20	65.40
T_5 - 75% P (PROM) + 25% P (SSP)	123.23	17.75	62.20
T_6 - 50% P (PROM) + 50% P (DAP)	152.67	24.28	72.00
T_7 - 50% P (PROM) + 50% P (SSP)	154.06	23.57	77.10
SEm ±	10.30	1.20	4.76
CD (P = 0.05)	31.62	3.67	14.59

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