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Yield, Economics and Quality of Soybean as Influenced by Foliar and Soil Application of Phosphatic Fertilizer

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ABSTRACT: *The field investigation was conducted at the experimental farm, Department of Agronomy, College of Agriculture, M.K.V., Parbhani during the kharif season of 2012. The experiment was laid out in FRBD design with twelve treatment combinations, comprising of three phosphorus levels viz.* P_1 *(0 kg* P_2O_2 *ha*$^{-1}$*),* P_2 *(30 kg* P_2O_2 *ha*$^{-1}$*) and* P_3 *(60 kg* P_2O_2 *ha*$^{-1}$*) and four foliar sprays of BOOST-52 (0:52:34) viz.,* F_0 *(no foliar application),* F_1 *(foliar application of BOOST-52 (0:52:34) at 35 DAS),* F_2 *(foliar application of BOOST-52 at 50 DAS) and* F_3 *(foliar application of BOOST-52 (0:52:34) at 35 DAS and 50 DAS). From the result of experiment it can be concluded that among the phosphorus level* P_3 *(60 kg* P_2O_2 *ha*$^{-1}$*) and foliar application of BOOST -52 (0:52:34) at 35 and 50 DAS (*F_3*) was productive, profitable and better for quality parameters also.*

Key words: *Soybean, foliar and soil application of phosphatic fertilizer, yield, economics*

The oil an economic end product of oilseed crop is an integral part of human diet. Beside the dietary needs, the vegetable edible oil has numerous mechanical, industrial, medicinal and therapeutic uses too. Soybean is of paramount importance in human and animal nutrition, because it is a major source of edible vegetable oil and high protein feed as well as food in the world. It is an excellent health food and contains about 40 percent quality protein, 23 percent carbohydrate and 20 percent cholesterol free oil (Halvankar, 1994). Soybean protein is rich in the valuable amino acid lysine (5 percent), which is deficient in most of the cereals. In addition it contains a good amount of the minerals, salts and vitamins (Thiamin and Riboflavin) and its sprouting grain contains considerable amount of vitamin 'C'. Soybean is a cheapest source of proteins therefore it is called "Poor man's meat". Phosphorus is the major essential element required by the crop. Phosphorus stimulates early root development, enhances the availability of *Rhizobia* and increases the formation of root nodules thereby fixing more atmospheric nitrogen.

As available phosphorus is very low in most of the soil, this level is required to be supplemented by adding chemical fertilizer but most of the supplied phosphorus is converted into less available forms which is not readily available to the crop. For high phosphorus use efficiency , the optimum level and proper method of application is required so that it will also prove economically remunerative to the farmers. In light of these facts this investigation was undertaken to to find out the influence of foliar and soil application of phosphatic fertilizer on yield, ecoonomics and quality of soybean.

MATERIALS AND METHODS

The field experiment was conducted at Department of Agronomy, College of Agriculture, Marathwada Krishi Vidyapeeth, Parbhani during *Kharif* 2012. The experiment was laid out in FRBD design with twelve treatment combinations, comprising of three phosphorus levels viz. P_1 (0 kg P_2O_2 ha^{-1}), P_2 (30 kg P_2O_2 ha^{-1}) and P_3 (60 kg P_2O_2 ha^{-1}) and four foliar sprays of BOOST-52 (0:52:34) viz., F_0 (no foliar application), F_1 (foliar application of BOOST-52 (0:52:34) at 35 DAS), F_2 (foliar application of BOOST-52 at 50 DAS) and F_3 (foliar application of BOOST-52 (0:52:34) at 35 DAS and 50 DAS). 30 kg N ha^{-1} as basal application and 1.25 kg K_2O ha^{-1} as foliar application at 35 and 50 DAS were common for all the treatments. Gross and net plot size was, 5.4 m x 4.5 m and 4.5 m x 4.0m, respectively. The soil was clayey in texture, low in organic carbon, poor in nitrogen and medium in available phosphorus and high in potash and slightly

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alkaline reaction. Sowing was done by dibbling on 7th July, 2012. The genotype used for study was MAUS-71.The recommended schedule of plant protection was followed.

RESULTS AND DISCUSSION

Effect of phosphorus levels and foliar application of BOOST-52 (0:52:34) on yield , economics and quality parameters of soybean was found significant, the is data is presented in Table 1,2 and 3.

Effect of phosphorus levels

Seed yield differed significantly at phosphorus levels. The phosphorus level P_3 (60 kg P_2O_5 ha^{-1}) recorded significantly high seed yield (2393 kg ha^{-1}) over phosphorus level P_1 (0 kg P_2O_5 ha^{-1}) and it was at par with P_2 (30 kg P_2O_5 ha^{-1}). The lowest seed yield (1671.2 kg ha^{-1}) was obtained at phosphorus level P_1 (0 kg P_2O_5 ha^{-1}). Similar trend was observed in case of straw and biological yield. Seed yield is a function of yield attributing characters, hence the increase in seed yield with phosphorus level P_3 (60 kg P_2O_5 ha^{-1}) resulted due to increase in yield attributes like weight of pods and seed weight per plant, number of seeds per plant. Similar results were reported by Sarawagi and Rajput (2005).

Among the phosphorus levels, P_2 (30 kg P_2O_5 ha^{-1}) recorded highest harvest index followed by phosphorus level P_3 (60 kg P_2O_5 ha^{-1}) and phosphorus level P_1 (0 kg P_2O_5 ha^{-1}) recorded lowest harvest index. Similar results were reported by Dwivedi *et al.* (1997)

The phosphorus level P_3 (60 kg P_2O_5 ha^{-1}) recorded significantly highest gross monetary return over P_1 (0 kg P_2O_5 ha^{-1}) but was at par with P_2 (30 kg P_2O_5 ha^{-1}). Phosphorus level P_1 (0 kg P_2O_5 ha^{-1}) recorded significantly lowest gross monetary return. Similar trend was observed in respect of net monetary return and B:C ratio.

Oil content in soybean differed significantly due to phosphorus levels. Oil content in soybean at phosphorus level P_3 (60 kg P_2O_5 ha^{-1}) was significantly superior over phosphorus level P_1 (0 kg P_2O_5 ha^{-1}) and P_2 (30 kg P_2O_5 ha^{-1}). Phosphorus level P_2 (30kg P_2O_5 ha^{-1}) was significantly superior over phosphorus level P_1 (0 kg P_2O_5 ha^{-1}). The phosphorus level P_3 (60 kg P_2O_5 ha^{-1}) recorded significantly higher protein content in seed over phosphorus level P_1 (0 kg P_2O_5 ha^{-1}) and it was at par with phosphorus level P_2 (30 kg P_2O_5 ha^{-1}). Similar results were reported by Krishna Mohan (2003).

Effect of foliar application

The seed yield was influenced significantly due to foliar application of BOOST-52 (0:52:34). Foliar application of BOOST-52 (0:52:34) at 35 and 50 DAS (F_3) recorded significantly highest seed yield (2387.7 kg ha^{-1}) over all other treatments of foliar application. Foliar application of BOOST-52 (0:52:34) at 35 days (F_1) and foliar application of BOOST-52 (0:52:34) at 50 days (F_2) recorded significantly higher seed yield over no foliar application (F_0) and were at par with each other. No foliar application (F_0) recorded significantly lowest seed yield (1891.7 kg ha^{-1}). Similar kind of variation was observed in case of straw and biological yield. These results are in conformity with those reported by Kalpana and Krishnarajan (2003).

As regards to the harvest index foliar application of BOOST-52 (0:52:34) at 35 and 50 days (F_3) recorded highest harvest index followed by foliar application of BOOST-52 (0:52:34) at 50 days (F_2). Foliar application of BOOST-52 (0:52:34) at 35 days (F_1) recorded lowest harvest index. Foliar application of BOOST-52 (0:52:34) at 35 and 50 DAS (F_3) recorded significantly highest gross monetary return over all other treatments of foliar applications of BOOST-52 (0:52:34). Foliar application of BOOST-52 (0:52:34) at 35 days (F_1) and foliar application of BOOST-52 (0:52:34) at 50 days (F_2) recorded significantly higher gross monetary return over no foliar application (F_0) and were at par with each other. Similar trend was found in case of net monetary returns and B:C ratio.

Effect of foliar application of BOOST-52 (0:52:34) on oil content in seed was found to be non significant. Where as foliar application of BOOST-52 (0:52:34) at 35 and 50 DAS (F_3) recorded significantly highest protein content in seed over remaining treatments of foliar application. Foliar application of BOOST-52 (0:52:34) at 35 days (F_1) and foliar application of BOOST-52 (0:52:34) at 50 days (F_2) were recorded significantly higher protein content over no foliar application (F_0) both were at par with each other. Similar results were reported by Shinde and Bhilare (2003).

Interaction (P x F)

The interaction effect of phosphorus levels and foliar applications found to be significant in respect of seed yield, gross monetary return and net monetary return. The significantly highest seed yield and gross monetary return net monetary return was recorded with the application of 60 kg P_2O_5 ha^{-1} with foliar application of BOOST-52 (0:52:34) at 35 and 50 days (P_3F_3) over all other treatment combinations except P_2F_3 i.e. application of 30 kg P_2O_5 with foliar application of BOOST-52 (0:52:34) at 35 and 50 days. In case of net monetary returns it was highest with treatment combination P_2F_3 i.e. application of 30 kg P_2O_5 with foliar application of BOOST-52 (0:52:34) at 35 and 50 days.

Table 1
Mean seed yield, straw yield, biological yield (kg ha^{-1}) and harvest index (%) as influenced by various treatments

Treatment	*Seed yield*	*Straw yield*	*Biological yield*	*Harvest index*
Phosphorus levels				
P_1 - 0kg P_2O_5 ha^{-1}	1671.2	2471.1	4147.5	40.31
P_2 - 30 kg P_2O_5 ha^{-1}	2280.2	3094.2	5374.4	42.43
P_3 - 60 kg P_2O_5 ha^{-1}	2393.0	3192.5	5668.7	42.21
S. E. ±	42.72	49.07	91.52	
CD at 5%	125.12	143.0	268.0	
Foliar application of BOOST-52 (0:52:34)				
F_0 – No foliar application	1891.7	2690.0	4581.7	41.28
F_1 – Foliar application of BOOST-52(0:52:34) at 35 DAS	2039.6	2850.0	5000.7	40.78
F_2 - Foliar application of BOOST-52(0:52:34) at 50 DAS	2141.7	2942.6	5095.3	42.03
F_3 - Foliar application of BOOST-52(0:52:34) at 35&50 DAS	2387.7	3194.6	5576.4	42.81
SE±	49.33	56.66	105.68	
CD at 5%	144.4	165.9	309.48	
Interaction (P x F)				
S. E. ±	85.44	98.14	183.04	
CD at 5%	250.23	NS	NS	
G. Mean	2115.1	2919.3	50635.0	41.69

Table 2
Economics of soybean production as influenced by different treatments

Treatment	*Cost of cultivation*	*GMR (Rs. ha^{-1})*	*NMR (Rs. ha^{-1})*	*B:C Ratio*
Phosphorus levels				
P_1 - 0kg P_2O_5 ha^{-1}	15986	45151	27586	2.82
P_2 - 30 kg P_2O_5 ha^{-1}	17187	61564	42798	3.58
P_3 - 60 kg P_2O_5 ha^{-1}	18393	64612	44639	3.51
SE±		1153.4	1153.4	
CD at 5%		3377.7	3377.6	
Foliar application of BOOST-52 (0:52:34)				
F_0 – No foliar application	15620	51077	33888	3.26
F_1 – Foliar application of BOOST-52(0:52:34) at 35 DAS	17459	55068	36040	3.15
F_2 - Foliar application of BOOST-52(0:52:34) at 50 DAS	17459	57825	38797	3.31
F_3 - Foliar application of BOOST-52(0:52:34) at 35&50 DAS	18259	64467	44639	3.53
SE±		1331.8	1331.8	
CD at 5%		3900.2	3900.2	
Interaction (P x F)				
SE±		2306.8	2306.8	
CD at 5%		6755.3	6755.3	
General Mean		**57109**	**38341**	

Table 3
Mean gross monetary return as influenced by phosphorus levels with foliar application interaction

Treatments	*Foliar application*			
Phosphorus levels	*F_0*	*F_1*	*F_2*	*F_3*
P_1	42663	45522	45765	46656
P_2	52380	59688	61290	72900
P_3	58188	59994	66420	73845
S. E. ±	2306.8			
CD at 5%	6755.3			

Table 4
Mean net monetary return as influenced by phosphorus levels x foliar application interaction

Treatments	*Foliar application*			
Phosphorus levels	*F_0*	*F_1*	*F_2*	*F_3*
P_1	26677	27697	27940	28031
P_2	35193	40662	42264	53074
P_3	39795	39762	46188	52813
S. E. ±	2306.8			
CD at 5%	6755.3			

Table 4
Mean oil content (%) and protein content (%) as influenced by various treatment.

Treatment	*Oil content (%)*	*Protein content (%)*
Phosphorus levels		
P_1 - 0kg P_2O_5 ha^{-1}	18.36	36.84
P_2 - 30 kg P_2O_5 ha^{-1}	19.50	39.36
P_3 - 60 kg P_2O_5 ha^{-1}	20.54	40.16
SE±	0.26	0.44
CD at 5%	0.76	1.29
Foliar application of BOOST-52 (0:52:34)		
F_0 – No foliar application	18.96	36.62
F_1 – Foliar application of BOOST-52 (0:52:34) at 35 DAS	19.30	38.50
F_2 - Foliar application of BOOST-52 (0:52:34) at 50 DAS	19.45	39.25
F_3 - Foliar application of BOOST-52 (0:52:34) at 35&50 DAS	20.15	40.78
SE±	0.30	0.51
CD at 5%	NS	1.49
Interaction (P x F)		
SE±	0.52	0.88
CD at 5%	NS	NS
General Mean	18.96	36.62

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