Contract Trial Report

Evaluation of "P'RISE" Microbial Formulation on Nodulation, Growth and Yield of Soybean

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Carried Out By

ICAR-Indian Institute of Soybean Research
Khandwa Road- Indore

Period-Kharif 2015

ICAR-INDIAN INSTITUTE OF SOYBEAN REASEARCH
Khandwa Road- Indore

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Project Tile: Evaluation of "P'RISE" Microbial Formulation on Nodulation, Growth and Yield of Soybean

Background

"P'RISE" is a microbial formulation containing phosphate solubilizing bacteria (PSB) which solubilizes the insoluble phosphates thereby enhances the bioavailability of phosphates to plants. The application of PRISE (PSB) also enhances the root development particularly lateral and fibrous roots and increases the availability of inaccessible Phosphorus to the plants and there by helps plant development and enhances seed quality and yield.

Present trial was conducted to determine the-

(i) Response of P'RISE Microbial Formulation to P-uptake and N-fixation in soybean
(ii) Responses of product on fertilizers use efficiency on soybean

Materials and Methods

The field (Vertisols, soil type, Sarol series) trial was conducted during *Kharif* 2015 at Research Farm of Indian Institute of Soybean Research, Indore. The product **'P'RISE'** was applied as basal or in split or as seed treatment doses as soil application as per the following treatments-

Treatments

1. Control (Recommended dose of fertilizers (RDF) @ 20:26.2:16.6 kg NPK/ha as basal dose)
2. P'rise application as seed treatment @15gm/kg seed along with RDF
3. P'rise @ 1kg/acre as soil application along with RDF*
4. P'rise Split dose (1 Kg/acre soil application at sowing and 1 Kg/Acre at 30DAS +RDF
5. 2 + 3
6. 2 + 4
7. 5 + 75% RDF
8. 6 + 75% RDF

*soil application of P'rise to be mixed with FYM@ 20Kg/acre for all the treatments

Soybean Cultivar: JS 97-52 (Late sown variety) **
Design: RBD

Replications: Three

Plot size: 3.6m × 5m = 18.0 m^2

**** (Due to heavy rains earlier crop JS 95-60 was failed and re-sowing was done with late sown recommended variety)**

Sampling and Analyses

Agronomic parameters were recorded during crop stand (soybean JS 97-52) and at harvest. Standard recommended agronomic practices were followed throughout the experimentation to maintain the crop. No weedicides was applied to eradicate weeds; however, weeds were removed by two hand weeding. Number of flowers, nodules per plant was recorded during crop stand and at harvest; total dry biomass of crops (straw + seed) and seed yield were recorded in each plot and extrapolated on per hectare basis. To assess the efficacy of product, the total nitrogen and phosphorus was assessed both in seeds and shoot/straw samples using standard procedures.

The data were analyzed using the analysis of variance. The least significant differences (LSD) were used to separate the treatment means using DMRT test (COSTAT statistical software, Cohart, Berkeley, California).

OBSERVATIONS

1. At emergence, % germination
2. Flower initiation (Day to flower) & Number of flower/plant
3. Shoot biomass per plant at 50% flowering
4. Nodule number; Nodule dry weight & N content of the nodule/ ARA
5. N, P content in the seed & straw at harvest
6. Protein content in seeds
7. Grain yield /per acre
8. Visual observations on biotic and abiotic stresses during the trial

Results

Based on the analysis of ANOVA test (Table 1) the results can be summarized as follows:

The application of P'rise did not influence the germination percentage significantly. Application of P'RISE showed significantly higher nodule dry weight per plant in all the treatments when compared to control (RDF plants). Highest dry weight was obtained when product was applied as seeds treatment followed by soil or combined application along with recommended dose of fertilizers (T2). The N-fixing ability assessed in terms of nitrogenase activity (acetylene reduction assay per g nodules/hr.) was also enhanced due to application of product either as soil and split application or combined use over the control plants. Although application at 75% NPK fertilizers did not influence the N-fixation.

N and P in seeds and seed protein did not influence by the application of P'rise.

When compared to other combinations of application, highest N and P content in straw was analysed in the plots treated as soil or as split dose application along with the recommended dose of fertilizers (T4). However, P content in straw of treated plants grown at 75% RDF of NPK was found to be comparable with treated plants grown at 100% RDF plots.

The grain yield was higher in all the treated plants. However, comparatively and significant higher response was obtained when the product was applied as either soil or split application along with the recommended dose of fertilizers (T3, T4) over rest of combinations. The yield was also found to be comparable with the plants grown at 100% RDF when the product was applied as seed treatment along with soil or split application at 75% recommended dose of fertilizers (T7, T8). It means combined application of P'rise as seed treatment coupled with soil/ split application can save 25% NPK fertilizers.

Due to heavy rain during flowering stage, the no. of flowers could not be recorded. However, as such apparently no differences were seen in the plots. The size of nodules was very small which could not be counted therefore to avoid error total nodule dry biomass was recorded.

Visual observations on biotic and abiotic stresses during the trial

Due to heavy rain at the flowering stage (R1 stage) and no rain and high temperature prevailed long time at pod initiation and grain filling stage (R4-R6) which affected the yield drastically. Besides abiotic stress, sporadic infection of YMV (about 10-15%) was noticed across all the plots.

Conclusion: P'rise application through seed treatment, soil treatment or split soil application combined with RDF has enhanced the grain yield significantly over the RDF alone. Split application of P'rise was found to be more effective when applied alone and found more promising when combined with seed treatment at 75% RDF.

Table1: Effect of P'RISE on nodulation, N & P uptake, accumulation in seeds and grain yield of soybean (JS 95-60) under field conditions during kharif 2015

Trts	% Germination	Nodule Dry weight(gm/plant)	% N in seeds	% P in seeds	%N in straw	% P in straw	% protein in seeds	ARA (nmoles C_2H_2 /gm nodules/hour)	Grain Yield (kg/ha)
1	39.52a	0.06c	6.53a	0.83bcd	1.64c	0.32bc	37.85a	263.80	182.5d
2	39.52a	0.12a	5.73cde	0.8d	1.75c	0.28c	33.23cde	287.32	257.91c
3	36.19ab	0.09ab	5.58de	0.9abc	2.2b	0.41a	32.38de	**404.07**	**349.58a**
4	32.37abc	0.08bc	6.37ab	0.92a	2.41a	0.37ab	36.96ab	**582.08**	**337.77ab**
5	30.95bc	0.08bc	6.37ab	0.82cd	2.13b	0.32bc	36.96ab	**474.69**	**279.99bc**
6	27.14c	0.08bc	6.14abc	0.91ab	1.73c	0.3bc	35.61abc	**369.85**	**357.37a**
7	38.09ab	0.09bc	5.97bcd	0.85abcd	1.49d	0.3bc	34.64bcd	204.09	145.55e
8	35.71ab	0.09bc	5.35e	0.93a	1.74c	0.34abc	31.03e	240.35	**305.55b**
LSD (0.05)	6.55	0.026	0.44	0.077	0.127	0.078	2.58	-	28.88

*Data are average of three replications; LSD, least significance different; Means followed by same letter did not differ significantly by DMRT (ANOVA, P=0.05)

T1=RDF, recommended dose of fertilizers (RDF) @ 20:26.2:16.6 kg NPK/ha as basal dose; T2= CROPMATE application as seed treatment @15gm/kg seed along with RDF; T3= CROP MATE @ 1kg/acre as soil application along with RDF; T4= CROP MATE Spilt dose (1 Kg/acre soil application at sowing and 1 Kg/Acre at 30DAS +RDF; T5=T2+T3; T6=T2+T4; T7=T5 + 75% RDF; T8=T6+ 75% RDF

Signature of PI

(Name and Designation)
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