

## **Contract Trial Report**

### **Evaluation of “P’RISE” Microbial Formulation on Nodulation, Growth and Yield of Soybean**

**Sponsored by M/s Zytex Biotech Pvt Ltd. Savli,  
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**Carried Out By**



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**Project No.....**

**Project Title: 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 P’RISE (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* 2016 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 Spilt 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
9. Recommended dose of fertilizers (RDF) @ 20:26.2:16.6 kg NPK/ha as basal dose+0.5 kg Cropmate + 0.5 kg P’rise at sowing and 0.5 kg each at 30 DAS

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

No herbicide and insecticide was applied during the experiment however, to control white flies' one spray of Coragen was applied.

Soybean Cultivar: JS 95-60

Design: RBD

Replications: Three

Plot size:  $3.6\text{m} \times 5\text{m} = 18.0\text{ m}^2$

### **Sampling and Analyses**

Agronomic parameters were recorded during crop stand (soybean JS 95-60) and at harvest. Standard recommended agronomic practices were followed throughout the experimentation to maintain the crop. No weedicide 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**

The conclusions based on the results of ANOVA test (Table 1) can be summarized as follows:

Application of P'RISE did not show significant effect on the flower number. However, the number was marginally higher when the inoculum was applied to both seed and soil along with 75% recommended dose of fertilizers (T7). It was found to be minimum in case of only recommended dose of fertilizers being applied with no inoculum (T1).

Shoot biomass was significantly affected by the PRISE application. It was found to be the highest in case of seed and soil application along with recommended dose of fertilizers (T5) and lowest in case of seed application along with recommended dose of fertilizers (T2) and also in

case of split soil application of both the inocula (P'rise & Cropmate) along with recommended dose of fertilizers (T9).

The nodule number, nodule dry weight and Leghaemoglobin were significantly enhanced by the application of P'RISE. Maximum increment was recorded when both seed and soil were treated with P'rise along with the recommended dose of fertilizers (T5) when compared to the other combinations. Overall seed treatment of the PRISE was more effective and its effectiveness increased when combined with soil application. However seed treatment with split application at 75% RDF was also found to be at par with best performing treatments.

The nitrogen content of nodules was found to be the maximum in case of both seed and soil application, but along with 75% recommended dose of fertilizers (T7). It was however, least when a mixture of both the products was applied to the soil along with recommended dose of fertilizers (T9).

The nitrogen content of seeds and straw and protein in seeds were found to be the maximum (significantly higher) in case of seed application along with recommended dose of fertilizers only (T2) followed by in T3 (soil application) when compared to other combinations. The control plots (only RDF) had lowest values.

The phosphorus content of seeds and straw was maximized by combined seed treatment and soil or split application along with recommended dose of fertilizers (T6, T4). The samples of control plots and plots of combined product (T9) showed lowest values.

The highest grain yield was recorded in case of PRISE applied as soil application along with the recommended dose of fertilizers (T3), followed by seed treatment with split dose application at 75% RDF (T8) and lowest was recorded in control plots and when both the products used together (T9).

***Overall, considering the response of two years yield (consolidated response), the plots where product was used as soil application (T3) or as split soil application at RDF (T4) or most economically, when product was applied as seed treatment together with split application at 75% RDF produced highest yield when compared to other combinations and significantly higher than control plots. The yield not found to be better when both the products used together when compared to control.***

**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 2016**

Trts	No. of flowers/plant	Shoot biomass (g/plant)	Nodule no/plant	Nodule Dry Wt (g/plant)	LegHb in Nodules (mg g <sup>-1</sup> )	% N in nodule	% N in seed	% P in seed	% N in straw	% P in straw	% Protein in seeds	Grain Yield (kg/ha)	Consolidated yield (Kg/ha)**
1	12.33 a	2.66 b	28.40 d	0.16 c	10.97 cd	3.39 de	6.79 bc	0.49 b	0.17 f	0.04 e	38.38 abc	1915.94bc	1049.22
2	15.93 a	2.33 b	51.20 a	0.25 a	14.86 ab	3.78 bc	7.42 a	0.57 a	0.36 e	0.08 ab	41.82 a	1968.89ab	1113.4
3	13.67 a	2.44 b	30.40 cd	0.14 c	13.96 b	3.64 c	6.86 ab	0.56 a	0.94 a	0.09 a	39.79 ab	<b>2049.72a</b>	<b>1199.65</b>
4	13.07 a	2.89 b	38.67 b	0.17 bc	9.82 d	4.17 a	6.44 bc	0.53 ab	0.69 b	0.05 cde	37.35 bc	1931.94b	1134.8
5	13.00 a	4.22 a	54.60 a	0.26 a	17.18 a	4.00 ab	6.20 c	0.56 a	0.52 d	0.05 de	35.93 c	1924.31b	1102.15
6	14.07 a	3.11 b	31.47 bcd	0.15 c	11.94 bcd	4.22 a	6.72 bc	0.58 a	0.64 c	0.07 bc	38.98 abc	1950.00b	<b>1153.69</b>
7	16.73 a	3.22 b	32.60 bcd	0.16 c	13.16 bc	4.27 a	6.53 bc	0.54 ab	0.50 d	0.09 a	37.89 bc	1826.39cd	985.97
8	15.13 a	2.89 b	27.50 d	0.15 c	13.90 b	3.73 bc	6.37 bc	0.55 ab	0.48 d	0.05 cde	36.95 bc	<b>1975.14ab</b>	<b>1140.35</b>
9	16.33 a	2.33 b	36.73 bc	0.19 b	12.76 bc	3.30 e	6.72 bc	0.49 b	0.18 f	0.07 bcd	38.98 abc	1815.28d	-
LSD (0.05)	4.27	0.80	7.08	0.03	2.61	0.30	0.57	0.06	0.05	0.02	3.16	92.31	

\*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-Control (Recommended dose of fertilizers (RDF) @ 20:26.2:16.6 kg NPK/ha as basal dose); T2-PRISE application as seed treatment @15gm/kg seed along with RDF; T3-PRISE @ 1kg/acre as soil application along with RDF; T4-PRISE 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; T9-Recommended dose of fertilizers (RDF) @ 20:26.2:16.6 kg NPK/ha as basal dose+0.5 kg Cropmate + 0.5 kg P'rise at sowing and 0.5 kg each at 30 DAS: \*\* average yield of two years