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Effect of fungicide and different *Rhizobium* inoculants on growth and yield of soybean (*Glycine max* (L.) Merrill)

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Abstract

An experiment was carried out at in *Kharif* season at student research field, College of Agriculture, Indore (M.P.) to study the Effect of fungicide and different *Rhizobium* inoculants on growth and yield of soybean (*Glycine max* (L.) Merrill). The soil of the experimental field was medium black in texture, neutral in reaction (pH 7.70) with normal EC (0.23 dS/m) and medium organic carbon contents (0.56%) and analysing low in available N (225 kg/ha), medium in available P (9.60 kg/ha) and high in available K (508 kg/ha) contents. A field experiment was consisted of 15 treatments replicated four times in randomized block design (RBD). As per treatment, the seed of soybean cv. JS 335 treated or not treated with fungicides and inoculated with *Rhizobium* culture before 15, 10, 05, 01 days of planting and on the day of sowing. Among the treatments, seed treatment with Thiram + Carbendazim 50 WP – inoculation with Premax+ Rizo-liq (ODS)] (T₁₀) recorded the maximum plant height (66.75 cm) at harvest, branches per plant (4.02), fresh weight (35.83 g) per plant at 75 DAS, dry matter per plant (23.14g) at 75 DAS, leaf area index (12.87) at 60 DAS, number of pods (39.18) per plant, number of seeds (2.84) per pod while minimum was recorded in T₁₅ absolute control (No fungicide, No culture). The maximum yield (2.15 t/ha) was recorded under [Thiram + Carbendazim 50 WP - Premax+ Rizo-liq (ODS)] (T₁₀) treatment and the minimum (1.51 t/ha) was recorded in absolute control (T₁₅) treatment. The application of *Rhizobium* with or without fungicides showed a synergic effect in increasing the seed yield of soybean per hectare.

Keywords: Soybean, fungicide, *Bradyrhizobium japonicum* (Premax + Rizo-liq), seed treatment, leaf area index and yield

Introduction

Soybean (*Glycine max* (L.) Merrill) is a major legume crop recognized as the efficient producer of the two scarce quality characters *i.e.* the protein and oil, which are not only the major components in the diet of vegetarians mass but a boon to the developing countries as well. Soybean contains 40 per cent protein, 20 per cent oil, 85 per cent PUFA and 25-30 per cent, carbohydrates, minerals, antioxidants, beta-carotene and iso-flavonoids. Soybean plays a vital role in the agricultural economy of India. Soybean [*Glycine max* (L.) Merrill] is one of the major economically predominant oilseed crops. It is recognized as the most important versatile and fascinating crop of the world. Hence it is known as a “Wonder crop” and “Golden bean” of the 21st century. Soybean is rich in a lysine an amino acid in which most of the cereals are deficit.

In Madhya Pradesh, Farmers generally apply unbalanced under dose of fertilizers and less use of FYM and bacterial cultures which lead to low production. Indiscriminate use of chemical fertilizers deteriorates the soil health with environmental pollution. Biofertilizers are the substitute or supplementary materials in addition to the chemical fertilizers. Biofertilizers are economically viable lever for realizing the ultimate goal of increasing productivity. These microbial systems siphon out appreciable amount of nitrogen from the atmospheric reservoir and enrich the soil with these important but scare nutrients. Culture inoculation of legume seeds at the time of sowing was found helpful in increasing the *Rhizobia* population in the soil which resulted into increased number of root nodules and ultimately gave 20-70% more yield of the legume (Dadson and Acquash, 1984) [5]

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The limitation of using the *Rhizobia* are that they cannot apply well in advance and in the other hand there is narrow window of soybean planting in India as it is rainy season crop. Soybean is becoming popular in Madhya Pradesh particularly in 'Malwa region' and hence efforts should be made to boost up the production of soybean by adopting modern techniques of crop production. The genuine problems limiting the production of soybean are poor germination and low seed viability. Micro-organisms play major role on quality of seed, of which fungi are in predominant quantity. These fungi are harmful as they minimize the vigour of seed and diminish the growth of plant at its initial stages. Fungicides or microbial antagonists act as a barrier for seed infection and seed treating with these save the seed from infection by seed borne and soil borne pathogens. Seed treatment is therefore a routine practice to ensure good emergence and better crop stand. These treatments allow the seed to germinate rapidly in to a healthy seedling. The present study was aimed to know the effect of seed treatment along with fungicides and bio-inoculants on growth and seed yield parameters of soybean.

Material and Methods

An experiment was carried out at in *Kharif* season at student research field, College of Agriculture, Indore (M.P.) to study the Effect of fungicide and different *Rhizobium* inoculants on growth and yield of soybean (*Glycine max* (L.) Merrill). The soil of the experimental field was medium black in texture, neutral in reaction (pH 7.70) with normal EC (0.23 dS/m) and medium organic carbon contents (0.56%) and analysing low in available N (225 kg/ha), medium in available P (9.60 kg/ha) and high in available K (508 kg/ha) contents. Due to dominance of montmorillonite clay content it has high capacity to swell and shrink and high CEC. A field experiment was consisted of 15 treatments replicated four times in randomized block design (RBD). It is located on latitude of 22.43°N and longitude of 75.66°E. It has subtropical climate having a temperature range of 23 °C to 41 °C and 4 °C to 29 °C in summer and winter season, respectively. The rainfall in the region is mostly inadequate and erratic. Late commencement, early withdrawal and two to three dry spells are the main features. The average rain is 964 mm and it was below normal (803 mm). The maximum temperature ranged from 25.7 °C to 40.8 °C while minimum temperature accelerated between 14.9 °C to 28.8 °C during the season.

Properties of fungicides and Bio-fertilizers

Thiram: Thiram is contact fungicide, most effective seed protectant, least phytotoxic and used for the control of many seed-borne or soil-borne diseases.

Carbendazim 50 WP (Bavistin): Carbendazim is systemic with prophylactic and curative action and also non-phytotoxic. It is used for the control of many internally and externally seed borne diseases. Besides the disease control, beneficial side effects like stimulation of growth, flowering and yield of plants on the treated hosts have been reported.

Premax (Protector): Premax protects Rhizobial population from the adverse effects of fungicides.

Rizo-liq: Rizo-liq (*Bradyrhizobium japonicum* Strain) is a liquid biofertilizer which is used well in advance to inoculate the seed and recommended for soybean crop.

Rhizobium cultures (Rh₁, Rh₂, Rh₃): *Rhizobium* cultures (*Rhizobium japonicum* strain) are solid biofertilizers which are used to inoculate the seed of soybean.

Pre Harvest Studies

Height of the plant (cm)

In each net plot five plants were selected randomly and tagged for periodic observation. The height was recorded at 30, 45, 60, 75 DAS and at harvest in all the plots. It was measured from the ground surface to the main stem apex.

Number of branches per plant

The primary branches were counted on five tagged plants at 45, 60 DAS and at harvesting of crop in all the plots.

Fresh weight per Plant (g)

Fresh weight studies were made in a sample of 5 plants removed from the sampling row randomly from each plot at 45, 60, 75 DAS. The fresh weight of the sample was recorded an averaged for fresh weight per plant.

Dry matter per Plant (g)

The above samples were kept in oven at 65 °C for 48 hours. The dry weight of the sample was recorded an averaged for dry matter per plant.

Leaf area index (LAI)

It express the total leaf area in relation with the total ground area in which the crop is grown as calculated by the following equation:

$$\text{Leaf area index} = \frac{\text{Total leaf area of the crop}}{\text{Total ground area under the crop}}$$

Post Harvest Studies

Number of pods per plant

The number of pods per plant was counted from five already tagged plants and mean per plant was calculated for analysis. The observation taken from all the plots.

Number of grains per pod

The number of grains per pod was counted from 20 randomly selected pods of 5 tagged plants for each plot.

Seed yield (tone per hectare)

The seed yield per net plot was recorded after drying the seed. The plot yield was later on converted into kg per hectare by multiplying it by conversion factor.

Stover yield (tone per hectare)

The stover yield per plot was obtained by subtracting grain yield from bundle weight of each plot. This was later on converted into kg per hectare.

Results and Discussion

Growth parameters

Plant Height (cm)

Plant height is an important index of plant growth, which usually affects total dry matter production of the crop and differs due to different treatments and agronomic conditions. The maximum (66.75) plant height at harvest was recorded in T₁₀ [Thiram + Carbendazim 50 WP - Premax + Rizo-liq (ODS)] treatment, which was closely (65.05 cm) followed by T₁₃ [Thiram + Carbendazim 50 WP- Rh₃ (ODS)] treatment whereas minimum (62.15cm) plant height was recorded in T₁₅ (Absolute Control) treatment.

Table 1: Effect of different treatments on average plant height at successive stages of growth

Tr. No.	Treatments	Plant height (cm)				
		30 DAS	45 DAS	60 DAS	75 DAS	Harvest
T ₁	Premax + Rizo-liq (15 DPS)	26.30	39.75	54.65	64.60	63.20
T ₂	Premax + Rizo-liq (10 DPS)	26.60	41.05	55.35	65.15	63.75
T ₃	Premax + Rizo-liq (05 DPS)	26.65	41.93	55.55	65.35	63.95
T ₄	Premax + Rizo-liq (01 DPS)	26.45	42.33	58.15	65.75	64.30
T ₅	Premax + Rizo-liq (ODS)	28.15	43.90	58.80	67.40	64.65
T ₆	Thiram+Carbendazim 50 WP- Premax + Rizo-liq (15 DPS)	26.15	39.35	55.05	64.55	62.95
T ₇	Thiram + Carbendazim 50 WP - Premax + Rizo-liq (10 DPS)	26.75	40.35	55.60	65.10	63.25
T ₈	Thiram + Carbendazim 50 WP - Premax + Rizo-liq (05 DPS)	26.30	41.43	57.35	65.70	64.45
T ₉	Thiram + Carbendazim 50 WP - Premax + Rizo-liq (01 DPS)	27.15	41.93	58.35	66.30	64.60
T ₁₀	Thiram + Carbendazim 50 WP - Premax + Rizo-liq (ODS)	29.55	44.10	61.15	69.15	66.75
T ₁₁	Thiram+Carbendazim 50 WP-Rh ₁ (ODS)	27.73	42.25	58.40	66.80	64.60
T ₁₂	Thiram+Carbendazim 50 WP-Rh ₂ (ODS)	28.20	42.25	58.95	66.70	64.65
T ₁₃	Thiram+Carbendazim 50 WP-Rh ₃ (ODS)	28.60	42.75	60.90	67.68	65.05
T ₁₄	Uninoculated seed (but fungicidal treatment)	25.50	38.90	54.50	64.23	62.70
T ₁₅	Absolute control (No fungicidal treatment and no inoculation)	24.50	38.25	54.20	63.23	62.15
SEm ±		0.67	0.74	0.74	0.77	0.77
CD at 5%		1.92	2.12	2.10	2.20	2.21

Number of branches per plant

Maximum number of branches per plant (4.02) was recorded in T₁₀ [Thiram + Carbendazim 50 WP- Premax+Rizo-liq (ODS)] treatment and minimum (2.95) was recorded under T₁₅ (Absolute control) treatment. The data revealed that

Rhizobium inoculation with or without fungicide on the day of sowing increased the number of branches per plant as compared to control and uninoculated seed treatment at all the growth stages. However rest of the treatments produced more number of branches per plant than absolute control.

Table 2: Number of branches per plant as affected by various treatments at successive stages of plant growth

Treatment No.	Treatments	Number of branches per plant		
		45 DAS	60 DAS	At Harvest
T ₁	Premax + Rizo-liq (15 DPS)	1.65	3.10	3.10
T ₂	Premax + Rizo-liq (10 DPS)	1.80	3.20	3.20
T ₃	Premax + Rizo-liq (05 DPS)	1.85	3.20	3.20
T ₄	Premax + Rizo-liq (01 DPS)	1.90	3.80	3.80
T ₅	Premax + Rizo-liq (ODS)	2.15	3.95	3.95
T ₆	Thiram + Carbendazim 50 WP - Premax + Rizo-liq (15 DPS)	1.85	3.15	3.15
T ₇	Thiram + Carbendazim 50 WP - Premax + Rizo-liq (10 DPS)	1.90	3.25	3.25
T ₈	Thiram + Carbendazim 50 WP - Premax + Rizo-liq (05 DPS)	1.95	3.30	3.30
T ₉	Thiram + Carbendazim 50 WP - Premax + Rizo-liq (01 DPS)	2.10	3.80	3.80
T ₁₀	Thiram + Carbendazim 50 WP - Premax + Rizo-liq (ODS)	2.60	4.02	4.02
T ₁₁	Thiram + Carbendazim 50 WP - Rh ₁ (ODS)	2.20	3.85	3.85
T ₁₂	Thiram + Carbendazim 50 WP - Rh ₂ (ODS)	2.25	3.80	3.80
T ₁₃	Thiram + Carbendazim 50 WP - Rh ₃ (ODS)	2.55	3.95	3.95
T ₁₄	Uninoculated seed (but fungicidal treatment)	1.60	3.05	3.05
T ₁₅	Absolute control (No fungicidal treatment and no inoculation)	1.55	2.95	2.95
SEm ±		0.23	0.31	0.31
CD at 5%		NS	NS	NS

DPS: Days prior sowing, ODS: On days of sowing, DAS: Days after sowing

Fresh weight per plant (g)

Data revealed that fresh weight per plant increased with advancement in age of the plant. It was found that rate of increase in fresh weight was maximum between 60 to 75 DAS in almost all the treatments and minimum between 45 to 60

DAS. The treatment T₁₀ [Thiram + Carbendazim 50 WP - Premax + Rizo-liq (ODS)] resulted in 16.44, 22.6 and 35.83 g fresh weight per plant at 45, 60 and 75 DAS, respectively which were significantly higher at respective growth stage when compared with absolute control.

Table 3: Fresh weight per plant as influenced by different treatments

Tr. No.	Treatments	Fresh weight per plant (g)		
		45 DAS	60 DAS	75 DAS
T ₁	Premax + Rizo-liq (15 DPS)	13.36	17.50	24.38
T ₂	Premax + Rizo-liq (10 DPS)	13.38	17.79	26.84
T ₃	Premax + Rizo-liq (05 DPS)	13.84	18.41	29.09
T ₄	Premax + Rizo-liq (01 DPS)	14.94	19.23	32.74
T ₅	Premax + Rizo-liq (ODS)	15.69	20.62	33.76
T ₆	Thiram+Carbendazim 50 WP-Premax+Rizo-liq (15 DPS)	13.68	17.77	27.72
T ₇	Thiram +Carbendazim 50 WP-Premax+Rizo-liq (10 DPS)	13.98	19.13	29.96
T ₈	Thiram +Carbendazim 50 WP-Premax+Rizo-liq (05 DPS)	15.05	19.28	30.97
T ₉	Thiram+Carbendazim 50 WP-Premax+Rizo-liq (01 DPS)	15.61	19.66	32.08
T ₁₀	Thiram+ Carbendazim 50 WP - Premax + Rizo-liq (ODS)	16.44	22.60	35.83
T ₁₁	Thiram + Carbendazim 50 WP - Rh ₁ (ODS)	15.67	20.52	34.19
T ₁₂	Thiram + Carbendazim 50 WP - Rh ₂ (ODS)	15.97	19.79	34.09
T ₁₃	Thiram + Carbendazim 50 WP - Rh ₃ (ODS)	16.08	21.60	34.83
T ₁₄	Uninoculated seed (but fungicidal treatment)	12.59	16.61	23.60
T ₁₅	Absolute control (No fungicidal treatment and no inoculation)	10.57	14.58	20.20
SEm ±		0.81	1.10	1.76
CD at 5%		2.30	3.14	5.01

Dry weight per plant (g)

Data revealed that average dry matter per plant increased gradually with increase in the age of crop. The accumulation was maximum between 60 and 75 DAS in almost all the treatments. The application of T₁₀ [Thiram+carbendazim 50 W - Premax+ Rizo-liq (ODS)] treatment registered the

maximum dry weight per plant followed by T₁₃ [Thiram + Carbendazim 50 WP - Rh₃ (ODS)] treatment at all stages. Dry matter per plant at 75 DAS was maximum (23.14g) in T₁₀ [Thiram+carbendazim 50 WP - Premax+ Rizo-liq (ODS)] treatment and minimum (14.6 g) in T₁ (Absolute control) treatment.

Table 4: Dry weight per plant as influenced by different treatments

Treatment No.	Treatments	Dry weight per plant (g)		
		45 DAS	60 DAS	75 DAS
T ₁	Premax + Rizo-liq (15 DPS)	5.44	8.65	16.15
T ₂	Premax + Rizo-liq (10 DPS)	5.64	8.97	16.33
T ₃	Premax + Rizo-liq (05 DPS)	5.86	9.66	16.80
T ₄	Premax + Rizo-liq (01 DPS)	5.92	9.88	17.75
T ₅	Premax + Rizo-liq (ODS)	6.05	9.98	20.40
T ₆	Thiram + Carbendazim 50 WP - Premax + Rizo-liq (15 DPS)	5.77	8.75	17.33
T ₇	Thiram + Carbendazim 50 WP - Premax + Rizo-liq (10 DPS)	5.82	8.94	17.38
T ₈	Thiram + Carbendazim 50 WP - Premax + Rizo-liq (05 DPS)	5.76	9.51	18.58
T ₉	Thiram + Carbendazim 50 WP - Premax + Rizo-liq (01 DPS)	6.10	9.92	19.45
T ₁₀	Thiram + Carbendazim 50 WP - Premax + Rizo-liq (ODS)	7.02	11.01	23.14
T ₁₁	Thiram+Carbendazim 50 WP - Rh ₁ (ODS)	6.22	10.51	21.95
T ₁₂	Thiram+Carbendazim 50 WP - Rh ₂ (ODS)	6.02	9.91	20.33
T ₁₃	Thiram+Carbendazim 50 WP - Rh ₃ (ODS)	6.47	10.73	22.78
T ₁₄	Uninoculated seed (but fungicidal treatment)	5.37	8.46	15.70
T ₁₅	Absolute control (No fungicidal treatment and no inoculation)	5.05	8.07	14.60
SEm ±		0.25	0.40	1.13
CD at 5%		0.72	1.15	3.23

Leaf Area Index (LAI)

LAI, a parameter of canopy growth was estimated at 30, 40, 60 and 75 DAS. Leaf area index was maximum at 60 DAS. Maximum leaf area index (12.87) at 60 DAS was found in T₁₀ [Thiram+carbendazim 50 WP - Premax+ Rizo-liq (ODS)]

treatment and it was significantly superior over other treatments except T₁₃, T₅, T₁₁ and T₉ treatments. Minimum leaf area index (10.54) was recorded in T₅ (Absolute control) treatment.

Table 5: Leaf area index as influenced by various treatments at successive stages of plant growth

Treatment No.	Treatments	Leaf area index			
		30 DAS	45 DAS	60 DAS	75 DAS
T ₁	Premax + Rizo-liq (15 DPS)	3.29	4.62	10.81	6.88
T ₂	Premax + Rizo-liq (10 DPS)	3.43	4.78	10.93	7.29
T ₃	Premax + Rizo-liq (05 DPS)	3.58	4.99	11.02	7.4
T ₄	Premax + Rizo-liq (01 DPS)	3.69	5.21	11.07	7.67
T ₅	Premax + Rizo-liq (ODS)	4.32	6.16	12.15	7.97
T ₆	Thiram + Carbendazim 50 WP - Premax + Rizo-liq (15 DPS)	3.55	5.24	11.05	7.48
T ₇	Thiram + Carbendazim 50 WP - Premax + Rizo-liq (10 DPS)	3.65	5.31	11.05	7.67
T ₈	Thiram + Carbendazim 50 WP - Premax + Rizo-liq (05 DPS)	3.73	5.55	11.26	7.74
T ₉	Thiram + Carbendazim 50 WP - Premax + Rizo-liq (01 DPS)	4.09	5.78	11.96	7.94
T ₁₀	Thiram + Carbendazim 50 WP - Premax + Rizo-liq (ODS)	5.18	6.75	12.87	8.24
T ₁₁	Thiram + Carbendazim 50 WP - Rh ₁ (ODS)	4.56	6.15	11.79	7.94
T ₁₂	Thiram + Carbendazim 50 WP - Rh ₂ (ODS)	4.62	6.06	11.70	7.91
T ₁₃	Thiram + Carbendazim 50 WP - Rh ₃ (ODS)	4.97	6.59	12.50	8.16
T ₁₄	Uninoculated seed (but fungicidal treatment)	3.19	4.66	10.75	6.73
T ₁₅	Absolute control (No fungicidal treatment and no inoculation)	3.06	4.54	10.54	6.12
SEm ±		0.33	0.40	0.40	0.33
CD at 5%		0.94	1.13	1.14	0.95

Yield attributing characters

Number of pods per plant

The maximum (39.18 pods/plant) number of pods in entire experiment was recorded in T₁₀ [Thiram+Carbendazim 50 WP - Premax+ Rizo-liq (ODS)] treatment, which was significantly superior to treatment T₁₄ (Uninoculated seed), T₁₅ (Absolute control) and at par with rest of the treatments. Minimum pods (24.53/plant) were recorded in T₁₅ (Absolute control) treatment. It is evident from the data (Table 6) that *Rhizobium* inoculation with or without fungicides resulted in

significant increase in number of pods per plant as compared to the control and uninoculated seed treatment.

Number of seeds per pod

Data showed that there was a variation in seeds per pod but statistically it was non significant. However, the maximum (2.84 seeds per pod) number of seeds per pod in entire experiment was recorded in T₁₀ [Thiram+Carbendazim 50 WP - Premax+ Rizo-liq (ODS)] treatment. Minimum seeds (2.45/pod) were recorded in T₁₅ (Absolute control) treatment.

Table 6: Average number of pods per plant and seeds per pod as influenced by different treatments

Treatment No.	Treatments	Number of pods per plant	Number of seeds per pod
T ₁	Premax + Rizo-liq (15 DPS)	34.20	2.63
T ₂	Premax + Rizo-liq (10 DPS)	34.43	2.65
T ₃	Premax + Rizo-liq (05 DPS)	34.63	2.68
T ₄	Premax + Rizo-liq (01 DPS)	35.70	2.69
T ₅	Premax + Rizo-liq (ODS)	36.80	2.74
T ₆	Thiram +Carbendazim 50 WP - Premax + Rizo-liq (15 DPS)	34.55	2.66
T ₇	Thiram +Carbendazim 50 WP - Premax + Rizo-liq (10 DPS)	35.43	2.68
T ₈	Thiram +Carbendazim 50 WP - Premax + Rizo-liq (05 DPS)	35.48	2.7
T ₉	Thiram +Carbendazim 50 WP - Premax + Rizo-liq (01 DPS)	36.23	2.7
T ₁₀	Thiram +Carbendazim 50 WP - Premax + Rizo-liq (ODS)	39.18	2.84
T ₁₁	Thiram + Carbendazim 50 WP - Rh ₁ (ODS)	37.23	2.76
T ₁₂	Thiram + Carbendazim 50 WP - Rh ₂ (ODS)	36.55	2.74
T ₁₃	Thiram + Carbendazim 50 WP - Rh ₃ (ODS)	39.00	2.78
T ₁₄	Uninoculated seed (but fungicidal treatment)	31.13	2.6
T ₁₅	Absolute control (No fungicidal treatment and no inoculation)	24.53	2.45
SEm ±		1.96	0.07
CD at 5%		5.59	NS

Seed yield per hectare

Yield of the crop is the result of the various biotic and environmental factors, which are responsible for changes brought about in the productivity. Effectiveness of any treatment could be judged by the magnitude of changes in the productivity brought about by that particular treatment. The seed yield was recorded per net plot and then it was converted into kg/ha. Perusal of data in Table 7 revealed that the maximum (2.15 t/ha) seed yield of soybean in entire experiment was recorded in T₁₀ [Thiram+carbendazim 50 WP - Premax+ Rizo-liq (ODS)] treatment which was appreciably higher than all other treatments, immediately followed by T₁₃ [Thiram + Carbendazim 50 WP - Rh₃ (ODS)] (2.12 t/ha)

treatment. Minimum (1.51 t/ha) seed yield was recorded in T₁₅ (Absolute control) treatment.

Stover yield per hectare

The stover yield obtained was statistically analysed in order to find out the effect of different treatments. The stover yield was calculated by subtracting the seed yield from the biological yield. The maximum (2.85 t/ha) stover yield in entire experiment was recorded in T₁₀ [Thiram+Carbendazim 50 WP- Premax+ Rizo-liq (ODS)] treatment. T₁₀ [Thiram+Carbendazim 50 WP- Premax+ Rizo-liq (ODS)] was found to be at par with all the treatments except T₁, T₂, T₁₄, and T₁₅ (Absolute control). The lowest stover yield (2.08 t/ha) was noted in T₁₅ (Absolute control) treatment.

Harvest index (%)

Data revealed that all the treatments increased the harvest index of soybean as compared to T₁₅ (Absolute control) treatment. The differences in harvest index among the treatments were non significant. The maximum harvest index

up to 43.62% equally found in T₁₁ [Thiram + Carbendazim 50 WP - Rh₁ (ODS)] and T₁ [Premax+Rizo-liq (15 DPS)] treatments whereas the minimum harvest index (39.56%) was recorded in T₁₅ (Absolute control).

Table 7: Seed yield, Stover yield (tonne/ha) and harvest index (%) as affected by different treatments

Treatment No.	Treatments	Seed Yield (t/ha)	Stover Yield (t/ha)	Harvest Index (%)
T ₁	Premax + Rizo-liq (15 DPS)	1.85	2.39	43.61
T ₂	Premax + Rizo-liq (10 DPS)	1.85	2.42	43.33
T ₃	Premax + Rizo-liq (05 DPS)	1.90	2.54	42.84
T ₄	Premax + Rizo-liq (01 DPS)	1.99	2.61	43.43
T ₅	Premax + Rizo-liq (ODS)	2.06	2.73	43.32
T ₆	Thiram+Carbendazim 50 WP-Premax + Rizo-liq (15 DPS)	1.90	2.53	43.00
T ₇	Thiram+Carbendazim 50 WP-Premax + Rizo-liq (10 DPS)	1.94	2.65	42.15
T ₈	Thiram+Carbendazim 50 WP-Premax + Rizo-liq (05 DPS)	1.98	2.65	42.69
T ₉	Thiram+Carbendazim 50 WP-Premax + Rizo-liq (01 DPS)	2.02	2.67	43.37
T ₁₀	Thiram+Carbendazim 50 WP-Premax + Rizo-liq (ODS)	2.15	2.85	43.20
T ₁₁	Thiram + Carbendazim 50 WP - Rh ₁ (ODS)	2.03	2.63	43.62
T ₁₂	Thiram + Carbendazim 50 WP - Rh ₂ (ODS)	1.93	2.72	41.42
T ₁₃	Thiram + Carbendazim 50 WP - Rh ₃ (ODS)	2.12	2.76	43.36
T ₁₄	Uninoculated seed (but fungicidal treatment)	1.64	2.17	43.03
T ₁₅	Absolute control (No fungicidal treatment and no inoculation)	1.51	2.08	39.56
SEm ±		0.07	0.13	1.67
CD at 5%		0.21	0.36	NS

DPS: Days prior sowing, ODS: On days of sowing, DAS: Days after sowing

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