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Combinatorial application of fungicides for management anthracnose of soybean *Colletotrichum truncatum*

Dhiraj Wasule, Yogesh Ingle, Prashant Shingote and Narsing Parlawar

Abstract
Colletotrichum truncatum pathogen of soybean is seed born, and attack at later growth stage is a threat to quality seed production. Field trial was conducted to evaluate the efficacy of fungicide and bio-agent as seed dresser, foliar application and combination of seed dressing and foliar application. In pooled data of three years the highest seed germination was recorded in treatment T_1 (94.39%). The least percent disease index (8.74%), pod infection (12.83%), maximum grain harvest (1628 kg/ha) and the highest ICBR ratio (1:4.2) was recorded in T_4-carboxin + thiram @2 g/kg seed + foliar application of thiophanate methyl @0.1% respectively at 50 and 70 days after sowing. The pooled data record recommended that the seed dressing with carboxin + thiram @ 2 g/kg seed + foliar application of thiophanate methyl @0.1% respectively at 50 and 70 DAS improve in seed germination and plant stand, least foliar percent disease index and pod infection, improved in 100 seed weight, seed yield and higher ICBR ratio.

Keywords: Bio agent, germination, fungicide, pod blight, seed dresser, soybean, yield

1. Introduction
Soybean (*Glycine max* L. Merril) the "Miracle crop" is the world's potential crucial seed legume. The world's most adaptable crops, be grown in a variety of soil and climatic situation than any other major world crop. The global production of soybean for the year 2019-2020 recorded 336.563 million metric tons which approximately 86% were concentrated in Brazil, the United States, and Argentina (USDA, 2020) [26]. Brazil tops global soybean production 123 million metric tons and productivity 3333 kg per hectare followed by America and Argentina. India is far behind and having the opportunity to improve its productivity (FAO 2020) [11]. The agricultural segment is particularly reliant on the availability of disease-free seeds for sowing. Seed born nature, and attack later growth stage pod blight disease of soybean is a major threat to soybean seed production. Shortage of healthy seeds leads to reduction in sowing area and ultimately production resulted in severe economic losses due to unavoidable oil important. Soybean spread out much quicker than any other major grains or oilseeds crops. Soybean is extremely sensitive at different stages of crop growth starting from seed germination to physiological maturity to biotic and abiotic stresses and especially disease menace cause significant yield loss each year. Soybean pod blight disease pathogen cause drastic reduction in yield around the globe are *Colletotrichum truncatum*, *Colletotrichum gleosporides* and *Diaporthe phaseolorum* f. sp. *sojae* appeared during later stage of crop growth (Sinclair and Hartman, 1999) [26]. Anthracnose and/pod blight incited by *Colletotrichum truncatum* one of the most destructive diseases that infects seedlings, stem, petioles, leaves, pods, and causes substantial yield losses to soybean reported in various countries of Asia, Europe, and South and North America (Sharma *et al*., 2011; Wrather and Koenning, 2006; Yang and Hartman, 2015) [21, 29, 30]. Anthracnose in soybean is the important yield reducing factors and caused 2539.6 and 117.6 thousand metric tonnes soybean yield losses in top eight soybean producing countries and in India alone, respectively (Wrather *et al*., 2010) [28]. This disease can reach up to 100% incidence in the field and incidence as low as 1% can cause yield losses of up to 90 kg/ha (Dias *et al*., 2016) [9]. In India, in terms of yield loss is concerned pod blight in soybean is the most severe disease caused an average of 10 to 30% significant reduction in the yield. (Sinclair 1989; Sinclair 1994; Chaudhary *et al*., 2005) [24-25, 7]. Shift in sowing date due to delayed onset of monsoon and the attack of pod blight pathogen at later stage of crop growth reduces the quality of harvested seed of soybean recent years.

Seed borne by nature caused systemic pod blight infection and seed transmission of disease (Neergard 1979) [18]. Infected seeds are responsible for cause of low yield due to seed rot or seedling blight. Sowing of treated seed with bioagents or chemical fungicides reduce the seed and soil borne pathogens infection (Ramos and Ribeiro 1993) [20]. Integrated strategies for management of pod blight includes use of healthy seeds, grow resistant varieties, seed treatment with bio agents or chemical fungicide and chemical fungicidal sprays. Therefore, the present investigation was carried consecutive for three years to study the influence of seed dresser and the foliar application of fungicides to evaluated integrated pod blight management good seed harvest.

2. Materials and Methods

Field trial was conducted consecutive three years to evaluate the efficacy chemical fungicide and bio agent as seed dresser, foliar sprays and combination of seed dressing and foliar spray for pod blight integrated management of soybean. The experiment was conducted during 2015-16, 2016-17 & 2017-18 in the field of Dr. Punjabrao Deshmukh Krishi Vidyapeeth, (RRC) Amravati. The variety JS-335 is sown in randomized block design in three replications with spacing of 45 x 5 cm, area 2.25 x 4 m^2/plot as per the treatments. Total nine treatments were undertaken which include seed dressing prior to half an hour of sowing with different fungicides or bio-agent separately as per treatments. Foliar application of fungicides was at crucial stage 50 and 70 DAS as per treatments. One control plot/replication was maintained without seed dressing and application of any fungicides.

Treatments

T_1: Seed dressing with carboxin 37.5% + thiram 37.5% (Combo product) @ 2 g/kg seed

T_2: Seed dressing with carbendazim 12% + mancozeb 63% (Combo product) @ 2 g/kg seed

T_3: Seed dressing with *Trichoderma viride* @ 5 g/kg seed

T_4: T_1 + foliar application of thiophanate methyl 70% WP @0.1% at 50 and 70 DAS (Days after sowing)

T_5: T_2 + foliar application of thiophanate methyl 70% WP @ 0.1% at 50 and 70 DAS

T_6: T_3 + foliar application of thiophanate methyl 70% WP @0.1% at 50 and 70 DAS

T_7: foliar application of thiophanate methyl 70% WP @0.1% at 50 and 70 DAS

T_8: Foliar spray with *Trichoderma viride* @ 5 g/litre

T_9: Control

Recommended package of practices and protective irrigation was given to the trial as and when required. Observations on percent seed germination and plant stand recorded on 8 and 30 days after sowing (DAS) respectively. Percent seed germination was recorded as per treatment using 100 seed.

Calculation of% Seed Germination

$$\% \text{ Seed Germination} = \frac{\text{Number or Germinated Seeds}}{\text{Total Number of Seeds}} \times 100$$

Calculation of Percent Disease Index (PDI)

The above rating scales or grades are utilized for the calculation of PDI using the following formula of Wheeler, 1969 [27] and yield of soybean (q/ha) recorded, and analysis was done using standard statistical methods.

$$\text{Percent Diseases Index} = \frac{\text{Sum of Numerical Rating}}{\text{Total Number of Plants} \times \text{Maximum Grade}} \times 100$$

Percent disease index was calculated and recorded by using uniform method given by (Anonymous, 2015). Disease scoring for recording percent disease index 0-9 scale was used Rating scale is as 0-No lesions/spots/discolorations, 1-1% area covered with lesions/spots/discolorations, 3-1.1-10% area covered with lesions/spots/discoloration, 5-10.1-25% area covered with lesions/spots/discolorations, 7-25.1-50% area covered with lesions/spots/discoloration, 9-More than 50% area covered with lesions/spots/discolorations. Three trifoliate leaves (bottom, middle and top) from main branch on each observation plant were selected for recording observations and percent disease index was worked out (Mayee and Datar, 1986) [16].

Calculation of % Pod Infection

$$\% \text{ Pod Infection} = \frac{\text{Number of Infected Pods}}{\text{Total Number of Pods Observed}} \times 100$$

Upon crop maturity the crop was harvested treatment wise separately, yield and yield attributes were recorded, and all the data were subjected to statistical analysis.

3. Results and Discussion

Percent Germination

Seed dressing with Carboxin + Thiram @2g/kg seed, Carbendazim + mancozeb @2g/kg seed and Trichoderma @5g/kg seed alone and in combination with foliar spray shows that the treatment having Carboxin + Thiram @2g/kg seed resulted in maximum percent germination upto 94.00, 95.65, 94.52 in 2015-16, 2016-17 and 2017-18 respectively (Table 1, 2, and 3). The pooled data result shows that seed dressing was influence significantly on seed germination maximum percent germination was observed in treatment T_1 94.35 having Carboxin + Thiram @2g/kg seed and is at par with other seed dressing treatments T_4, T_2, T_5, T_6 and T_3 and significantly least germination 82.23% was found in control treatment (Table 4) which clearly indicate the role of seed dresser in improving seed germination. Dhurwey (2015) [5] recorded improvement in seed germination of soybean by seed treatment with carbendazim + mancozeb in blotter paper. Similar trends were recorded by Anitha *et al.* 2015 [3] that the seed treatment with carboxin + thiram @ 0.2%, *Trichoderma harzianum* @ 0.6% and carbendazim + mancozeb @ 0.2% significantly increased the seed germination of soybean over control. These results in accordance with the observation recorded by (Anitha *et al*. 2015) [3] that the seed dressing with carboxin + thiram @ 0.2%, *Trichoderma harzianum* @ 0.6% and carbendazim + mancozeb @ 0.2% significantly increased the seed germination of soybean over control. Management of soybean anthracnose should start with sowing disease-free seeds as the survival of species of *Colletotrichum* that infect soybean is by the dissemination of the pathogen by seeds (Pellegrino *et al*., 2010; Yang & Hartman, 2016) [19, 30]. Nagaraj (2013) [17] recorded that seed dressing with carboxin + thiram or captan along with foliar spray of trifloxystrobin + tebuconazole at 55 DAS was found highly effective in reducing the anthracnose of soybean.

Plants stand (30 DAS)

Improved seed germination also reflects in plant stand results.

Maximum plant stands in pooled data recorded in treatment seed dressing with Carboxin + Thiram @2g/kg seed + spray with thiophanate methyl @0.1% at 55 and 75 DAS i.e., 18.32. Minimum plant stand was recorded in pooled data in control i.e., 15.19. Pooled data of three consecutive years for management of pod blight pathogen results shows that, the improvement in seed germination and plant stand due to seed dressing with fungicide or bioagents.

Percent Disease Index

Typical anthracnose symptoms are dark, depressed, and irregular spots stems, petioles, and pods; and necrotic laminar veins on leaves, shrunken, rolled, or wilted, and have necrotic laminar veins, that result in premature defoliation. During crop growth period, *Colletotrichum truncatum* symptoms were observed in field in the array of 8.72 to 28.44% in the year 2015-16 (Table 1), 11.88 to 30.33 in the year 2016-17 (Table 2), 5.63 to 17.84 in the year 2017-18 (Table 3) and pooled data of three years shows 8.74 to 25.54. Least percent disease 8.74% recorded in pooled treatment T_4- Seed dressing with carboxin + thiram @ 2g/kg seed + foliar application of thiophanate methyl @ 0.1% at 50 and 70 DAS followed by treatment T_5- Seed dressing with carbendazim + mancozeb @ 2g/kg seed + foliar application of thiophanate methyl @ 0.1% at 50 and 70 DAS (10.4%) (Table 4). Chaudhary *et al*. (2005) [7] found lowest incidence of pod blight caused by *Colletotrichum truncatum* by application of thiophanate methyl. Maximum percent disease index was observed in control treatment i.e., T9 (25.54%).

Percent Pod Infection

Pod rot, immature opening of pods was observed percent pod infection in pooled registered in the range of 12.83 to 28.77 (Table 4) in respective treatments. Minimum percent pod infection noticed in pooled treatment T_4-Seed dressing with carboxin + thiram @ 2g/kg seed + foliar application of thiophanate methyl @ 0.1% at 50 and 70 DAS i.e. 12.83% followed by treatment T_5-T_2 + foliar application of thiophanate methyl @ 0.1% at 50 and 70 DAS i.e. 14.18%, treatment T_6-T_3 + foliar application of thiophanate methyl @ 0.1% at 50 and 70 DAS i.e. 16.39% and treatment T_7- foliar application of thiophanate methyl @ 0.1% at 50 and 70 DAS registered 17.24% pod infection (Table 4). Two sprays at 50 and 70 DAS foliar application of fungicide/bioagents reflects in reduction of pod infection. Maximum pod infection in pooled data recorded in unsprayed control i.e., 28.77% (Table 4). Amrate *et al*., (2018) [1] and Ingle *et al.* (2018) [14] found that seed treatment with carboxin 37.5% + thiram 37.5% @ 2 g/kg seed plus spray with thiophanate methyl 70% WP @ 0.1% at 55 and 75 DAS was superior in improvement in seed germination and management of anthracnose/pod blight complex disease under field conditions. Currently, fungicides used as preventives are azoxystrobin, captan, mancozeb, carbendazim, thiophanate methyl, and members of the sterol demethylation inhibitors (DMI), such as triazoles (Dias *et al*., 2016) [9]. Nagaraj (2013) [17] recorded that seed dressing with carboxin + thiram or captan along with foliar spray of trifloxystrobin + tebuconazole at 55 DAS was found highly effective in reducing the anthracnose of soybean. In treatment where the foliar application of either fungicide of bioagents was used minimum foliar and pod percent incidence was recorded similar application of fungicides in controlling anthracnose disease and increasing the yields were reported by researchers. (Shukla and Singh, 1993; Bestor *et al*. 2014) [22, 4].

100 seed weight

Two sprays at 50 and 70 DAS foliar application were significantly reduce pod blight that reflects in improving the 100 seed weight and grain yield as compared with unsprayed control treatment. Treatments T_4 and T_5 registered higher 100 seed weight in pooled data i.e., 11.81 and 11.01g respectively compared to other treatments (Table 5).

Seed yield (Kg/ha)

The highest seed yield 1628 kg/ha was recorded in the pooled data in treatment T_4- Seed dressing with carboxin + thiram @ 2g/kg seed dressing + foliar application of thiophanate methyl @ 0.1% at 50 and 70 DAS followed by treatment T_5-T_2 + foliar application of thiophanate methyl @ 0.1% at 50 and 70 DAS (1523 kg/ha) and treatment T_6-T_3 + foliar application of thiophanate methyl @ 0.1% at 50 and 70 DAS (1406 kg/ha). Least yield recorded in control treatment T9 i.e., 1080 kg/ha (Table 5). Similar results were observed by Shukla and Singh, 1993 [22]; Hingole *et al.* 2017 [13].

ICBR ratio

The economics of treatments was calculated to know the economically best treatment for recommendation. In this pooled data for three years for the best seed treatment incremental cost: benefit ratio (ICBR) in treatment T_3-Seed dressing with Trichoderma @ 5g/kg seed recorded highest ICBR ratio (1:15.1) over the other two seed treatments. The combination of seed dressing and foliar spray is concerned treatment T_4- Seed dressing with carboxin + thiram @ 2g/kg seed dressing + foliar application of thiophanate methyl @ 0.1% at 50 and 70 DAS found highest ICBR ratio (1:4.2) followed by treatment T8- Spray with Trichoderma @5g/litre at 50 and 70 DAS (1: 3.9) over the rest of the treatment (Table 5). These results of ICBR ratio for the management of soybean pod blight disease are in conformity with the Chandrasekaran *et al*., 2000 [6]. Treatment T_4 - Seed dressing with carboxin + thiram @ 2g/kg seed dressing + foliar application of thiophanate methyl @ 0.1% at 50 and 70 DAS found superior over the rest of the treatment in terms of percent seed germination, plant stand, percent foliar and pod incidence, seed yield, 100 seed weight and higher ICBR ratio these results trends like the findings of Chandrasekaran and Rajappan, 2002 [6]; Jagtap GP 2013 [15].

Table 1: Effect of treatments on percent germination, plant stand, percent disease index, percent pod infection, 100 seed weight and seed yield (2015-16)

SN	Treatment	% Germination	Plant stand (30 DAS)	% Disease index	% pod infection	100 seed weight (g)	Seed Yield (kg/ha)
T_1	Seed dressing with Carboxin + Thiram @2 g/kg seed	94.00 (76.90)	18.60	14.29 (22.19)	16.14 (23.68)	9.11	1011
T_2	Seed dressing with Carbendazim + mancozeb @ 2g/kg seed	93.00 (75.10)	17.67	15.70 (23.29)	17.96 (24.96)	8.87	1004
T_3	Seed dressing with Trichoderma @ 5g/kg seed	92.33 (74.22)	17.20	17.81 (24.93)	21.18 (27.40)	7.74	922
T_4	T_1 + spray with thiophanate methyl @ 0.1% at 50 and 70DAS	93.33 (75.42)	17.87	8.72 (17.12)	11.01 (19.37)	11.31	1389
T_5	T_2 + spray with thiophanate methyl @0.1% at 50 and 70 DAS	92.67 (74.53)	17.07	9.45 (17.87)	12.34 (20.51)	10.40	1233
T_6	T_3 + spray with thiophanate methyl @0.1% at 50 and 70 DAS	91.33 (73.17)	16.67	11.81 (20.00)	16.16 (23.67)	9.60	1130
T_7	Spray with thiophanate methyl @ 0.1% at 50 and 70 DAS	78.33 (62.38)	14.93	15.97 (23.49)	16.88 (24.19)	10.01	1159
T_8	Spray with Trichoderma @5 g/litre at 50 and 70DAS	78.00 (62.09)	15.40	19.57 (26.23)	20.71 (27.00)	7.92	944
T_9	Control	77.67 (62.04)	14.40	28.4 (32.19)	30.25 (33.34)	6.84	770
	SE ± (m)	2.74	0.45	1.57	1.79	0.32	79.97
	CD (P=0.05)	8.21	1.36	4.72	5.38	0.97	239.73
	CV (%)	5.40	4.72	17.31	17.20	6.19	13.04

*Figures in parentheses are arc sine transformed value

Table 2: Effect of treatments on percent germination, plant stand, percent disease index, percent pod infection, 100 seed weight and seed yield (2016-17)

SN	Treatment	% Germination	Plant stand (30 DAS)	% Disease index	% pod infection	100 seed weight (g)	Seed Yield (kg/ha)
T_1	Seed dressing with Carboxin + Thiram @2g/kg seed	94.65 (76.86)	18.13	18.06 (25.10)	22.26 (28.09)	10.14	1956
T_2	Seed dressing with Carbendazim + mancozeb @2g/kg seed	92.97 (75.05)	17.60	19.06 (25.84)	24.47 (29.61)	9.50	1922
T_3	Seed dressing with Trichoderma @5g/kg seed	89.49 (71.16)	16.53	22.52 (28.31)	27.93 (31.90)	9.32	1830
T_4	T_1 + spray with thiophanate methyl @0.1% at 50 and 70DAS	95.17 (77.65)	18.87	11.88 (20.13)	16.42 (23.82)	13.02	2248
T_5	T_2 + spray with thiophanate methyl @0.1% at 50 and 70 DAS	92.77 (74.43)	17.87	13.82 (21.80)	18.09 (25.12)	12.30	2196
T_6	T_3 + spray with thiophanate methyl @0.1% at 50 and 70 DAS	90.89 (72.47)	16.80	14.56 (22.43)	19.88 (26.47)	10.92	2056
T_7	Spray with thiophanate methyl @0.1% at 50 and 70 DAS	86.42 (68.70)	15.93	16.17 (23.67)	20.95 (27.10)	10.34	2011
T_8	Spray with Trichoderma @5g/litre at 50 and 70DAS	85.30 (67.60)	15.80	20.67 (27.02)	25.84 (30.49)	9.12	1859
T_9	Control	84.53 (67.08)	15.73	30.33 (33.41)	33.37 (35.28)	8.82	1730
	SE ± (m)	2.08	0.72	1.30	2.07	0.53	105.01
	CD (P=0.05)	6.24	2.15	3.90	6.22	1.60	314.78
	CV (%)	4.00	7.29	12.15	15.46	8.89	9.19

*Figures in parentheses are arc sine transformed value

Table 3: Effect of treatments on percent germination, plant stand, percent disease index, percent pod infection, 100 seed weight and seed yield (2017-18)

SN	Treatment	% Germination Pooled	Plant stand (30 DAS) Pooled	% Disease index Pooled	% pod infection Pooled	100 seed weight (g)	Seed Yield (kg/ha)
T_1	Seed dressing with Carboxin + Thiram @2g/kg seed	94.52 (76.53)	18.17	10.93 (19.25)	14.52 (22.36)	25.12	966
T_2	Seed dressing with Carbendazim + mancozeb @2g/kg seed	92.80 (74.67)	17.57	11.73 (20.01)	16.11 (23.66)	23.42	939
T_3	Seed dressing with Trichoderma @5g/kg seed	90.16 (71.85)	16.63	13.98 (21.93)	18.59 (25.52)	22.80	904
T_4	T_1 + spray with thiophanate methyl @0.1% at 50 and 70DAS	94.55 (76.77)	18.23	5.63 (13.67)	11.06 (19.41)	33.28	1246
T_5	T_2 + spray with thiophanate methyl @0.1% at 50 and 70 DAS	92.64 (74.28)	17.53	6.85 (15.17)	12.11 (20.32)	30.99	1139
T_6	T_3 + spray with thiophanate methyl @0.1% at 50 and 70 DAS	90.29 (71.97)	16.77	7.09 (15.43)	13.14 (21.22)	28.21	1033
T_7	Spray with thiophanate methyl @0.1% at 50 and 70 DAS	85.68 (68.17)	15.70	9.37 (17.81)	13.89 (21.85)	28.48	1000
T_8	Spray with Trichoderma @5g/litre at 50 and 70DAS	84.80 (67.22)	15.67	13.57 (21.58)	18.22 (25.24)	22.43	874
T_9	Control	84.50 (66.99)	15.43	17.84 (24.98)	22.70 (28.41)	19.41	740
	SE ± (m)	2.25	0.68	0.83	1.14	0.47	84.75
	CD (P=0.05)	6.76	2.05	2.49	3.42	1.41	254.06
	CV (%)	4.34	7.03	13.33	12.66	9.42	14.94

*Figures in parentheses are arc sine transformed value

Table 4: Effect of treatments on percent germination, plant stand, percent disease index and percent pod infection (Pooled 15-16, 16-17 & 17-18)

SN	Treatment	% Germination Pooled	Plant stand (30 DAS) Pooled	% Disease index Pooled	% pod infection Pooled
T_1	Seed dressing with Carboxin + Thiram @2g/kg seed	94.39 (76.76)*	18.30	14.43 (22.18) *	17.64 (24.71) *
T_2	Seed dressing with Carbendazim + mancozeb @2g/kg seed	92.92 (74.94)	17.61	15.50 (23.05)	19.51 (26.08)
T_3	Seed dressing with Trichoderma @5g/kg seed	90.66 (72.41)	16.79	18.10 (25.06)	22.57 (28.27)
T_4	T_1 + spray with thiophanate methyl @0.1% at 55 and 75 DAS	94.35 (76.61)	18.32	8.74 (16.97)	12.83 (20.87)
T_5	T_2 + spray with thiophanate methyl @0.1% at 55 and 75 DAS	92.69 (74.42)	17.49	10.04 (18.28)	14.18 (21.98)
T_6	T_3 + spray with thiophanate methyl @0.1% at 55 and 75 DAS	90.84 (72.54)	16.74	11.15 (19.28)	16.3 (23.78)
T_7	Spray with thiophanate methyl @0.1% at 55 and 75 DAS	83.48 (66.42)	15.52	13.84 (21.66)	17.24 (24.38)
T_8	Spray with Trichoderma @5g/litre at 55 and 75 DAS	82.70 (65.64)	15.62	17.94 (24.94)	21.59 (27.58)
T_9	Control	82.23 (65.37)	15.19	25.54 (30.19)	28.77 (32.34)
	SE ± (m)	1.71	0.49	0.62	0.90
	CD (P=0.05)	5.13	1.46	1.86	2.71
	CV (%)	4.13	5.00	4.81	6.12

*Figures in parentheses are arc sine transformed value

Table 5: Effect of various treatments on 100 seed weight, seed yield and ICBR ratio (Pooled 2015-16, 2016-17 & 2017-18)

SN	Treatment	100 seed weight (g) pooled	Seed Yield (kg/ha) pooled	ICBR ratio
1	Seed dressing with Carboxin + Thiram @ 2g/kg seed	9.21	1311	1:13.3
2	Seed dressing with Carbendazim + mancozeb @ 2g/kg seed	8.72	1288	1:11.9
3	Seed dressing with Trichoderma @ 5g/kg seed	8.22	1219	1:15.1
4	T1 + spray with thiophanate methyl @ 0.1% at 55 and 75 DAS	11.81	1628	1:4.2
5	T2 + spray with thiophanate methyl @ 0.1% at 55 and 75 DAS	11.01	1523	1:3.2
6	T3 + spray with thiophanate methyl @ 0.1% at 55 and 75 DAS	9.98	1406	1:2.3
7	Spray with thiophanate methyl @ 0.1% at 55 and 75 DAS	9.95	1390	1:2.4
8	Spray with Trichoderma @ 5g/litre at 55 and 75 DAS	8.17	1226	1:3.9
9	Control	7.38	1080	
	SE ± (m)	0.29	45.00	
	CD (P=0.05)	0.87	134.90	
	CV (%)	5.38	5.81	

4. Conclusion

Seed born nature, and attack later growth stages pod blight pathogen *Colletotrichum truncatum* of soybean is a major threat to soybean seed industry. Scarcity of superior quality seeds leads to reduce in cultivation area and production resulted in severe economic losses due to unavoidable oil important. Disease free quality seed production is important to fulfill the target requirement of superior quality seed, which resulted in increased area of sowing, improve production and productivity. Three years pooled data was concluded that, the seed dressing with carboxin + thiram @ 2 g/kg seed, along with foliar application of thiophanate methyl @ 0.1% at 50 and 70 DAS resulted in improving seed germination, plant stand, least disease index, percent pod infection and improved in 100 seed weight which ultimately contributed in higher seed yield and highest ICBR ratio as compared to other treatments and is recommend for management of pod blight in soybean (Chaudhary *et al.* 2005 [7]; Gawade *et al.* 2009; Anitha *et al.* 2015 [3] and Amrate *et al.* 2018) [1].

5. Declarations of conflicts of interest

Research facilities provide by university and no conflicts of interest/competing interests. The availability of data and material is original. The corresponding author is principal investigator and remaining authors are co-investigator. On behalf of all authors, the corresponding author states that there is no conflict of interest.

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