RESEARCH ARTICLE

STUDIES ON AERIAL BLIGHT OF SOYBEAN CAUSED BY *RHIZOCTONIA SOLANI* KÜHN

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Abstrct: Soybean aerial blight caused by *Rhizoctonia solani* is a most important oilseed disease. This disease is destructive and causes heavy losses in the yield particularly in warn and humid parts of the countries. The use of resistant varieties is the cheapest, easiest, safest and most effective method to manage the aerial blight disease. Forty-two entries screened for resistant to aerial blight of soybean, 2 entries (SL 752 and RKS 48) were found absolutely resistant and 6 entries were highly resistant. Soybean crop sown at 29th July showed least disease severity (11.04%) in comparison to 21st June, 9th July and 19th July sowing. Losses assessment study revealed that maximum percent reduction in seed weight, plant height, pods and branches were recorded in 9 score plants (more than 50% leaf area infected) i.e., 55.55%, 40.90%, 71.42%, and 72% respectively. Maximum aerial blight intensity was recorded in the crop sown in flooded field.

Keywords: Aerial blight of soybean, *Rhizoctonia solani*, Screening of soybean varieties, Web blight

INTRODUCTION

Soybean (*Glycine max* (L.) Merrill) is one of the most important oil seed crop of India .It was wonder of the twentinth century. Soybean rank first among world oilseed with an annual production of about 105 mt. Among the different growing countries of the world, USA, China, Brazil, Argentina and India are main which accounts more than 90% of the world's acreage (Taware *et al*., 2007). Soybean (*Glycine max* (L.) Merill.) a grain legume is widely crop due to its high quality protein (40%) and edible oil (20%). Aerial blight caused by *Rhizoctonia solani* is one of the most soil borne diseases of soybean particularly in the northern zone comprising the states of Haryana, Punjab, Uttar Pradesh and Uttarkhand. Soybean is mainly grown during Kharif season in sandy loam to clay loam soil in Chhattisgarh. In Chhattisgarh, area, production and productivity of soybean are 0.82 m ha, 0.73 mt and 891 kg/ha, respectively which are much lower than national average (Anonymous, 2006b). The disease appears July-August and is characterized by sudden and complete death of the plants. This disease is considered to be one of the most destructive and causes heavy losses in the yield particularly in warn and humid parts of the countries (Anwar *et al*., 1995). Yield losses can exceed 35-60 per cent and the disease is considered as economically important (Patel *et al.*, 1998). The use of resistant varieties is the cheapest, easiest, safest and most effective method to manage the aerial blight disease. Few tolerant cultivars were reported against aerial blight disease (Thind,1998 and Palat *et al.*, 2004). In same context, an attempt was made through this investigation, to "Studies on aerial blight of soybean caused by *Rhizoctonia solani* Kühn*"*.

MATERIAL AND MATHOD

Symptomatology

Disease samples were collected from naturally infected soybean plants, just after initiation of disease and at different development stages. Collected samples were brought to the laboratory for critical examination of symptoms produced using simple microscope.

Evaluation of different entries against *Rhizoctonia solani* under field condition.

The experiment was conducted to evaluate the soybean entries against *Rhizoctonia solani*. Three row of each entries were grown in 5 m length in alternate with susceptible check viz., Bragg and JS 335 on dated 13/7/07 at National Seed Project Research Farm, IGAU, Raipur. Recommended agronomic practices were adopted. For recording observation on aerial blight, 10 plants per cultivar randomly selected and tagged. Visual observations on aerial blight intensity were recorded on the bottom, middle and top trifoliate. Numerical grades were assigned to the amount of disease observed applying 0-9 disease rating scale and per cent disease intensity/index (PDI) was computed applying the formula (Anonymous, 2006-07) as given below.

$$PDI = \frac{\text{Summation of individual rating}}{\text{No. of leaves examined} \times \text{Maximum ratings}} \times 100$$

*Corresponding Author

Uniform method of disease rating

Rating (0-9)	Description	Reaction
0	No lesion/spots	Absolutely resistant
1	1% leaf area covered with lesion/spots	Highly resistant
3	1.1-10% leaf area covered with lesion/spots, no. spots on stem	Moderately resistant
5	10.1-25% of the leaf area covered, no defoliation, little damage	Moderately susceptible
7	25.1-50% leaf area covered, some leaves drop, death of a few plants, damage conspicuous	Susceptible
9	More than 50% area covered, lesion/spots very common on all plants, defoliation common, death of plants common, damage more than 50%	Highly susceptible

Effect of date of sowing on disease severity of aerial blight of soybean under field condition

The experiment was conducted to find out the effect of date of sowing on severity of *Rhizoctonia* aerial blight. Five soybean cultivars i.e. JS-9305, JS-335, JS-9, Bragg and NRC-37 were sown at four dates i.e. 21st Jun, 9th July, 19th July and 29th July in the year 2007 at National Seed Project Research Farm, IGAU, Raipur. Plot size was 1.5×5m. Recommended agronomic practices were adopted for cultivation of soybean crop. For recording observation on aerial blight, 10 plants per cultivar randomly selected and tagged. Visual observations on aerial blight severity were recorded at grain formation stage of the crops. Numerical grades were assigned to the amount of disease observed applying 0-9 disease rating scale and per cent disease intensity/index (PDI) was computed applying the formula (Anonymous, 2006-07).

$$PDI = \frac{\text{Summation of individual rating}}{\text{No. of leaves examined} \times \text{Maximum ratings}} \times 100$$

Assessment of the losses due to aerial blight disease on soybean

Naturally aerial blight infected one acre field, variety JS 335 was selected to asses the losses at National Seed Project Research farm, IGAU, Raipur. The crop was at flowering stage. Field were equally divided in three parts and treated as replication. In each part of the field diseased plants were randomly selected, tagged and grouped in the categories described by Directorate of oilseed Research, Hyderabad as absolutely resistant (healthy), highly resistant, moderately resistant, moderately susceptible, susceptible and highly susceptible. In each category five plants were tagged for assessment of losses and observed for seed weight, plant height, number of pods and number of branches. Percent reduction was calculated by adopting the following formula.

$$\% \text{ reduction} = \frac{\text{Healthy} - \text{Infected}}{\text{Healthy}} \times 100$$

Uniform method of disease rating

Rating (0-9)	Description	Reaction
0	No lesion/spots (healthy)	Absolutely resistant
1	1% leaf area covered with lesion/spots	Highly resistant
3	1.1-10% leaf area covered with lesion/spots, no spots on stem	Moderately resistant
5	10.1-25% of the leaf area covered, no defoliation, little damage	Moderately susceptible
7	25.1-50% leaf area covered, some leaves drop, death of a few plants, damage conspicuous	Susceptible
9	More than 50% area covered, lesion/spots very common on all plants, defoliation common, death of plants common, damage more than 50%	Highly susceptible

RESULT AND DISCUSSION

Symptomatology

Leaves, stem, pods and petiole were infected with the disease. Initial symptoms were observed on the lower leaves touching to the ground. Infected leaves were water soaked brown to reddish brown and later on leaves become tan to black. Slowly and slowly complete leaves become blighted. Tissue in the centre of spot fallout giving the plant a ragged appearance. Dropping of leaves were also observed and some of the leaves were adhere with stem, petiole and pods. Brownish lesion was also observed on stem and pods. Some of the pods were completely blighted.Web like mycelial growth of the fungus was observed on leaves and petioles along with dark brown sclerotia in flood affected field of soybean variety JS 335 at flowering and poding stage.Two type of sclerotia i.e., micro sclerotia and macro sclerotia were observed on infected leaves and petioles.

Similar symptoms of aerial blight were also observed by Happerly *et al*. (1982), Sinclair (1982), Mukhopadhyay and Sing (1984) and Thapliyal and Dubey (1987). They reported that leaves, stem, pods and petiole were infected with the disease. Infected leaves were water soaked brown to reddish brown and later on leaves become tan to black and slowly and slowly leaves become blighted completely. Brownish lesion was also observed on stem, petiole and pods. Some of the pods were completely blighted. Web like mycelial growth of the fungus was formed on leaves and petioles along with dark brown sclerotia at flowering and poding stage.

Evaluation of different entries against *Rhizoctonia solani* under field condition

Forty-two soybean entries were evaluated under natural field condition for resistant to aerial blight of soybean. Observations were recorded at grain formation stage and data are presented in Table 1, indicated that 2 entries (SL 752 and RKS 48) to be free from disease or absolutely resistant, 6 entries were highly resistant, 21 entries were moderately resistant, 13 entries were moderately susceptible and none of the entries exhibited susceptible and highly susceptible reaction. Palat *et al*. (2004) also screened soybean germplasm for their resistance to web blight. They observed 8 cultivars free from the disease, 11 cultivars as resistant and 9 cultivars as moderately resistant. The remaining cultivars categorized in moderately susceptible (6 cultivars), susceptible (9 cultivars) or highly susceptible (6 cultivars), groups. At Pantnagar out of 35, 15 soybean entries were also observed as highly resistant to Rhizoctonia aerial blight during study of performance of previous year resistant entries (Anonymous, 2007).

Effect of date of sowing on disease severity of *Rhizoctonia solani* on soybean under field condition

The results indicated that (Table 2) aerial blight intensity was found to differ with respect to sowing dates. Average aerial blight severity observed at grain formation stage ranged from 0.72 to 56.67% in the crops sown at different dates. However minimum aerial blight severity was recorded in the crop sown at 29th July (11.04%) and maximum aerial blight severity was recorded in the crop sown at 21st June (45.45%). As regards varietals response to aerial blight severity, JS-9 exhibited minimum disease severity in the range of 0.72 to 49.40% at grain formation stage. Thus, from the result, it is revealed that soybean crop sown at 29th July showed least disease severity in comparison to the crop sown at 21st June, 9th July and 19th July. Further, among the varieties JS-9 showed least disease severity in comparison to Bragg, JS-335, NRC-37 and JS-9305. Similar results were also reported by Teo *et al*. (1988). They reported that early sowing or seeding resulted significantly increased seedling infection and disease severity in comparison to late sowing.

Assessment of the losses due to aerial blight of soybean

The data presented in Table 3. It is clear from the data that the per cent reduction in seed weight, plant height, pods and branches differs with respect to different categories of infected plants. The percent reduction in seed weight was ranged from 5.55 to 55.55%. The per cent reduction in plant height was ranged from 4.54 to 40.90%. The per cent reduction in pods was ranged from 7.14 to 71.42%. The per cent reduction in branches was ranged from 8 to 72%. The maximum per cent reduction in seed weight, plant height, pods and branches were recorded in 9 score plants (more than 50% leaf area infected) i.e., 55.55%, 40.90%, 71.42%, and 72% respectively followed by 7 score plants i.e., 44.44%, 36.36%, 64.28% and 64%. The minimum per cent reduction in seed weight, plant height, pods and branches were recorded in 01 score plants (1% leaf area infected) i.e., 5.55%, 4.54%, and 7.14% and 8% in comparison to healthy plants. Stetina *et al.* (2006) also assessed disease severity and yield losses in moderately resistant cultivars of soybean in field plots using foliar and pod ratings (0-10 scale corresponding to 0-100% of tissue affected)

Table 1. Evaluation of different entries against *Rhizoctonia solani* under field condition

Reaction	Number of entries	Entries
Absolutely resistant	2	SL 752 and RKS 48
Highly resistant	6	Nso 11, Dsb 12, Himso 1608, JS 20-06, SL-744 and RKS 45
Moderately resistant	21	LSB 23, JS 20-01, MACS 1126, PS 4221, MAUS 285, DS 2410, NSO 78, AMS 4-4, PS 1433, NRC 78, Himso 1609, TS 94, NRC 77, SL 79, VLS 69, TS 56, VLS 68, MACS 1149, Bragg, RAUS 5 and JS 335
Moderately susceptible	13	JS (SH) 2001-04, VLS 70, DSb 10, PS 1437, NSO 111, KDS 167-9, MACS 1148, AMS 4-63, RCS-9, NRC-76, RKS 45, JS 20-09 and RCS 1
Susceptible	0	-
Highly susceptible	0	-

Table 2. Effect of date of sowing on disease severity of aerial blight of soybean under field condition

Date of sowing	PDI at grain formation stage					
	JS 9305	JS-335	JS-9	Bragg	NRC-37	Average
D 1 21.06.07	51.30	45.92	49.40	34.12	46.53	45.45
D 2 09.07.07	43.89	46.37	24.37	50.65	56.67	44.39
D 3 19.07.07	18.07	7.26	0.72	16.08	29.96	14.40
D 4 29.07.07	32.29	2.20	18.94	0.77	1.04	11.04
Mean PDI	36.38	25.43	23.35	25.40	33.55	

Table 3. Assessment of the losses due to aerial blight of soybean

Rating	Description	Seed weight (gm)*	Reduction (%)	Plant height (cm)*	Reduction (%)	Pods (no.)*	Reduction (%)	Branch (no.)*	Reduction (%)
0	No lesion/spots	90	0.00	110	0.00	140	0.00	25	0
1	1% leaf area covered with lesion/spots	85	5.55	105	4.54	130	7.14	23	8
3	1.1-10% leaf area covered with lesion/spots, no spotson stem	75	16.66	95	13.63	100	28.57	20	20
5	10.1-25% of the leaf area covered, no defoliation, little damage	60	33.33	80	27.27	60	57.14	10	60
7	25.1-50% leaf area covered, some leaves drop, death of a few plants, damage conspicuous	50	44.44	70	36.36	50	64.28	9	64
9	More than 50% area	40	55.55	65	40.90	40	71.42	7	72

	covered, lesion/spots very common on all plants, defoliation common, death of plants common, damage more than 50%								
	Sem±	2.88		3.53		2.88		1	
	CD (5%)	8.9		11		8.9		3.1	

* Means of three replication

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