



Effect of date of sowing and varieties on severity of *Alternaria* leaf spot, rust and yield in soybean (*Glycine max* L. Merrill)

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ABSTRACT

Rust caused by *Phakopsora pachyrhizi* Syd. & P. Syd. and *Alternaria* leaf spot caused by *Alternaria tenussiana* are the major diseases of soybean appeared in north east region of India. The purpose of this study was to evaluate the date of sowing and varieties on disease severity and its effect of yield attributes. The experiment was conducted at Research Farm of School of Agricultural Sciences and Rural Development, Medziphema during kharif of 2012 and 2013. Four varieties namely 'JS 93-05', 'JS 335', 'JS 97-52' and 'RKS 18' having different disease reaction to *Alternaria* leaf spot and rust were sown on different dates starting from 15 June to 25 July at 10 days intervals in a split plot design and replicated thrice. The crop sown on 15th June exhibited lowest *alternaria* leaf spot (12.10 & 14.70%) and rust (13.99 & 16.03%) intensity with highest number of pods/plant (63.55 & 66.35), 100-seed weight (12.93 & 12.31%) and maximum seed yield (1695.2 & 1606.7 kg/ha), respectively during both the year. Variety 'JS 97-52' showed significantly means lowest *alternaria* leaf spot intensity of 14.48 and 14.02 per cent, respectively during both the year over rest of the varieties. However, minimum mean intensity of rust was recorded on variety 'JS 93-05'. The results clearly indicate that early sowing of the above mentioned soybean varieties will help in managing these diseases in better way.

Keywords: Soybean, *Alternaria* leaf spot, rust, date of sowing, varieties.

Received 05.08.2017

Revised 11.08.2017

Accepted 26.08. 2017

INTRODUCTION

Soybean (*Glycine max* L. Merrill) is the most important oilseed crop in India, grown in about 11.40 m ha with the production of 14.12 metric tonnes with average productivity of 1239 kg/ha. It contains highest protein (40-42%) among all food crops and is second only to groundnut in terms of oil content (18-20%) among the food legumes with calcium, iron and glycine. The isoflavones present in it; help in preventing heart diseases, cancer and HIVs. A number of fungal foliar diseases have been reported on this crop. Among them, *Alternaria* leaf spot (*Alternaria tenussiana*) causes enormous yield loss. Rust caused by *Phakopsora pachyrhizi* Syd. & P. Syd. (Sarbhoy and Pal, 1997) is the most destructive and causing 30-100% yield loss. The disease is reported to cause 20-80, 50-70, 30-100 % yield loss in Karnataka, Maharashtra, Madhya Pradesh and Tamilnadu respectively (Patil and Anshosur, 1998). Since 1994, the disease has been identified by several countries, damaging up to 40% of crops in Thailand, 90% in India, 50% in the south of China and 40% in Japan (Hartman *et al.*, 1991; Mendes *et al.*, 2009). Devaraj *et al.*, (2013) also reported the soybean rust is an economically important disease in northern Karnataka and causing yield loss of 80 to 100 per cent. Though, measures for managing these diseases by chemical are available but it is not safe. Considering the importance of the crop, destructive nature of the diseases the study was undertaken to find out the effect of date of sowing and varieties for the management of these diseases.

MATERIALS AND METHODS

The field experiment was conducted with four soybean varieties having varied range of susceptibility to alternaria leaf spot, target leaf spot and rust, namely 'JS 93-05', 'JS 335', 'JS 97-52' and 'RKS 18' at Research Farm of the School of Agricultural Sciences and Rural Development, Medziphema (25° 45' 16.6" N, 93° 51' 43.1" E 440 m above mean sea level), Dimapur, Nagaland during *Kharif* season of 2012 and 2013. The crop was planted on different dates starting from 15 June to 25 July of 2012 and 2013 at 10 days intervals in a split plot design with three replications having 45 cm row to row and 10 cm plant to plant distance. Recommended doses of NPKS @ 25:100:50:50 kg/ha was applied as basal dose in the form of urea, DAP, MOP and SSP. Observations were recorded on disease severity at fortnightly interval. Data were also recorded on pods/plant, test weight (g) and yield (kg/ha). Observations on disease severity were recorded by following 0-9 point scale (Mayee and Datar, 1986) where 0 = no lesions; 1 = 1%; 3 = 1.1 - 10%; 5 = 10.1 - 25%; 7 = 25.1 - 50% and 9 = more than 50% leaf area covered by lesions. The data of each character were subject to statistical test by applying analysis of variance technique (Panse and Sukhatme, 1985). Per cent disease index (PDI) was calculated as follow:

$$\text{Per cent disease index (PDI)} = \frac{\text{Sum of individual rating}}{\text{No. of leaf examined}} \times \frac{100}{\text{Maximum disease rating}}$$

RESULTS AND DISCUSSION

Year 2013 was most susceptible for both alternaria leaf spot and rust as compare to 2012. The crop sown on 15th June exhibited lowest mean alternaria leaf spot severity of 12.10 and 14.70 per cent and rust of 13.99 and 16.03 per cent which was significantly higher than the rest date of sowing. However, it was maximum recorded in last date of sowing i.e. 25th July during both the years (Table 1). First date of sowing (15th June) showed highest number of pods/plant of 63.55 and 66.35, respectively during 2012 and 2013. It was significantly superior to rest of the date of sowing. The mean minimum pods/plant (33.10 & 28.66) was recorded in 25th July sown crops during both the years (Table 2). Maximum average 100 seed weight of 13.14 and 12.60 g and seed yield of 1796.8 and 1548.2 kg/ha was recorded in second date of sowing (25th June), respectively during both the years. Statistically it was found significantly superior to rest of date of sowing. However, it was minimum noted in fifth date of sowing (25th July) during the years of testing. The present study was in conformity with findings of Shukla *et al.* (2005) who reported the early sown soybean showed low disease incidence as compared to late sown crop.

The second factor was follow variety. Variety 'JS 97-52' showed significantly lowest alternaria leaf spot of 14.48 & 14.02 per cent, respectively during 2012 and 2013, while mean minimum severity of rust (31.06 & 32.56%) was noted on variety 'JS 93-05' during (Table 1). However, the maximum severity of alternaria leaf spot of 31.62 and 36.46 per cent was reported on variety 'RKS 18' while the maximum severity of rust was recorded on variety 'JS 335' during both the years. Variety 'JS 97-52' showed significantly highest number of pods/plant (60.37 & 56.98), respectively during 2012 and 2013. However, it was minimum recorded on variety 'JS 335'. The mean maximum 100 seed weight of 13.06 and 12.41 g was recorded in variety 'JS 93-05' followed by 'RKS 18' during both the years. In respect of seed yield variety 'JS 97-52' showed highest seed yield of 1590.7 and 1470.3 kg/ha, respectively during both years followed by 'RKS 18'. Whereas variety 'JS 335' had lowest seed yield. In accordance with present findings, Karmakar and Bhatnagar (1995) also reported the yield and yield attributes as influenced by varieties.

So, our findings clearly indicate the importance of early sowing and varietal selection of soybean for the farmers of Nagaland for obtaining higher yield.

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Table 1 Effect of date of sowing and varieties on *Alternaria* leaf spot and rust of soybean

Factor	Alternaria leaf spot severity (%)											
	2012						2013					
	D ₁	D ₂	D ₃	D ₄	D ₅	Mean	D ₁	D ₂	D ₃	D ₄	D ₅	Mean
JS 93-05	17.30 (24.58)	21.69 (27.76)	32.64 (34.82)	35.36 (36.51)	40.50 (39.52)	31.50 (32.64)	20.08 (26.64)	25.83 (30.53)	32.88 (35.00)	40.73 (39.64)	47.64 (43.62)	33.66 (35.09)
JS 335	8.03 (16.43)	12.44 (20.62)	19.31 (26.06)	22.81 (28.52)	25.35 (30.26)	17.58 (24.38)	14.07 (22.06)	18.94 (25.77)	24.76 (29.87)	32.80 (34.94)	38.34 (38.23)	25.76 (30.17)
RKS 18	18.24 (25.25)	24.06 (29.40)	34.66 (36.09)	37.95 (38.06)	43.21 (41.09)	31.62 (33.98)	20.00 (26.56)	29.23 (32.71)	40.24 (39.35)	44.28 (41.73)	48.72 (44.25)	36.46 (36.92)
JS 97-52	4.88 (12.79)	11.17 (19.55)	16.17 (23.73)	19.44 (26.13)	20.72 (27.06)	14.48 (21.85)	4.69 (12.52)	10.22 (18.63)	13.48 (21.56)	19.44 (26.13)	22.30 (28.18)	14.02 (21.40)
Mean	12.10 (19.76)	17.35 (24.33)	25.75 (30.18)	28.88 (32.31)	32.45 (34.49)		14.70 (21.95)	21.06 (26.91)	27.84 (31.45)	34.31 (35.61)	39.25 (38.57)	
CD (P = 0.05%)												
D	1.60						1.84					
V	1.43						1.65					
D × V	3.18						3.68					
	Rust severity (%)											
	D ₁	D ₂	D ₃	D ₄	D ₅	Mean	D ₁	D ₂	D ₃	D ₄	D ₅	Mean
JS 93-05	10.59 (19.00)	14.99 (22.79)	31.81 (34.33)	47.76 (43.74)	50.05 (45.06)	31.06 (32.98)	12.70 (20.88)	18.77 (25.70)	28.12 (32.01)	50.67 (45.40)	52.52 (46.43)	32.56 (34.08)
JS 335	16.95 (24.35)	27.22 (31.44)	49.63 (44.77)	64.65 (53.55)	74.71 (59.80)	46.63 (42.78)	18.07 (25.19)	30.84 (33.71)	48.04 (43.85)	65.30 (53.91)	79.65 (63.22)	48.38 (43.98)
RKS 18	11.78 (20.09)	20.42 (26.85)	41.99 (40.40)	59.88 (50.71)	66.54 (54.63)	40.12 (38.53)	12.91 (21.05)	23.26 (28.86)	43.30 (41.15)	62.66 (52.36)	75.25 (60.20)	43.48 (40.72)
JS 97-52	16.66 (24.12)	27.34 (31.50)	48.73 (44.25)	66.32 (54.51)	70.69 (57.23)	45.95 (42.32)	20.44 (26.85)	29.70 (33.02)	50.95 (45.57)	69.37 (56.42)	64.35 (53.37)	46.96 (43.05)
Mean	13.99 (21.89)	22.49 (28.15)	43.04 (40.94)	59.65 (50.63)	65.50 (54.18)		16.03 (23.49)	25.64 (30.32)	42.60 (40.65)	62.00 (52.02)	67.94 (55.81)	
CD (P = 0.05%)												
D	1.77						2.21					
V	1.58						1.98					
D × V	3.53						4.42					

Figures are given in parenthesis are angular transformed value, D = Date of sowing; V = Variety; D₁ = 15 June; D₂ = 25 June; D₃ = 05 July; D₄ = 15 July; D₅ = 25 July

Table 2 Effect of date of sowing and varieties on pods/plant, 100 seed weight and seed yield of soybean

Factor	Pods/plant											
	2012						2013					
	D ₁	D ₂	D ₃	D ₄	D ₅	Mean	D ₁	D ₂	D ₃	D ₄	D ₅	Mean
JS 93-05	63.60	57.63	55.45	46.89	33.03	51.32	66.64	60.40	56.00	42.64	28.78	50.89
JS 335	56.96	53.02	50.84	47.65	28.62	47.42	60.36	57.37	53.73	41.30	25.41	47.63
RKS 18	61.07	52.00	51.31	45.04	32.63	48.41	62.97	59.71	52.76	46.62	28.03	50.02
JS 97-52	72.58	67.24	66.00	57.91	38.12	60.37	75.44	70.74	55.09	51.21	32.42	56.98
Mean	63.55	57.47	55.90	49.37	33.10		66.35	62.06	54.40	45.44	28.66	
CD (P = 0.05%)												
D	1.911						1.755					
V	1.715						1.564					
D × V	3.832						3.500					
	100 seed weight (g)											
	D ₁	D ₂	D ₃	D ₄	D ₅	Mean	D ₁	D ₂	D ₃	D ₄	D ₅	Mean
JS 93-05	14.21	14.43	13.78	12.44	10.43	13.06	12.81	13.57	13.22	12.15	10.31	12.41
JS 335	11.55	11.65	11.14	10.45	9.64	10.89	11.28	11.14	10.74	10.18	9.46	10.56
RKS 18	13.44	13.61	13.29	12.21	10.46	12.60	12.93	13.31	12.76	11.78	9.88	12.13
JS 97-52	12.53	12.88	12.36	11.54	9.48	11.76	12.20	12.36	11.88	11.06	8.97	11.29
Mean	12.93	13.14	12.64	11.66	10.00		12.31	12.60	12.15	11.29	9.66	
CD (P = 0.05%)												
D	0.418						0.413					
V	0.364						0.371					
D × V	0.826						0.836					
	Seed yield (kg/ha)											
	D ₁	D ₂	D ₃	D ₄	D ₅	Mean	D ₁	D ₂	D ₃	D ₄	D ₅	Mean
JS 93-05	1715.3	1781.9	1621.0	1387.1	900.9	1481.2	1638.0	1677.0	1413.7	1280.5	808.9	1363.6
JS 335	1530.7	1607.9	1540.6	1297.0	793.6	1354.0	1451.7	1463.7	1357.1	1197.2	703.6	1234.7

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RKS 18	1757.9	1820.5	1653.8	1420.4	927.1	1515.9	1679.9	1712.1	1520.7	1290.5	843.8	1409.4
JS 97-52	1777.0	1976.9	1861.2	1436.8	901.6	1590.7	1657.1	1739.9	1740.4	1367.1	847.0	1470.3
Mean	1695.2	1796.8	1669.2	1385.3	880.8		1606.7	1648.2	1508.0	1283.8	800.8	
CD (P = 0.05%)												
D			46.551						60.428			
V			41.635						54.048			
D × V			93.102						120.846			

Figures are given in parenthesis are angular transformed value; D = Date of sowing; V = Variety; D₁ = 15 June; D₂ = 25 June; D₃ = 05 July; D₄ = 15 July; D₅ = 25 July

CITATION OF THIS ARTICLE

Sunil Kumar and Pardeep Kumar. Effect of date of sowing and varieties on severity of Alternaria leaf spot, rust and yield in soybean (*Glycine max* L. Merrill). Bull. Env. Pharmacol. Life Sci., Vol 6 Special issue 1, 2017: 448-451