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Soybean genotype DS 3108 identified as potential donors for major insect pest and disease resistance

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Abstract

The soybean [*Glycine max (*L.) Merrill] is a nutrient rich & economically important crop. Soybean is affected by many pest and disease complexes, which results in significant yield reduction. Genotype DS 3108 was evaluated in plant breeding, entomological, pathological and agronomic trials for four consecutive years in All Indian Co-ordinated Research Project on Soybean over multiple locations. It was tested in north eastern hill zone for four years. Based on three years data over multiple locations genotype DS 3108 has been identified as a potential donor for high yield and resistance traits. It showed considerable tolerance against *Mung bean yellow mosaic virus*, whitefly infestation, and stem-tunnelling by stem fly and damage by defoliators. Genotype DS 3108 recorded 4.1% tunnelling due to stem fly as against 14.6% in susceptible check (JS 335). From the three year screening it was confirmed that DS 3108 has shown highly resistant reaction against Pod blight, *rhizoctonia* aerial blight, *Phakapsora pachirizi, mungbean yellow mosaic virus*, Bacterial leaf blight, Collar Rot and for bacterial leaf blight from all the three locations i.e. Medziphema, Jorhat and Bisnath Chariali. It was also found resistant to majority of insect as compared to other test entries which showed susceptible to slightly resistant reactions. In case of Bihar hairy caterpillar infestation DS 3108 has shown lowest damage i.e. 10.98 and 2.82 in the consecutive two year (2018, 2019) and has been demarcated under moderately resistant whereas susceptible check has shown highest damage i.e. 11.66 and 4.68 in the same two consecutive years. In the Agronomy trial (2019), DS 3108 has out yielded all the three checks in both the row spacing (30cm and 45cm) experiments. It has yielded 2193 kg/ha which is 11% increase in grain yield over the susceptible check JS 335 and 25% yield enhancement over DSb -32.

Key words: Soybean, insects, pest, disease, potential donor.

Introduction

Soybean, *Glycine max* (L) Merrill, is a native of East Asia and known as a 'wonder crop' due to its quick growth and multipurpose uses. It is a *Kharif* (rainy season) season crop and it takes around 90 to 120 days for maturity. It is the most important source of protein for farm animal and human consumptions. It is a raw material for numerous commercially important and nutrient rich products. The commercially important soy products are soy milk, tofu, soy-sauce, bean paste, soybean oil and textured vegetable protein (TVP). Soybean seed has 40% protein, 20% oil and many nutritionally important component i.e., dietary mineral and vitamins. Low productivity of soybean in India (10 q/ha) as compared to average world productivity (24 q/ha) is a major concern. Lal & Sapra (2013) have listed top three constraints as drought (as it s a rain fed crop), losses due to weeds and location specific biotic stress. Lal

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(2022a) has identified the major constraints in soybean cultivation in north-east as soil acidity, water-logging, losses due to weeds, diseases and insects. Acidic soils are a major constraint in the states of north east India. Average annual rainfall is higher than 1200 mm in north east states of India; therefore incidence of diseases is also very high in north east states of India. More than twenty different diseases have been reported from north east states of India (Lal, 2022b). Major diseases reported from north east states of India are charcoal rot, rust, yellow mosaic disease, collar rot, bacterial pustule, rust, brown spot, Myrothecium leaf spot, target eye leaf spot, Cercospora leaf spot, Alternaria leaf spot, pod blight, Indian bud blight, soybean mosaic diseases, powdery mildew, *Rhizoctonia* root rot and Rhizoctonia aerial blight (Lal, 2022b). The major insects hampering its productions are whitefly (*Bemisia tabaci*), stem fly (*Melanagromyza sojae*) tobacco caterpillar (*Spodoptera litura*), leaf weevil (*Myllocerus* spp.), leaf beetle (*Monoleptaa sp*.) and soybean caterpillar. Both nymph and adults of *Bemisia tabaci* sucks sap of plants and make them devitalised. It is also a vector of important viral disease *Mungbean yellow mosaic virus* (MYMV) which is a major drawback in soybean production. Heavy infestation of MYMV kills 100% crop in endemic area (Fig. 1b).

Whitefly, *B. tabaci* infestation starts right from its seedling stage and continues till maturity. Infestation starts from seedling stage and remains till maturity. The highest infestation occurs between 35th to 37th standard meteorological weeks (SMW). Whereas stem fly infestation occurs in later stage of plant growth. Symptoms of damage by stem fly include tunnelling, weakening and drying of stems.

Materials and Methods

Soybean genotype DS 3108 is a pure line derived from the cross (DS 2708 X JS 335). It was tested in coordinated trials of AICRP on soybean in 2017. It was promoted to AVT I in North Eastern Hill Zone (NEHZ) and tested in AVT I during 2018. It was again tested for AVT II trial from 2019 and 2021. evaluated for pathological traits, entomological traits, agronomical as well as genetic traits. Under pathological trail observation for Pod blight, *Rhizoctonia* aerial blight, *Phakapsora pachirizi*, *mungbean yellow mosaic virus*, Bacterial leaf blight, collar rot and for Bacterial leaf blight (BLB) has been recorded. For entomological traits infestation index of Bihar hairy caterpillar, leaf webber, Tobacco caterpillar, Aphids and stem fly for three consecutive years (2017, 2018, 2019) were recorded. In case of Bihar hairy caterpillar, tobacco caterpillar, leaf webber, infested leaf were counted whereas in case of aphid, population was counted on top 10 cm of pants and in case of whitefly population were counted on top three leaves. Whitefly transmitted *yellow mosaic virus* infestation was reported based on number of plants infected and severity level of disease. For agronomical trial two experiments was laid on the consecutive year i.e. in Kharif 2019 and Kharif 2021. Plants were grown in 30 cm and 45 cm row spacing and then yield was recorded in kg/ha. Plant descriptors of DS 3108 were defined and data were recorded.

Results and Discussion

Evaluation under pathological trial

DS 3108 was evaluated for disease resistance under natural ephiphitotic conditions for different diseases. The results of screening for different diseases are summarized in Table 1. DS 3108 was

Fig. 1: a) *Monolepta* infestation b) MYMV infestation c) Healthy and infested plots

found resistant to multiple diseases like yellow mosaic diseases (YMD) caused by *mungbean yellow mosaic virus* (MYMV) in north eastern hill zone (2 locations), central zone (2 locations) and north plain zone (2 locations); *Rhizoctonia* aerial blight (RAB), bacterial pustule (BP); pod blight in north eastern hill zone (2 locations), north hill zone (1 location) and north plain zone (1 location); and to charcoal rot at Jorhat and Amravati. From the three year screening it has found that DS 3108 has shown highly resistant traits for pod blight, *Rhizoctonia* aerial blight, *Phakapsora pachirizi, Mungbean yellow mosaic virus,* Bacterial leaf blight and Collar Rot from all the three location i.e Medziphema, Jorhat and Bisnath Chariali. The susceptible check JS 335 has shown susceptibility for all the disease enlisted from the respective three locations whereas the response of selected resistant check PS 1613, RKS-18 and improved local cultivar JS 97-52 has ranged between susceptible to moderately resistant. The detail description of results has been given on Table 1.

Table 1. Reaction to major diseases (three years summary), 2017, 2018, 2019

Disease name	Item	Proposed variety (DS 3108)	Check var. 1 (JS 335)	Check var. 2 (JS 97-52)	Check var. 3 (RKS-18)	Qual. var. 1 (PS 1613)
NAT.BP (Medziphema) (Bacterial Pustule)	1st Year	**AR**	—	—	AR	AR
	2nd Year	**—**	—	—	—	—
	3rd Year	**—**	— —	—	—	— —
NAT. PB (Ct) (Medziphema) (Pod blight)	1st Year	**S**	HS	AR	—	MR
	2nd Year	**HR**	S	AR	—	MR
	3rd Year	**AR**	S	— —	MR	MR
NAT.RAB (Medziphema)	1st Year	**HR**	S	— —	—	MR
(*Rhizactonia* aerial blight)	2nd Year	**AR**	MS	HS	—	AR
	3rd Year	**AR**	MS	— —	MR	AR
NAT.Rust (Medziphema)	1st Year	**—**	— —	— —	— —	— —
(Phakapsora pachirizi)	2nd Year	**— —**	— —	— —	— —	— —
	3rd Year	**HR**	HR	— —	MR	HR
NAT.PB (Ct) (Jorhat)	1st Year	**MS**	S	— —	— —	MR
(Pod blight)	2nd Year	**HR**	MS	— —	— —	AR
	3rd Year	**HR**	MS	— —	— —	— —
NAT.YMV (Jorhat) (MYMV)	1st Year	**MR**	MS	HR	—	MR
	2nd Year	**HR**	MS	— —	— —	HR
	3rd Year	**HR**	MS	— —	— —	— —
NAT (Bisnath-Chariali) (MYMV)	1st Year	**MR**	MS	HR	— —	MR
NAT.BLB (jorhat)	1st Year	**HR**	MS	HR	—	MR
(Bacterial leaf blight)	2nd Year	**AR**	AR	— —	— —	AR
	3rd Year	**—**	— —	— —	— —	
NAT.RAB (jorhat) (Collar Rot)	1st Year	**— —**	— —	— —	— —	— —
2nd Year		**MS**	MS	— —	— —	MR
3rd Year		**MR**	MS	— —	— —	
NAT.RAB (jorhat) (*Rhizactonia*	1st Year	**—**	— —	— —	— —	—
aerial blight)	2nd Year	**AR**	MS	— —	— —	MR
	3rd Year	**AR**	MS	— —	MR	
NAT.CR (jorhat) (Charcoal rot)	1st Year	**— —**	— —	— —	—	—
2nd Year		**— —**	— —	— —	— —	
3ndYear		**AR**	MR	— —	— —	
NAT. Coll Rot(Bisnath Chariali	1st Year	**HS**	S	—	— —	MR
BLB (Bisnath Chariali)	1st Year	**HR**	MS	—	— —	MR
NAT.PB (Ct) (Bisnath Chariali), (Pod blight)	1st Year	**MS**	S			

NAT: Natural, MYMV- *Mungbean yellow mosaic virus*

Evaluation under entomological trial

In entomology trials, AVT-I and II entries of different zones, along with those found resistant in previous years were screened for insect resistance/tolerance. Further, they were categorized into different resistance categories against individual insect spp. by employing AICRPS method and against location specific insect-pest complex by maximin - minimax method. Information on reaction of different entries against major insect-pests during last three years (2019, 2020 and 2021) was compiled and promising genotypes were identified by using following criteria: (i) Resistance against one or more insect spp. at three or more locations for three years ii) Location specific insect-pest complex by maximin - minimax method (RHY/ SHY (T) at three or more locations for three years. Based on above criteria, lines were identified as potential donors for insect resistance / tolerance against specific insect pests. The genotypes DS 3108 was identified as potential donors for insect resistance / tolerance against specific insect pests are mentioned in Table **5**. Damage against Bihar hairy caterpillar, leaf webber, tobacco caterpillar, Aphids and stem fly for the consecutive three year, 2017, 2018, and 2019 were recorded. From the entomology trials it was found to be tolerant/ resistant to stem fly, defoliators and pest complex.

In the check JS 335, **JS 97-52, RKS18, PS 1613** mean tunnelling of stem fly was found 14.61%, 16.26%, 14.4%, 17.24% percent (Table-2) whereas in the DS 3108 the tunnelling was negligible, i.e. 4.05 % which is much lower than all others checks. *Spodoptera litura* started appearing in initial two weeks of sowing. At starting trap catch population were very low and again it was observed in the first and second week of September. Pheromone traps were kept in the field to know the weekly number of *Spodoptera litura* and for Bihar hairy caterpillar adults trap. The highest number of *Spodoptera* adults was obtained in 36th SMW (3.5) followed by 30th SMW (3.25) in the susceptible check (JS 335) whereas in the peak infestation periods, the trap catch was reported very less. The other defoliator, soybean caterpillar was seen in the susceptible check but occurrence was negligible in the, DS 3108. Leaf beetle, *Monolepta sp. and* Grey weevil, *Myllocerus sp.* makes numerous holes (Fig-1b) in the early stage of the crops which in turns affects the yields. The identified genotype, DS 3108 has been found tolerant to this infestation (Fig-1a) . It has found to have potential to resume the growth and proliferation of subsidiary braching which compensate the damage caused by leaf beetles. Developing pest resistance in soybean cultivar is a difficult task especially through genetic modification (Babu, *et al*., 1986). Cultivar with high protein and seed yield has been also reported by Carter *et al*. (2010) and Villagarcia (2010). So here we took initiative to identify the cultivar showing highest pest and disease resistant with improved quality traits. The drought tolerance parameter has positive interaction with the available subsoil nutrients (Goldman, et al., 1989). Before selecting the traits a through studies on traits selection parameter has been sorted out (Gizlice *et al*., 1994,; Nelson *et al*., 2001; Purcell *et al*., 2004; Sinclair *et al*., 2007)

The genotype DS 3108 has shown moderately resistant to majority of insect as compared to other tested genotypes which has shown susceptible to slightly resistant reactions.

In case of Bihar hairy caterpillar infestation DS 3108 has show, lowest damage reaction rate i.e. 10.98 and 2.82 in the consecutive two year, 2018, 2019 and has been demarcated under moderately resistant whereas susceptible check has shown highest damage i.e. 11.66 and 4.68 in the same two consecutive year whereas other cultivar JS 97-52, RKS18, PS 1613, has also shown light resistant with the damage reaction value of 5.35, 6.71, 7.28 respectively on the third year. In case of leaf Webber too DS 3108 has shown moderately resistant from both the location i.e. Imphal, Medziphema, The damage reaction was shown lowest with 3.11, 1.67 as compare to the susceptible check JS 335 and improved line JS 97-52, RKS18, PS 1613**.** Stem tunnelling by stem fly has also shown lowest damage with the reaction value of 4.05, 12.90, 12.84 in the three consecutive year which has demarcated as HR (Highly resistant), LR (Light resistant) and MR (Moderately resistant) respectively whereas susceptible check, JS 335 along with improved cultivar has shown LR reaction in all the three year. Hence it has been well established that DS 3108 has outperformed

and shown resistant characteristics for all the major insects pests of soybean (Table 2).

Evaluation under agronomical trials

It was tested in agronomy trials for two different row spacing for three years (2017-2019). The results of agronomy trials are summarized in Table 3 and 4. In the first year it has out yielded all the three checks as well as the qualifying variety PS 1613 (Table 3). In the second year, it out yielded all the three checks in all the three location tested (Table 4).

In the agronomy trail of 2019, DS3108 has out yields in both the row spacing experiments. It has

Table 2. Reaction to major pest (three years summary): 2017, 2018, 2018

Insect pest	**Item**	Proposed variety **(DS 3108)**	Check var. 1 **(JS 335)**	Check var. 2 **(JS 97-52)**	Check var. 3 **(RKS18)**	Qual. var. 1 **(PS 1613)**
Bihar Hairy caterpillar	1st. Year	— —	— —	— —	— —	— —
	2nd Year	120.00	136		98.50	19.00
		(10.98) MR	(11.66) LR	—	(9.89) LR	(4.41) MR
	3rd Year	11.90	28.80	62.0	46.60	23.
		(2.82) MR	(4.68) LR	(5.35) LR	(6.71) LR	(7.28) LR
leaf webber larvae/m	1st Year	9.50	15.00	11.50	15.50	6.50
	Imphal	(3.11) MR	(3.92) LR	(3.46) LR	(4.36) LR	(2.60) MR
1st year Medziphema	2.30	2.75	3.05	3.15	2.80	
	(1.67) MR	(1.79) LR	(1.88) S	(1.91) S	(1.81) LR	
	2nd Year	8.00	11.00		12.00	8.50
	(2.92) MR	(3.36) LR	—	(3.51) LR	(3.00) MR	
	4.20	5.50	4.60	4.60	4.20	
	3rd Year	(2.15) LR	(2.45) S	(2.26) LR	(2.26) LR	(2.17) LR
Tobacco	1st Year		— —	— —	— —	— — — —
caterpillar	2nd Year	10.50	13.00	—	13.00	9.00
		(3.24) LR	(3.67) LR		(3.67) LR	(3.08)
	3rd Year	3.50	6.10	5.20	5.30	5.90
		(2.0) MR	(2.56) S	(2.38) LR	(2.35) LR	(2.53) S
Per cent defoliation						
at peak incidence /plant	1st Year	7.00	9.00	10.0	10.0	11.0
		(2.68) LR	(2.96) S	(2.7) S	(2.73) S	(3.31) S
	2nd Year	16.17	23.17		19.47	12.27
		(23.29) LS	(28.58) MS	—	(26.36) MS	(20.35) LS
	3rd Year	26.26 MS	26.63 MS	24.80 LS	25.26 MS	26.89 MS
No. of aphids/ plant	1st Year	11.00	24.80	33.60	33.40	45.60
	Imphal	(3.31) MR	(4.97) LR	(5.82) LR	(5.79) LR	(6.77) LR
	1st Year	3.25	6.25	4.55	11.00	21.85
	Medziphema	(1.93) HR	(2.59) R	(2.25) HR	(3.39) MR	(4.72) HS
	2nd Year	26.00	24.00	—	25.80	27.00
		(5.14) LR	(4.84) LR		(5.1) LR	(5.24) LR
	3rd Year	18.80	21.00	19.80	19.60	15.80
		(4.35) LR	(4.63) LR	(4.50) LR	(4.48) LR	(4.00) LR
Stem tunneling at	1st Year	0.00	5.93	7.34	5.77	8.30
physiological tunneling		(4.05) HR	(14.61) LR	(16.26) S	(14.4) LR	(17.24) S
(stem fly)	2nd Year	4.59	10.30		8.10	5.46
		(12.90) LR	(19.07) LR	—	(16.97) LR	(13.90) LR
	3rd Year	4.45	5.14	6.20	6.20	5.63
		(12.84) MR	(13.72) LR	(14.99) LR	(15.00) LR	(14.11) LR
Reaction to insect-Pest						
Complex	1st Year	1st Year	— —	— —	— —	— —
	Complex					
	2nd Year	SLY	SLY	—	SLY	SLY
	3rd Year	SHY (T)	SLY	SLY	SLY	SLY

resulted in yield 2193 kg/ha which has shown 11% increase yield from the susceptible check JS 335 which has shown 1971 kg/ha. It has also shown enhanced yield in both the location i.e. Imphal and Medziphema and outperformed the checks. It has shown 25% yield enhancement over DSb -32. Upon Analysis it was found that yield of DS 3108 significantly higher than the PS 1613, JS 335, KDS-921, RSC 10-71, DSb -32, JS 9752 which yielded 1813 kg/ha, 1971 kg/ha, 1196 kg/ha, 1020, kg/ha 852, kg/ha 1102 kg/ha respectively in the year *kharif* 2019 (Table-3). In the year 2021 too, DS 3108 has shown significantly higher yield in case of both the row spacing (30cm and 45cm) experiments. The mean Zonal yield at 30cm row spacing was the yield is 2304 kg/ha and at 45 cm row spacing yield is 2250kg/ha which is much higher the susceptible check JS 335 (c) at 1871 kg/ha and 1817 kg/ha respectively for 30 cm and 45 cm row spacing. DS 3018 has significantly outperformed too other tested check i.e. RKS18 (c), JS 97-52 (c) which has resulted in mean zonal yield of 1856 kg/ha 1923 kg/ha (Table 4). Mean performance of entry respectively DS 3108 in AVT-I and AVT II at North eastern Himalayan zone (NEHZ) was also recorded at the year 2017, 2018, 2019, 2021.On an average, genotype DS 3108 produced comparable yield with JS335 and showed 12.3 and 9.3% higher yield over JS 97-52 and RKS 18, respectively. Results are summarized in Table 5. Other available genotype which has shown resistance to stem fly, defoliators and pest complex has been given in Table 5. The proposed potential genotype DS3108 has been found resistant against the all above mentioned pests.

Evaluation under Plant Breeding Trials

Under plant breeding trials DS3108 was evalu-

Table 3. Agronomy trial (*Kharif* 2019), Evaluation of AVT II entries under different row spacing

Treatment	Imphal			Medziphema			Zonal mean		
Row spacing									
Entry	30 cm	45 cm	Mean	30 cm	45 cm	Mean	30 cm	45 cm	Mean
PS 1613	1640	1985	1813	—	——	—	1640	1985	1813
DS 3108	2213	2173	2193	—	—	—	2213	2173	2193
JS 335	1933	2008	1971	—	—	—	1933	2008	1971
KDS- 921	—	—	—	1835	557	1196	1835	557	1196
RSC 10-71	——	—	—	1424	615	1020	1424	615	1020
DSb -32	—	—	—	1182	522	852	1182	522	852
JS 97 52	—	—	—	1425	779	1102	1425	779	1102
Mean	1928	2056	1467	618	1665	1234			
CD(P=0.05)									
Row spacing			NS			106.20			-
Entries			159			NS			-
Interaction			NS			NS			-

—Data Not Reported. Yield is expressed in kg/ha

Table 4. Agronomy trial (*Kharif* 2021), Evaluation of AVT II entries under different row spacing

	Imphal			Medziphema			Zonal mean		
	Row spacing								
Entry	30 cm	45 cm	Mean	30 cm	45 cm	Mean	30 cm	45 cm	Mean
DS 3108	2890	2929	2909	1719	1571	1645	2304	2250	2277
JS 335 (c)	2301	2452	2377	1441	1181	1311	1871	1817	1844
RKS18 (c)	2183	2202	2193	1584	1453	1519	1883	1828	1856
JS 97-52 (c)	2210	2256	2233	1584	1661	1612	186	1959	1923
Row spacing	2396	2460	1563	1467	1986	1963			
Entries			NS			1577		NS	—
Interaction			368.9			NS		—	
			NS			NS		—	

Table 5. Genotypes identified as potential source of resistance against insect-pests

Insect(s)	Genotypes
Stem fly	AMS 100-39, MACS 1566, NRC 148, AMS 2014-1, MAUS 732, PS 1611, RSC 11-03, RSC 11-07, RSC 11-15, RSC 11-17, NRC 142, MACS 1620, HIMSO 1689, **DS3108**
Defoliators	DLSb 1, NRC 152, NRC 149, AMS 100-39, MACS 1493, **DS 3108**, DSb 34, NRC 148, Dsb 33, KDS 992, SKF-SP-11, JS-20-34, MACS-NRC 1575
Pest complex	KDS1096, RVS 2011-10, RSC 10-46, AMS100-39, DSb 33, JS 21-72, NRC 142, NRC 149, NRCSL 2, RVSM 2011-35, JS-20-116, MACS 1566, NRC 148, AMS 2014-1, MAUS 732,PS 1611, RSC 11-03, RSC 11-07, RSC 11-15, RSC 11-17 MACS 1620, HIMSO 1689, **DS 3108**

Table 6. Mean performance of entry DS 3108 in AVT and AVT II in north eastern Himalayan zone (NEHZ)

S. No.	Entry	Yield (kg/ha) IVT					Rank
		2017	AVT **I** 2018	AVT **II** 2019	AVT **III** 2021	Mean	
1	DS 3108	1506	1850	2189	2744	2073	II
2	JS 335	1297	1867	2278	2861	2076	I
3	JS 97-52	1247	1144	2074	2917	1846	IV
4	RKS 18	1235	1867	2241	2244	1897	III

Table 7. Plant descriptors of DS 3108

1.	Growth habit	Determinate
2.	Days to flower initiation	39-45
3.	Days to 50% flowering	44.55(42-50)
4.	Days to maturity	104.69 (92-115)
5.	Plant height (cm)	40.43 (61-90)
6.	No. of branches per plant	3.8 (2-6)
7.	Leaf surface	——
8.	Leaf thickness and colour	Green
9.	Leaf hair	—
10.	Pubescence colour	Glabrous
11.	Flower colour	White
12.	Pods per plant (No.)	109.36 (69-280)
13.	Seeds per pod (No.)	2.34 (2.0 -2.6)
14.	Seed colour	Yellow
15.	Seed shape & size	Spherical & medium
16.	Hilum colour	Black
17.	100-seed weight (g)	12.61(10.89-15.50)
18.	Any distinguishing character	Short, early maturity.
19.	Hypocotyl colour	Green
20.	Pod shattering behaviour	Non-shattering
21.	Pod and Stem colour at maturity	Tawny
22.	Reaction of diseases	Resistance against yellow mosaic virus, *Rhizoctonia* Arial blight (RAB), Bacterial Pustule (BP)
23.	Reaction of pests	Moderately resistant to stem fly and Defoliators.
24.	Oil percent	21.30 (18-21.90)
25.	Protein (%)	32.14 (31-35)
26.	Germination	Good
27.	Yield potential	18.48 q/ha (15.06-21.89 q/ha)

ated for 4 years. The results of plant breeding trials are summarized in table 6. Based on mean of four year trial it yielded at par with the best check JS 335. It has clearly out yielded all the checks in first year by more than 2q. The list of descriptors of DS 3108 is enclosed in table 7.

Conclusion

Agronomy trial carried out in 2019 and also in 2021 shows that DS 3108 is superior to all the three checks in both the years. DS 3108 out yielded all the three checks by 3q/ha in both the years Pathology trials clearly show that DS 3108 has multiple disease resistance and is superior to JS 335. JS 335 is susceptible to 15 diseases and is being used in trap nursery Thus DS 3108 is a high yielding genotype with resistance against multiple diseases and insect pests.

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