

Physiological basis of seed yield variation in soybean [*Glycine max* (L.) Merrill]

Abstract

The experiment was conducted at AICRP Soybean, Seed Breeding Farm, Department of Plant Breeding and Genetics, College of Agriculture, JNKVV, Jabalpur (M.P.). Experiment was consisting of 90 genotypes to study the difference in growth, morpho-physiological characterization and yield response of soybean. The genotype JS 21-72 followed by JS 22-18 and PS-1613 recorded highest number leaves per plant. AGS-48 showed maximum plant height among all other genotypes. Genotype DS 31-09 followed by JS 22-16 produced maximum number of pods per plant. DS 31-09 followed by JS 22-16 produced maximum number of pods per plant with respects to all other genotype. Early work with infrared thermometers proved successful in monitoring plant Evaporative rate. The canopy temperature in the current study ranged from 32.13 in JS 23-03 to 36.15 in JS 22-49. In yield attributing characters genotype highest seed yield produced by JS 21-72 whereas JS 24-35 followed by JS 24-37 shows highest number of seed per pod and 100 seed weight. Genotype NRC-137 followed by JSM 259 showed higher range of harvest index. It is concluded that the six genotype viz., JS 21-72, JS 24-35, JS 24-37, JS 22-16 AGS-48 and NRC- 137 found best to describe the morpho-physiological characterization in present study.

Keywords: Canopy Temperature, LAI, LAD and Morpho-physiology.

Introduction

Soybean [*Glycine max* (L.) Merrill.] is one of the miraculous crops due to its extraordinary qualities. It has transformed the agricultural economy through its enormous potential for food, fuel, and a variety of industrial products. Its production has a very complex character; it is reliant on a variety of physiological and genetic elements that interact with the environment. Genetic yield potential is static as a result of unclear productivity restrictions, such as decreasing sink demand, which invites a huge gap in critical yield status. It is vitally necessary to determine the potential key physiological variables that are the physiological determinant and connected with the seed yield of crop in light of the rapid depletion of agricultural resources. This may be the sole glimmer of hope for choosing the genotype that is best for Madhya Pradesh. Currently, soybean has emerged as a key agricultural product, contributing to roughly 25% of the world's production of edible oil as well as two thirds of the protein concentrate used in animal, poultry, and fish feed Agrawal *et al.*, (2013). In India, soybeans are the main oilseed crop farmed in the Kharif season (10.93 mt production and 10.83 mha area), and the nation ranks fifth globally in soybean production behind the United States, Brazil, China, Argentina, and USA Anonymous (2020). In India, soybean genotypes and cultivars exhibit limited genetic diversity Agrawal *et al.*, (2013), Barela *et al.*, (2022) and Mehra *et al.*, (2020). There are limitations of knowledge regarding the physiological growth characteristics (such as relative growth rate, leaf area ratio, specific leaf area ratio, and shoot/root) that correspond to the responses of various soybean genotypes to various plant densities.

Materials and methods

The present investigation was carried out during kharif 2021 at the experiment was conducted at AICRP Soybean, Seed Breeding Farm, Department of Plant Breeding and Genetics, College of Agriculture, JNKVV, Jabalpur (M.P.). The experiment was laid out in Randomized Block Design (RBD) with three replications and 90 genotypes. The experimental site had uniform topography, medium black soil with 7.5

pH and free from water logged conditions. Leaf area index is the leaf area existing on unit ground was proposed by Watson (1952) and was calculated by following formula:

$$LAI = \frac{\text{Leaf area per plant (cm}^2\text{)}}{\text{Ground area per plant (cm}^2\text{)}}$$

Power *et al.*,(1967) integrated LAI with time and this was known as leaf area duration. LAD takes into account both the duration and the extent of photosynthetic tissue of the crop canopy. The LAD is expressed in days. The LAD was calculated for 60 DAS and 90 DAS as LAD1 and LAD 2 respectively using formula as follows:

$$LAD = \frac{(LA2 + LA1) \times (t2 - t1)}{2}$$

Where, LA1 and LA2 represent the leaf area at two successive time intervals (t1 and t2)

Harvest index (HI) was determined from mean value of seed yield per hectare and biological yield per hectare at the time harvest using formula given by Donald (1962).

$$\text{Harvest Index} = \frac{\text{Economic yield}}{\text{Biological yield}} \times 100$$

Results and discussion

The results clearly highlighted the increased trends in plant height, which is statistically significant at all the growth stages of crop (Table 1). JS 22-41 followed by JS 22-43 and JSM-259 recorded significant

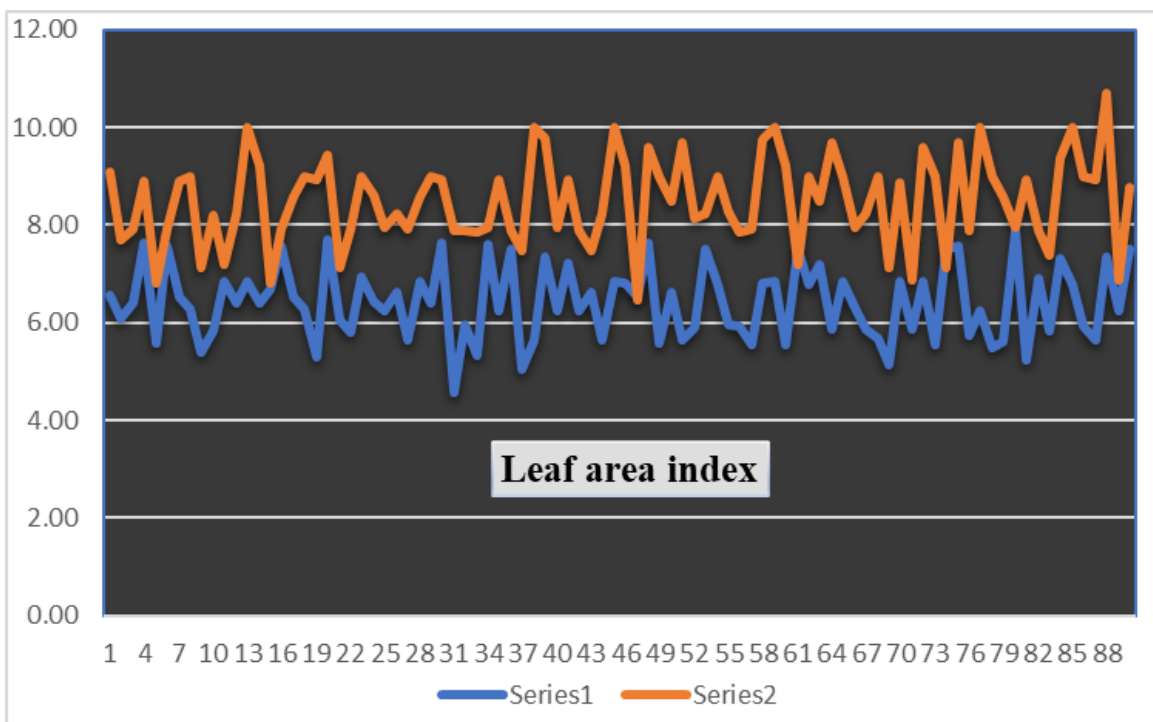


Figure 1: Graphical representation of Leaf Area Index in different series of LAI at 60DAS and 90DAS respectively.

maximum plant height at 60 DAS (Days After Sowing) whereas AGS-48 followed by JS 22-04 and JS 22-52 recorded maximum height at 90 DAS. In current investigation it was evident that genotype with short stature showed more tolerance against drought as compared to taller one Mishra *et al.*, (2020) Genotypic difference in plant height in soybean were also reported by Abbas *et al.* (1992). Genotype JS 21-72 followed by DS 31-09, JS 22-16 produced maximum number of pods per plant with respects to all other genotypes and these results are in conformity with Deshmukh *et al.* (1991) in soybean. Genotype JS 21-72 followed by JS 22-18 and PS-1613 recorded highest number leaves per plant. (Table 1). The differences in mean leaf area were statistically significant at 60 and 90 DAS (Table 1). The genotype JS 24-37 followed by JS 22-26 and JS 22-33 maintained highest value of leaf area from 60 DAS onward. Similar result was observed by Gontia and Awasthi (1998) in soybean. LAI and biomass are the two key indicators of plant health and development Barela *et al.*, (2022). The growth analytical parameter studies like Canopy temperature, LAI and LAD exhibited significant trends (Table 1). According to recent studies infrared thermometers have been a useful instrument for measuring canopy temperatures in semi-arid and dry settings. The optimal canopy temperatures for peak photosynthetic enzyme activity, which were discovered to be 27 °C, served as the basis for the soybean temperature thresholds (Fig 2). Early work with infrared thermometers proved successful in monitoring plant Evaporative rate, the canopy temperature in the current study ranged from 32.13 in JS 23-03 to 36.15 in JS 22-49. The genotypic difference with respect to Canopy temperature, LAI and LAD were reported by Rahangdale *et al.*, (2023), Rajput and Shrivastava (1991) in soybean. All the genotypes were different in yield attributing character (Table 1). As regards to yield attributing Table 1: Morpho-physiological characters of soybean genotype included Plant height at 30,60 and 90 DAS(Days after sowing), leaf number at 30,60 and 90 DAS, LAI(Leaf area index) at 60 and 90 DAS, LAD(Leaf area duration at 60 and 90 DAS), CT(Canopy

temperature), S/POD(Seed per pod), P/P(Pods per plant), NS/P(Number of seeds per plant), 100SW(Hundred seeds weight), BY/P(Biological yield per plant), HI(Harvest index),SY/P(Seed yield per plant). Similar result was obtained by Singh et al. (1983). The genotype JS 24-35 followed by JS 24-37 recorded highest number of seed per pods and 100 seed weight. Genetic variability in soybean was also obtained by Singh et al. (1983). The genotype JS 21-72 followed by JS 22-16 recorded highest seed yield per plant and biological yield per plant as well. Seed per pod were highest in JS 22-52 followed by JS 22-32 and JS 22-33, whereas the highest seed yield produced by JS 21-72 might be due to highest number of pods per plant and number of seed per plant. Similar variations in soybean were also obtained by Deshmukh et al. (1991). The genotype NRC-137 followed by JSM 259 showed highest value of harvest

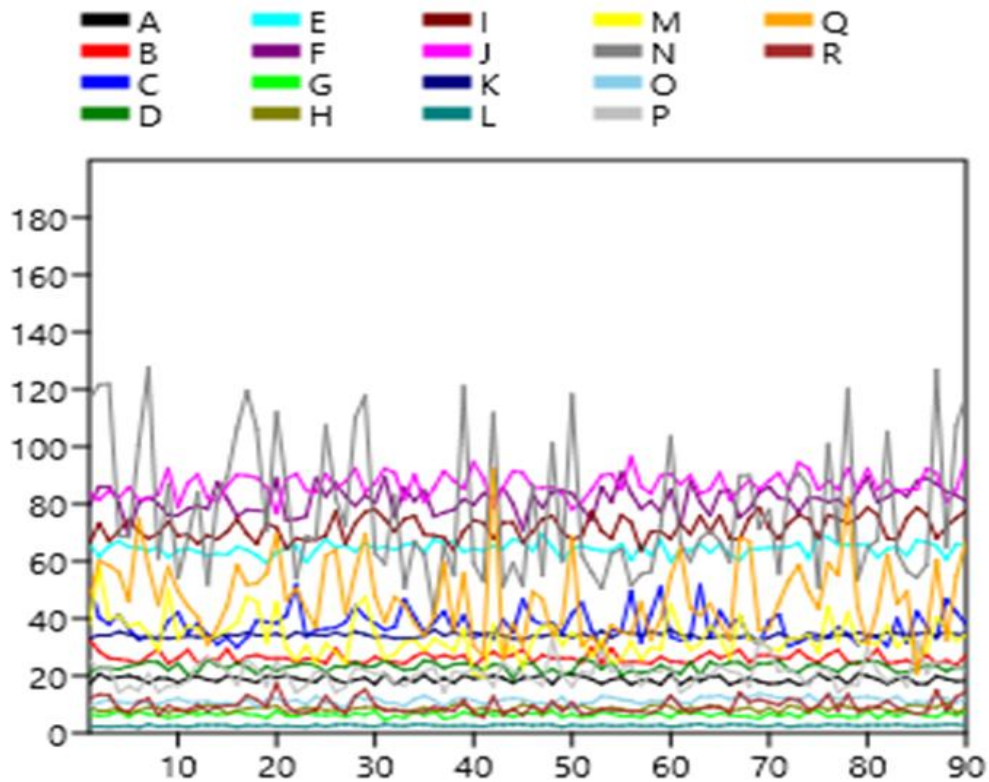


Figure 2. Graphical representation of different physiological along with quantitative traits

index and this is conformity with results of Nirmal Kumari and Balasubramanian (1991) in soybean.

Conclusion

The observed results imply that physiological features restrict soybean genotypes' ability to develop and function metabolically. These features demonstrated the existence of significant diversity throughout several growth periods. The results of this work may help to identify various adaptive mechanisms developed by soybean genotypes and contribute to the identification of useful.

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	Germplasm	Plant height			Leaf number			Leaf area index		Leaf area duration			S/POD	P/P	NS/P	100SW	BY/P	HI	SY/P
		30DAS	60DAS	90DAS	30DAS	60DAS	90DAS	60DAS	90DAS	LAD1	LAD2	CT							
1	AGS 48	17.10	32.92	52.17	21.33	66.33	79.33	6.56	9.08	66.06	83.68	33.18	2.17	38.00	116.50	9.32	25.29	47.57	12.09
2	AGS 163	20.67	28.45	40.33	22.67	61.67	86.00	6.07	7.70	73.28	81.48	34.17	2.33	46.03	121.67	10.73	22.43	60.18	13.49
3	AVKS 199	19.00	26.19	38.00	22.67	65.33	86.00	6.41	7.92	67.14	84.67	34.10	2.17	39.50	121.83	11.58	22.84	58.52	13.32
4	AVKS 206	19.53	25.77	41.33	22.33	67.00	80.33	7.63	8.89	70.49	82.19	35.35	2.33	41.00	68.83	10.90	14.23	56.17	8.09
5	Cat 87	20.02	25.30	36.50	23.33	65.00	69.67	5.59	6.82	74.50	85.87	34.47	2.50	37.00	68.50	10.53	16.34	45.99	7.46
6	Cat 783	19.19	24.27	32.67	24.00	64.67	80.33	7.56	7.92	70.49	81.47	33.40	2.00	38.50	100.50	11.07	14.78	74.70	10.72
7	JS 24-35	17.53	26.97	33.33	25.00	63.67	82.33	6.53	8.89	67.93	82.11	33.90	3.00	34.67	133.67	10.35	20.74	58.37	12.10
8	DS 3106	19.20	29.21	32.83	24.67	65.00	80.00	6.26	8.98	69.71	83.15	33.03	2.33	28.50	61.00	10.10	14.17	44.75	6.32
9	DS 3109	19.03	24.33	39.00	22.00	61.33	76.00	5.38	7.13	73.70	92.39	33.10	2.50	51.00	86.67	11.35	16.57	57.97	9.62
10	JS 24-36	17.70	26.19	42.17	24.33	63.67	76.00	5.82	8.19	68.85	79.00	33.19	2.50	32.50	54.17	12.10	16.47	49.45	8.12
11	EC350664	19.17	29.01	35.00	20.33	64.33	78.33	6.85	7.20	69.45	87.22	33.93	2.17	37.67	68.17	10.78	18.17	44.35	7.99
12	EC481571	19.77	24.33	38.17	21.33	63.33	79.33	6.41	8.24	66.13	90.26	33.57	2.67	36.17	84.00	10.83	24.28	40.47	9.84
13	JS 335	18.60	26.19	34.50	25.67	62.00	78.33	6.85	10.00	69.03	82.07	33.55	2.67	32.50	51.83	11.10	26.06	30.90	7.75
14	JS 2069	18.06	25.33	31.00	23.67	62.67	87.67	6.41	9.22	67.71	80.70	33.64	2.67	34.17	82.83	10.20	24.59	37.02	9.14
15	JS 20-73	19.87	29.21	33.33	22.67	62.33	81.67	6.68	6.82	70.35	86.55	34.34	2.67	36.00	89.50	10.70	21.52	44.54	9.57
16	JS 20-98	19.37	24.33	30.00	24.33	65.00	75.67	7.56	7.92	74.71	90.18	34.08	2.17	38.67	106.50	9.40	16.74	58.75	9.81
17	JS 20-105	18.58	26.72	33.50	23.00	64.00	78.00	6.53	8.57	69.58	89.91	35.08	2.67	47.44	119.50	12.05	26.12	51.77	13.28
18	JS 20-116	17.71	27.22	39.17	20.67	62.00	77.67	6.26	8.98	66.06	89.09	34.17	2.44	45.81	106.17	9.10	22.30	52.28	11.62
19	JS 21-05	19.82	26.19	38.83	23.33	59.33	77.33	5.30	8.94	73.28	85.73	34.10	2.83	31.67	70.67	11.61	16.32	55.73	9.28
20	JS 21-72	19.35	26.19	38.33	25.67	68.00	89.00	7.71	9.44	71.75	76.73	34.73	2.33	52.57	132.00	12.63	25.00	69.38	17.35
21	JS 22-03	20.15	26.19	41.17	23.00	64.33	74.33	6.05	7.12	64.53	88.72	33.24	2.50	29.62	86.17	10.80	20.74	46.29	9.59
22	JS 22-04	19.08	24.67	51.83	23.67	65.33	74.67	5.80	7.92	67.97	90.53	35.18	2.33	25.40	54.00	11.55	14.17	50.59	7.17
23	JS 22-10	18.38	26.05	33.67	24.33	59.67	75.67	6.94	8.98	67.21	84.77	34.27	2.17	30.67	68.83	9.85	16.57	42.98	7.15
24	JS 22-11	17.91	25.70	36.00	23.67	64.00	89.00	6.42	8.61	67.46	84.22	34.28	2.83	24.34	67.67	12.80	21.52	36.77	7.91
25	JS 22-12	20.67	24.33	36.33	21.33	67.67	82.67	6.24	7.94	69.03	90.53	34.00	2.33	31.26	107.33	10.86	20.74	61.90	12.87
26	JS 22-13	18.53	29.61	36.83	23.33	64.67	87.33	6.62	8.25	77.38	85.33	35.08	2.83	28.28	82.00	10.17	14.17	63.93	9.05
27	JS 22-14	17.53	24.67	38.67	23.00	65.67	82.67	5.66	7.92	66.06	87.78	34.10	3.00	24.45	72.50	8.85	16.06	41.54	6.73

28	JS 22-15	18.57	24.74	44.33	24.67	63.33	79.33	6.85	8.57	73.28	92.39	35.35	2.83	43.70	110.17	13.10	22.90	56.42	12.91
29	JS 22-16	19.30	24.30	40.50	23.00	66.33	83.00	6.41	8.98	77.19	84.06	34.47	2.50	50.47	127.89	11.73	24.90	63.48	15.22
30	JS 22-17	17.10	26.60	38.33	23.33	64.33	80.33	7.63	8.94	78.13	87.15	33.40	2.33	34.67	62.83	12.44	20.74	47.64	9.85
31	JS 22-18	20.67	25.03	36.00	25.33	66.70	88.33	4.58	7.88	74.70	92.39	33.90	3.00	25.83	59.00	10.61	20.74	38.81	8.04
32	JS 22-19	17.00	24.74	37.00	26.33	64.00	75.67	5.96	7.88	70.35	90.86	33.03	2.67	27.45	83.00	10.48	17.24	47.49	8.14
33	JS 22-20	19.20	24.30	46.67	22.00	65.67	85.67	5.32	7.85	74.71	81.48	33.10	2.50	31.84	50.67	9.50	16.57	44.81	7.41
34	JS 22-22	18.03	26.60	40.67	22.33	66.33	81.00	7.61	7.95	75.84	90.18	33.19	3.00	32.50	67.00	11.80	20.09	38.36	7.45
35	JS 22-23	20.20	28.38	35.17	25.33	63.00	84.67	6.24	8.94	69.30	80.70	33.93	3.00	28.67	62.17	13.00	21.52	34.05	7.32
36	JS 22-24	17.70	26.19	38.67	24.67	67.67	75.67	7.51	7.88	69.03	85.61	36.15	2.67	32.83	41.17	11.45	22.84	40.48	9.22
37	JS 22-25	19.17	27.16	42.50	22.67	66.33	77.00	5.03	7.47	68.24	91.45	34.10	2.50	31.00	65.50	9.40	14.17	59.52	8.44
38	JS 22-26	17.53	26.19	35.50	24.00	67.00	78.00	7.63	10.10	63.74	88.04	35.08	2.50	28.50	55.22	11.60	21.52	35.63	7.67
39	JS 22-27	20.20	27.16	41.00	24.33	63.33	81.67	7.36	9.78	70.49	85.33	34.00	2.67	36.45	121.00	12.30	20.74	55.77	11.52
40	JS 22-28	19.00	23.37	33.50	23.67	64.33	79.67	6.24	7.95	74.31	94.57	35.08	2.50	20.67	59.33	11.45	22.43	30.51	6.84
41	JS 22-29	19.53	26.19	34.33	22.00	63.67	83.67	7.22	8.94	73.45	88.97	34.55	2.33	19.50	53.00	10.10	20.74	26.73	5.55
42	JS 22-30	20.02	28.35	37.00	24.00	65.33	82.00	6.24	7.88	67.97	78.58	35.17	2.83	38.00	111.67	11.33	16.37	92.14	12.71
43	JS 22-31	19.19	26.19	39.67	23.67	64.33	85.67	6.62	7.47	73.56	85.61	33.98	2.83	26.67	51.17	11.70	24.59	25.88	6.34
44	JS 22-32	17.53	27.35	35.17	19.00	67.67	80.00	5.66	8.23	73.60	91.45	33.03	3.10	30.33	59.33	12.15	21.52	38.64	8.32
45	JS 22-33	19.20	29.01	46.67	24.33	66.67	71.00	7.95	10.08	66.59	90.86	32.67	3.07	22.83	51.33	11.69	20.74	30.29	6.28
46	JS 22-34	19.50	24.67	39.50	24.33	63.67	83.33	6.82	9.22	70.35	85.63	33.86	2.67	32.83	87.00	10.63	18.74	49.39	9.70
47	JS 22-35	20.20	27.22	37.83	20.67	69.33	78.67	6.53	6.46	74.71	85.61	33.77	2.83	37.33	55.00	10.55	16.57	46.71	7.71
48	JS 22-36	17.10	26.19	38.50	22.33	65.00	84.33	7.63	9.58	75.84	85.93	34.60	2.83	37.84	101.17	9.65	32.65	33.88	11.06
49	JS 22-38	20.67	26.19	35.00	20.33	60.33	84.67	5.59	8.98	70.20	83.67	34.16	2.17	30.50	60.00	12.65	20.18	38.70	7.52
50	JS 22-39	20.33	26.19	41.67	21.33	64.33	83.67	6.62	8.50	67.46	78.18	33.42	2.83	35.00	118.17	8.60	16.32	68.54	10.70
51	JS 22-40	19.91	24.67	45.50	26.00	65.33	78.67	5.63	9.68	69.03	80.70	34.85	2.50	32.50	62.00	10.60	21.52	30.41	6.55
52	JS 22-41	18.80	29.87	35.83	25.00	64.33	74.33	5.90	8.15	77.38	84.97	33.42	2.50	26.50	56.00	10.40	20.74	33.76	6.99
53	JS 22-42	17.23	24.33	29.33	22.33	63.67	86.00	7.51	8.24	70.49	89.91	35.67	2.83	32.67	50.50	12.80	29.65	29.58	8.37
54	JS 22-43	18.70	29.61	36.00	25.00	63.67	80.67	6.79	8.98	67.93	90.53	33.42	2.50	24.67	62.67	12.50	21.52	37.72	8.12
55	JS 22-44	19.40	24.67	35.67	20.33	66.00	91.00	5.96	8.26	76.12	84.97	35.17	2.50	25.67	64.33	11.65	22.43	35.31	7.92
56	JS 22-45	17.00	24.74	49.67	21.67	60.33	83.67	5.92	7.85	73.60	96.38	35.08	2.83	32.00	51.50	11.20	23.89	34.23	7.46
57	JS 22-46	18.40	24.74	31.67	21.00	65.67	78.33	5.54	7.92	63.74	85.93	34.10	2.50	25.50	55.50	10.10	16.57	45.64	7.59

58	JS 22-47	18.37	24.30	41.50	21.67	62.00	81.00	6.80	9.74	70.21	83.67	35.35	2.50	29.83	56.33	11.25	21.52	32.59	7.02
59	JS 22-48	16.90	26.60	51.00	23.67	67.33	77.00	6.85	10.00	70.43	89.91	34.47	2.83	29.17	72.33	11.00	21.52	39.57	8.50
60	JS 22-49	20.67	25.03	33.67	22.00	60.00	85.00	5.54	9.22	67.71	90.53	36.15	2.17	45.00	103.50	12.80	23.67	54.56	13.03
61	JS 22-50	17.00	24.74	32.33	20.67	64.00	72.67	7.51	7.21	73.28	86.79	34.10	2.50	35.50	66.33	10.60	14.17	64.60	9.14
62	JS 22-51	19.20	24.30	33.00	24.67	63.67	88.00	6.79	8.98	69.35	89.97	34.34	2.83	29.00	60.00	10.34	16.57	43.61	7.19
63	JS 22-52	18.20	26.60	51.67	20.33	66.00	80.67	7.19	8.50	75.84	83.63	33.10	3.17	31.17	67.83	12.70	20.74	41.07	8.52
64	JS 22-53	19.67	28.38	33.33	25.00	63.00	76.00	5.88	9.68	70.20	84.97	33.19	2.50	37.33	70.67	12.60	20.18	45.23	9.13
65	JS 22-54	19.87	26.19	42.67	23.33	66.00	84.33	6.85	8.98	75.93	90.86	33.93	2.50	33.83	67.00	13.10	23.40	38.53	9.03
66	JS 22-55	16.90	27.35	37.17	24.67	62.33	84.67	6.29	7.95	67.97	81.57	33.57	3.00	26.00	59.67	11.85	21.52	32.37	6.96
67	JSM 259	18.20	29.01	40.50	24.67	60.33	75.33	5.88	8.24	67.55	84.97	33.40	2.83	41.50	89.83	12.65	21.74	67.21	14.14
68	JSM 232	19.20	24.67	33.00	22.33	64.33	78.33	5.69	8.98	75.10	88.31	33.97	2.83	32.67	90.00	12.55	16.16	67.03	10.75
69	JS 23-03	18.03	27.22	31.17	24.33	64.33	84.00	5.15	7.13	78.79	84.97	32.13	2.33	32.50	71.33	13.81	32.65	35.87	11.71
70	JS 23-05	17.23	27.16	39.17	24.33	64.67	86.00	6.85	8.88	71.67	88.04	33.40	2.33	29.67	78.00	13.02	29.65	36.59	10.74
71	JS 23-08	17.43	26.19	41.33	25.33	64.67	82.00	5.88	6.89	67.80	90.79	34.88	3.00	28.71	55.67	12.20	21.52	45.48	9.80
72	JS 23-09	18.53	26.19	30.33	22.00	65.00	81.67	6.85	9.58	73.21	84.97	33.26	2.17	33.00	87.00	12.40	22.43	53.27	11.95
73	JS 23-10	16.90	29.01	31.67	21.33	66.33	77.00	5.54	8.98	76.12	94.45	32.66	2.50	33.00	90.83	10.90	20.18	58.72	11.73
74	MAUS 71	17.70	26.19	33.33	23.67	61.00	82.00	7.51	7.13	74.82	92.39	34.83	2.67	34.33	86.33	13.47	16.57	49.52	8.25
75	MACS 450	20.67	24.67	32.67	24.00	68.67	82.00	7.57	9.68	67.93	84.97	34.27	2.50	28.17	50.83	10.90	21.52	43.40	9.34
76	NRC 125	18.70	27.42	33.67	22.67	68.33	80.67	5.73	7.88	76.12	88.04	33.42	3.00	44.17	100.83	13.25	22.67	59.46	13.56
77	NRC 128	19.67	29.01	37.00	21.33	65.67	81.67	6.24	10.00	74.82	84.97	34.22	2.67	32.00	67.00	11.95	14.17	55.10	7.79
78	NRC 137	17.10	24.67	34.50	24.00	65.67	78.67	5.48	8.98	73.21	92.39	34.00	2.83	42.00	120.00	12.52	18.57	68.03	13.56
79	PS 1092	20.67	24.40	31.00	24.67	65.67	84.33	5.61	8.58	75.10	84.97	35.08	2.50	31.50	53.67	12.45	16.72	44.00	7.36
80	PS 1225	19.91	25.70	33.50	25.00	65.67	89.33	7.88	7.95	78.79	92.39	34.27	2.67	31.67	64.83	12.73	29.65	31.05	8.98
81	PS 1613	18.80	29.21	33.50	26.30	68.33	86.67	5.22	8.94	76.12	84.97	34.00	2.67	31.00	67.33	12.05	21.52	43.07	9.27
82	PS 1641	17.23	24.33	30.33	23.33	64.33	82.33	6.91	7.88	67.97	88.04	35.08	2.67	37.56	105.17	11.44	18.00	62.29	11.24
83	RVS 2012-19	18.70	24.74	40.00	21.00	65.00	85.00	5.83	7.37	67.55	84.09	34.83	3.00	30.00	63.00	12.70	20.18	44.98	8.85
84	SL 96	19.50	25.42	31.50	21.33	62.00	82.67	7.30	9.37	75.10	84.97	34.27	2.67	33.50	56.50	10.34	16.32	49.46	7.70
85	SL 710	17.23	23.62	42.50	22.33	67.33	88.00	6.78	9.00	78.79	84.97	34.57	2.50	28.33	54.33	11.05	32.65	20.74	6.77
86	SL 744	17.20	27.30	37.17	23.67	66.67	89.00	5.92	8.98	76.12	92.39	35.08	2.67	28.33	58.67	10.73	20.74	35.40	7.34
87	JS 24-37	19.87	24.33	33.00	23.33	65.33	87.00	8.3.63	10.94	67.97	90.78	34.10	2.72	40.50	129.83	12.60	24.91	60.47	15.03

88	NRC 86	18.90	25.42	46.83	21.67	60.67	84.33	7.36	10.69	72.00	80.70	35.35	2.97	37.00	64.83	12.20	24.22	32.38	7.85
89	NRC 130	18.07	23.62	42.17	23.00	66.00	83.00	6.24	6.88	75.10	84.97	34.47	2.92	32.17	107.33	10.68	23.00	54.80	12.61
90	PS 1569	18.31	27.30	38.00	22.33	65.33	81.00	7.51	8.78	77.66	95.65	34.55	2.60	34.33	118.00	11.97	21.67	66.98	14.50
	Mean	18.76	26.23	37.60	22.93	64.43	80.35	6.41	8.47	71.47	86.76	34.15	2.61	33.48	77.93	11.38	20.73	47.44	9.51
	SE	0.83	1.76	1.90	1.58	2.00	4.16	0.96	0.88	3.71	5.18	0.61	0.15	2.08	6.86	0.31	1.33	5.51	0.85
	C.D.5%	2.32		5.30						8.59		1.71	0.41	5.80	19.14	0.86	3.71	15.37	2.39

Table1: General Mean Values of each genotype for Physiological and quantitative traits

Note: Plant height at 30,60 and 90 DAS(Days after sowing), leaf number at 30,60 and 90 DAS, LAI(Leaf area index) at 60 and 90 DAS, LAD(Leaf area duration at 60 and 90 DAS), CT(Canopy temperature), S/POD(Seed per pod), P/P(Pods per plant), NS/P(Number of seeds per plant), 100SW(Hundred seeds weight), BY/P(Biological yield per plant), HI(Harvest index),SY/P(Seed yield per plant).

UNDER PEER REVIEW