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Physiological quality of soybean (*Glycine max* L.) as affected by sowing date

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Abstract
An experiment was conducted to study the influence of sowing dates on physiological quality of soybean variety JS 335 during *kharif*, 2013. Sowings were taken up at weekly interval from July to August. Data were recorded on various parameters like germination, shoot length, root length, seedling dry weight, vigour index and field emergence on seeds produced from different sowing dates. The results of the experiment revealed that the above parameters significantly affected by sowing dates. The highest germination percentage (99%), shoot length (18.13 cm), root length (18.56 cm), seedling dry weight (89.0 mg), seedling vigour index- I and II (3607 and 8.81 respectively) and field emergence (91%) were recorded for crop sown in July 2nd week. It was noticed that sowing date significantly affected the seed quality parameters and seeds from early sowings (July 2nd week sowing) had the good seed quality.

Keywords: soybean, sowing date, seed quality, germination, vigour

1. Introduction
Soybean (*Glycine max* (L.) Merr) is the most important grain legume of the world and soybean seed contains 40-45% protein, 20-22% oil, 20-26% carbohydrate and a high amount of Ca, P and vitamins (Rahman *et al.*, 2011) [10]. Soybean oil is cholesterol free and is very popular as cooking oil over the world. Soybean protein contains essential amino acid in desired quantity. Hence, it is regarded as a well balanced protein food. Therefore, soybean has huge potential as healthy food. In 2013, it occupied an area of 12.03 M ha in India with seed yield of about 1192 kg ha^{-1}. In India, major soybean growing states are Madhya Pradesh, Maharashtra, Rajasthan, Karnataka, Uttar Pradesh and Andhra Pradesh (Indiastat, 2013). In India, average yield of soybean is less than the world average yield, mainly due to non-availability of quality seed, use of low yield potential varieties, poor agronomic practices, besides optimum time of sowing. The improper agronomic management, such as, sowing at wrong time may be a cause for this problem. It has been reported that the environment that helps production of good crop also helps producing good quality seed (Rahman *et. al*., 2005) [11]. The field environment at which the crop is grown and also seeds are harvested regulates the quality of seeds. Therefore, the present research work was undertaken with a view to investigate the effect of sowing dates on germination, vigour and field performance of soybean seed.

2. Materials and Methods
2.1 Experimental site, sowing and design
To investigate the effect of sowing date on physiological quality of soybean cultivar, an experiment was conducted based on randomized complete block design with three replications at College farm, College of Agriculture, Rajendranagar, Telanagana (with 17^0 19' N latitude and 78^0 28' E longitude and 542.3 m height sea), India in 2013 growing season. Factors of experiment consisted of eight sowing dates (July 1st week, July 2nd week, July 3rd week, July 4th week, August 1st week, August 2nd week, August 3rd week and August 4th week). The weekly meteorological observations during crop growth period are presented in Table1. The unit plot size was 6m × 4 m. All the standard seed production practices of soybean crop from land preparation to harvesting were followed during the course of the above study. All the quality observations were recorded on randomly selected seeds in each replication and the mean values were considered for statistical analysis. The procedure of tests for germination, vigour and field emergence are stated below.

2.2 Data Collection and Analysis

2.2.1 Seed germination

Germination test was conducted in three replications of 100 seeds each by adopting between paper method (ISTA, 1999) [4]. The temperature of 25 ± 1°C and RH of 95 per cent was maintained during the germination test. The first and final germination counts were recorded on fifth and eighth day of germination test respectively for normal seedlings and germination was expressed in percentage.

$$\text{Germination (\%)} = \frac{\text{Number of normal seedlings}}{\text{Total number of seeds planted}} \times 100$$

Table 1: Weekly distribution of minimum, maximum and mean temperature (°C), rainfall (mm), relative humidity (%) and sunshine (hours) during crop growth period from July to August, 2013.

Period	Temperature (°C)			RH (%)		Rainfall (mm)	Sunshine (h)
	Max.	Min.	Mean	I	II		
July 1st	34.3	23.7	29.1	84	57	9.0	6.5
July 2nd	30.9	23.0	26.8	85	64	3.4	2.6
July 3rd	33.5	24.2	28.8	77	46	3.3	5.0
July 4th	30.9	25.0	27.9	81	61	3.4	3.9
August 1st	27.8	21.6	24.7	86	78	4.1	3.5
August 2nd	29.0	22.2	25.6	89	66	7.8	5.7
August 3rd	28.1	22.1	25.1	90	78	10.4	2.2
August 4th	29.2	22.0	25.6	92	77	0.2	3.4

Max- Maximum, Min- Minimum, RH- Relative Humidity, mm- milli meter, h- hours

2.2.2 Root length (cm)

Ten normal seedlings were selected randomly in each treatment from all the replications on eighth day of germination test. The root length was measured from the tip of the primary root to base of hypocotyle with the help of a scale and mean root length was expressed in centimeters.

2.2.3 Shoot length (cm)

Ten normal seedlings used for root length measurement, were also used for the measurement of shoot length. The shoot length was measured from the base of the primary leaf to the base of the hypocotyle and mean shoot length was expressed in centimeter.

2.2.4 Seedling dry weight (mg)

Ten normal seedlings used for root and shoot length measurements were put in butter paper bags and kept in hot air over at 85 ± 1°C for 24 hours. Later they were removed and allowed to cool in a desiccator for 30 minutes before weighing in an electronic balance. The mean dry weight of the seedlings was recorded and expressed in milligrams.

2.2.5 Seedling vigour indices

The seedling vigour index I and II was calculated as per the method suggested by Abdul- Baki and Anderson (1973) [1] and expressed in whole number.

Seedling vigour index I = Germination (%) x Seedling length (cm)

Seedling vigour index II = Germination (%) x Seedling dry weight (g)

2.2.6 Field emergence

One hundred seeds selected at randomly from each treatment in three replications were used for the field emergence studies. The seeds were sown in well-prepared soil at 2.0 to 2.5 cm depth and covered with soil. Field emergence count was taken on the 8th day after sowing and the emergence percentage was calculated taking into account the number of seedlings emerged three centimeter above the soil surface.

$$\text{Field emergence (\%)} = \frac{\text{Number of seedling emergence at 8th day}}{\text{Total number of seeds sown}} \times 100$$

The data recorded was subjected to Analysis of Variance (ANOVA) technique (Gomez and Gomez, 1984) [3] and standard error of difference was calculated at 5% probability level to compare the mean difference among the treatments.

3. Results and Discussion

3.1. Germination

Non significant variations realized for standard germination percentage among different sowing dates of soybean (Table 2). The highest germination percentage was recorded in seeds obtained from July 2nd week sowing (99%) followed by July 1st week sowing (98%). Higher germination in case of July 2nd week sowing might be due better environment conditions *i.e.*, optimum temperature (25°C) during seed filling, seed development, maturity and harvesting. The lowest germination in seeds obtained from August 4th week sowing (94%) might be due to the improper growth and development of plants and crop exposed low mean temperature (21.6°C) during maturity and harvesting stage.

Relatively higher seed germination was observed from sowings of July than the sowings of August and this might be due heavy rainfall (31.7 mm) during maturity and harvesting stages of August sown crop and seeds obtained from these sowings had relatively higher moisture content and fungal infection. These findings are in conformity with Uem and Unioeste (2003) [14] who reported that seeds from the optimum sowing dates had higher percentage of germination than early or delayed planted crop because of the more favourable climatic conditions during seed development.

3.2. Shoot length (cm)

Sowing dates differed significantly for shoot length (Table 2) and varied from 15.8 to 18.13 cm. The highest shoot length was recorded with July 1st week (18.13 cm) followed by July 2nd week sowing (18.00 cm) which were statistically on par but significantly different from other sowings. The lowest shoot length (15.8 cm) was observed for the seeds received from August 4th week sowing. The significant increase in shoot length might be due to bold seed size which might have supplied adequate food reserves to resume embryo growth, consequently leading to more seedling length, seedling dry weight and higher vigour index. These findings are supported by Kumar *et al*. (2011) [9] who reported that in niger seed quality parameters like germination percentage and seedling length were observed to be lower when the sowing was delayed.

3.3 Root length (cm)

The sowing dates differed significantly for root length. Root length was more for the seeds harvested from July 2nd week (18.56 cm) followed by July 1st week (16.73 cm) and lower root length recorded for August 4th week sown crop (13.23 cm) (Table 2). The significant increase in shoot and root length might be due to higher seed index as is reflected in the test weight of the seed, which might have supplied adequate food reserves to resume embryo growth. These findings are supported by Kumar *et al*. (2011) [9] who reported that in niger seed quality parameters like germination percentage and seedling length were observed to be lower when the sowing date was delayed.

3.4 Seedling dry weight (mg)

The time of sowing significantly influence the seedling dry weight and results were presented in Table 2. Higher seedling dry weight was recorded for July 2nd week sown crop (89.0 mg), lower seedling dry weight was observed for August 4th week sowing (54.0 mg). Higher seedling dry weight in early sowings might be due to larger seed size which could be attributed to more food reserves in the seed ultimately resulting into good seedlings. Decrease in seedling dry weight was due to restricted supply of nutrients from mother plant to seed due to disruption of vascular connection and utilization in various physiological and metabolic processes (Khatun *et al*., 2009) [7]. These findings are supported by Khan (2001) [6] who reported that soybean seedling dry weight decreased in seeds from late sown crop.

3.5 Seedling Vigour Index- I

Seedling vigour index-I differed significantly among the sowing dates (Table 2). The highest seedling vigour index- I (3607) was recorded with July 2nd week sowing followed by July 1st week sowing (3463) and were statistically on a par but significantly different from other sowings. The lowest seedling vigour index- I recorded with August 4th week sowing (2613).

Higher seedling vigour index recorded in July 2nd week sowing could be attributed to high root and shoot length besides good seed germination. Singh *et al.* (1987) [13] reported that the seeds obtained from early set bolls in cotton had high seedling vigour index than the later set bolls. These findings are supported by Rahman *et al*. (2013) [12] who reported that soybean seeds from optimum time of sowing had higher vigour index because of high seed quality;

3.6 Seedling Vigour Index- II

A significant difference in seedling vigour index -II was observed among the sowing dates (Table 2). The highest seedling vigour index- II (8.81) was recorded with July 2nd week sowing followed by July 1st week sowing (7.70). The lowest seedling vigour index- II (4.86) was recorded with August 4th week sowing. High seedling vigour index recorded could be attributed to increased seedling dry weight besides good seed germination. The variation in seed germination and vigour comes from the environmental conditions that the crop experiences during the seed development and maturation (Dornbos, 1995) [2]. These findings are in line with reports of Rahman *et al.* (2013) [12] who reported that seeds from optimum time of sowing had high seedling vigour index because of high seed quality.

3.7 Field emergence (%)

Field emergence studies conducted with seeds from different sowing dates and results showed a significant variation ranged from 84 to 91% (Table 2). The highest field emergence was recorded with July 2nd week sowing (91%) followed by July 1st week (89%) and July 3rd week sowing (87%). Lower field emergence was observed in case of August 4th week sowing (84%). This might be due to seeds from early sowings had higher seed size, seed germination and seed vigour index. The higher field emergence percentage in bold seeds when compared to small seeds is due to large food reserves present in bold seeds. These findings are supported by Indrakumar *et al*. (2009) [5] who reported that seed size and test weight positively correlate with field emergence. Kolasinska *et al*. (2000) [8] reported that there was a strong positive correlation of field emergence with either laboratory germination or vigour index.

Table 2: Influence of sowing dates on seed moisture content (%), germination (%), shoot length (cm), root length (cm) seedling dry weight (mg) and seedling vigour indices of soybean cv. JS 335

Dates of sowing (Weekly)	G (%)	SL (cm)	RL (cm)	SDW (mg)	SVI-I	SVI-II	FE (%)
July 1st	98	18.00	16.73	78.66	3463	7.70	89
July 2nd	99	18.13	18.56	89.00	3607	8.81	91
July 3rd	97	17.30	16.30	70.66	3269	6.85	87
July 4th	97	17.10	15.60	64.33	3182	6.24	88
August 1st	97	16.96	14.70	64.00	3081	6.20	88
August 2nd	96	16.26	13.70	57.33	2871	5.50	86
August 3rd	94	16.20	13.70	56.00	2815	5.26	87
August 4th	94	15.80	13.23	54.00	2613	4.86	84
Mean	96	16.97	15.31	66.74	3112.83	6.11	87.50
S.Em	1.84	0.30	0.12	1.47	59.15	0.15	1.41
S.Ed	2.60	0.43	0.17	2.08	83.65	0.22	2.00
C.D (0.05)	NS	0.35	0.38	4.46	178.87	0.47	1.70
C.V%	3.29	3.13	1.42	3.85	3.29	4.39	2.79

S.Em- Standard Error of Mean, S.Ed- Standard Error of deviation, C.D- Critical Difference, C.V- Coeficient of Variation

Table 3 Analysis of Variance for seed quality characters as affected by sowing dates in soybean

Source of variation	df	G (%)	SL (cm)	RL (cm)	SDW (mg)	SVI-I	SVI-II	FE (%)
Treatment	7	11.6	2.14*	10.10*	391.21*	339839.81*	5.14*	56.95*
Error	14	10.83	0.28	0.05	8.33	10497.96	0.07	1.42
Total	21	22.43	2.42	10.15	399.54	350338	5.21	58.37

G- Germination, SL- Seedling Length, RL- Root Length, SDW- Seedling Dry Weight, SVI-I- Seedling Vigour Index-I, SVI-II- Seedling Vigour Index-II, FE- Field Emergence, cm- centi meter, mg- milli gram.

* Significance at 5% level

4. Conclusions

The dates of sowing differed significantly for seed quality parameters such as root length shoot length, total seedling length, seedling dry weight, seedling vigour indices and field emergence, at 5% level of significance. Non significant variations realized for standard germination percentage among different sowing dates of soybean. The highest germination percentage (99%), shoot length (18.13 cm), root length (18.56 cm), seedling dry weight (89.0 mg), seedling vigour index- I and II (3607 and 8.81 respectively) and field emergence (91%) were recorded for crop sown in July 2nd week. It was noticed that sowing date significantly affected the seed quality parameters and seeds from early sowings (July 2nd week sowing) had the good seed quality.

5. References

1. Abdul-Baki AS, Anderson JD. Vigour determination in soybean by multiple criteria. *Crop Science.* 1973; 13:630-633.
2. Dornbos DL. Production environment and seed quality. In: Seed Quality. Basic Mechanisms and Agricultural Implication, Food Product Press, New York. 1995, 119-152.
3. Gomez KA, Gomez AA. Statistal proceudres in agricultural research. 2nd edition. Wiley, New York, 1984.
4. ISTA. International rules for seed testing, Supplement to Seed Science and Technology. 1999; 27:27-32.
5. Indrakumar N, Seema ; Chauhan JS. Effect of seed size on quality within seed lot of pea and correlation of standard germination, vigour with field emergence test. *Nature and Science*. 2009; 7(4):72-78.
6. Khan AZ. Influence of planting date and plant density on canopy temperature, seed development, seed quality and yield of soybean. *Ph.D Dissertation*, University of Agriculture, Faisalabad, 2001.
7. Khatun A, Kabir G, Bhuiyan MAH. Effect of harvesting stages on the seed quality of lentil (*Lens culinaris* L.) during storage. Bangladesh Journal of Agricultural Research. 2009; 34(4):565-576.
8. Kolasinska K, Szyrmer J, Dul S. Relationship between laboratory seed quality tests and field emergence of common bean seed. *Crop Science*. 2000; 40:470-475.
9. Kumar BNM, Basavegowda, Vyakaranahal BS, Deshpande VK, Kenchanagoudar PV. Influence of sowing dates on production of seed yield in niger (*Guizotia abyssinica* Cass.). Karnataka Journal of Agricultural Sciences. 2011; 24(3):289-293.
10. Rahman MM, Hossain MM, Anwar MP, Juraimi AS. Plant density influence on yield and nutritional quality of soybean seed. Asian Journal of Plant Sciences. 2011; 10(2):125-132.
11. Rahman MM, Hampton JG, Hill MJ. Soybean seed yield as affected by time of sowing in a cool tempera tureenvironment. Seed Science and Technology, 2005; 7:1-15.
12. Rahman MM, Rahman MM, Hussain MM. Effect of sowing date on germination and vigour of soybean (*Glycine max*) seeds. *The Agriculturists.* 2013; 11(1):67-75.
13. Singh IP, Singh DP, Chabra BS. Seed germination in relation to time of pickings in cotton. *Cotton Development*. 1987; 17(2):37-38.
14. Uem and Unioeste. Sowing seasons and quality of soybean seeds. *Scientia Agricola*. 2003; 60 245-252.