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Seedling Parameters of Soybean Cultivars as Influenced with Seed Storage Periods

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ABSTRACT
This investigation was elucidated seedling characters effects of soybean cultivars Soybean is classified as "poor storer" as it loses viability drastically under warm and humid conditions under hot and humid storage conditions. The present research study was conducted to evaluate soybean seed material with the objectives to relate field emergence and laboratory evaluation with respect to physiological quality of soybean, with special reference to germinative evaluation criteria, to study the effect of storage on vigour and viability on soybean seeds. Seeds of soybean variety, JS-9305, JS-335, JS-9752, MAUS-158, MAUS-162, MAUS-71, MAUS-81 stored in air tight plastic containers and kept under ambient laboratory conditions. Completely randomized block design was employed with four replications. Various germinative criteria including imbibition rate, standard germination test and vigour indexes were studied. The storage of seeds resulted in deterioration of seed vigour as evident by decline in the various parameters investigated. . A number of germinative parameters apart from initial seed weight and seed moisture, imbibition rate, germination %, germination index, root length, shoot length, seedling length, root shoot length ratio, root fresh weight, shoot fresh weight, seedling fresh weight, root shoot fresh weight ratio, root dry weight, shoot dry weight, seedling dry weight, root shoot dry weight ratio, root moisture, shoot moisture, seedling moisture, vigor index – I, vigor index – II, mobilization efficiency, field emergence and tetrazolium test were studied.
Keywords- *Soybean, cultivars, storage, viability, seed vigor*

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INTRODUCTION

Soybean *(Glycine max* (L.) Merrill) is one of the world's leading sources of vegetable oil and plant protein. As the world demand for
vegetable oil and protein meal continues to increase, soybean production has spread rapidly from the temperate zone into the hot and humid tropics. It is an important food crop and possesses 40-42% protein and 20-22% oil in its seeds making it highly suitable for human food, animal feed and infant food product. It is also rich in vitamins, phosphorous and iron.
Soybean is being cultivated in the Himalayan region from time immemorial but the lower yield potential of the traditional cultivars has restricted its large-scale adoption. Among other constraints which hinder soybean production are the deterioration of seed quality under ambient storage conditions and several biotic and abiotic factors. Soybean being a potential oil and protein crop for narrowing the oil and nutrition gap, occupies an important place in agricultural economy of India. It is third important Soybean is finding its place in policy agenda of industrial, medicinal and food sector of India due to wide spectrum of its chemical composition. The dry seed of soybean is rich source of phosphorous, potassium, sulphur, iron, vit. A, D, E, K and unsaturated fatty acid with the anti-cholesterol principle. While its sprout contains appreciable amount of vitamin C which is generally obtained from fresh fruits and vegetables.
Soybean oil is low in saturated fat and high in monounsaturated and polyunsaturated fat. It is widely used as 'vegetable oil". Soybean oil also contains the essential fatty acids linoleic and linolenic, required for human health Soybean oil rich in omega-3 fatty acids, is believed to reduce the risk for heart diseases and may prevent osteoporosis. It also contains phytosterols which could lower LDL cholesterol. Soybean oil does not contain cholesterol (Kakde and Chavan. 2012). Developing seeds attain maximum viability and vigour at physiological maturity (defined as the stage when seeds reach maximum dry weight during development) and with age, the viability and vigour decline, thereafter (Harrington, 1972).In case of dry

weight per plant of soybean seed decreases all cases but the rate of weakening is highest in cloth bag [17]. Chuansin, et al. [6] reported that soybean seeds were stored in Metallized film bags and Aluminum foil bags observed highly typical germination and seed vigour, and keep water activity and seed moisture content in low level could delay seed quality deterioration followed by Polypropylene bags and woven bag. Tatipata, et al. [28] reported that soybean seeds were stored in aluminums foil bags observed highly seedling vigor and keep moisture content in low level could delay seed deterioration followed by polyethylene and wheat bags.

MATERIALS AND METHODS

The experiment was conducted at experimental seed testing laboratory of Botany Department, Faculty of Agriculture, VNMKV University, Parbhani during 2015 and 2016. The seeds of soybean genotype are produced from Soybean Research Station V.N.M.K.V, Parbhani. The experiment was conducted at laboratory. Department of Agricultural botany. VNMKV, Parbhani.

The seed of each entry were stored Oct 2016 onward in air tight plastic container kept in the laboratory under ambient condition. The sample were be drawn for various observation at one month interval till the seed germination declines considerably below Indian minimum seed certification standard.

1. Determination Seed moisture (%)

Four grams of seed sample per replicate of each entry were weighed on electronic balance and dried in an oven at 130^0 C for 2 hours. (ISTA, 1985). Average value was presented.

2. **Seed viability**

The tetrazolium test was performed according to the procedure devised by International Seed Testing Association . One hundred seeds from each seed lot of soybean or niger were used for this test in five replications of 20 seeds each. The seeds were soaked in distilled water for 24 h before staining to allow complete hydration of all the tissues. The seeds were then bisected longitudinally to expose the embryo and stained with 1% solution (w/v) of triphenyl tetrazolium chloride (TTC) made by dissolving the 2,3,5 TTC in double distilled water. The seeds were then placed in 1% TTC solution in petridishes on double sheets of Watman No.1 filter paper moistened with distilled water, which were then covered with aluminum foil and incubated at 30 ± 1°C temperature in dark for 36 h.

The tissues of the living cells of the seed took up the stain in different patterns during this period. After staining, the solution was drained off and seeds were rinsed with tap water. Viability of each seed was interpreted according to the topographical staining pattern of the embryo and the intensity of the colouration with the help of magnifying glass and the pattern of each individual seed was recorded under three staining categories, completely colored embryos (viable), partially coloured (potentially viable) and completely colorless embryos (not viable).

Statistical analysis

The data were analyzed as per completely randomized design (Gomez and Gomez, 1983). Simple correlation and regression analyses between field emergence (final count) and other individual evaluation criteria were also carried out.

Studied Characteristics

The following seedling parameters were studied as following:

1. **Root length (cm):** Ten normal seedlings were randomly selected in each petri dishes from final count and the root length was determined from the collar region to the tip of the primary root. The average root length of ten seedlings was computed and expressed in centimeter.
2. **Shoot length (cm):** Ten seedlings used for root length were used for shoot length measurement. The length between the collar region and the tip of the primary shoot was considered as shoot length and it was measured. The mean value of shoot length was calculated and expressed in centimeter.
3. **Root/ shoot ratio:** The root/shoot ratio was computed according to Harris, et al. [9], the root/shoot ratio is the ratio of the length of root divided on the length of the shoot.
4. **Seedling dry weight (g):** Ten seedlings used for measuring the seedling were also utilized for determining the dry weight of the seedling. Seedlings were dried in hot air oven maintained at 70±1°C for 24 hr. and then at 105°C until constant dry weight. After drying, seedlings were kept in desiccators for cooling and further weighed and expressed in grams.
5. **Seedling fresh weight (g):** Ten seedlings used for measuring seedling length were also utilized for determining the fresh weight of the seedling expressed in grams.
6. **Seedling vigor index:** Seedling vigor index was computed by adopting the formula as suggested by Abdul-baki, et al. [9] and expressed in whole number.

Vigor Index = Germination (%) x [(Shoot Length + Root Length)]

RESULTS AND DISCUSSION

The results showed a significant effect of storage periods on the means of root length, shoot length, seedling dry weight, seedling fresh weight and seedling vigor index It important to harvest mature, relatively dry seed or to reduce the moisture content of high moisture seed soon after harvest. In the present investigation the seeds were air dried amicably but there was still a decline in the moisture content after the initiation of storage and experimentation. Seed moisture was recorded in different entries of soybean during different storage intervals**.** The overall maximum seed moisture was recorded in the entries JS9305 and JS335 A while minimum seed moisture was recorded in MAUS-162 and JS9752 respectively. The relations of the temperature, time and moisture content of seed during storage are most influential factor affecting their longevity. Similar findings were reported by (Bass. 2011), Shelar *et al*. (2015) and jaya joshi *et al,* (2014).

Root length of ten randomly selected germinated seedlings after seven days in germination trial was measured in each of four replications and mean values .The entries differed significantly with respect to root length while the storage period show significant differences, though there was a numerical decline with the advancement of storage period. The entries and storage periods was significant and the highest root length was recorded in the entries JS9305 at the initiation of storage (Dec 2016) while the lowest root length was recorded in the JS9752 at the end of storage period (Mar 2017). Shoot length is another linear measurement, which gives an idea of seed vigour of a seed lot. The differences due to shoot length as influenced by storage periods and the entries were significant. Overall, there was a decline in shoot length with the increase in the storage period. also reported the decline in root and shoot length due to storage period in soybean seeds. The entries JS9305, JS335 and MAUS81 recorded higher shoot length**.** 12], Muhammad, et al. [18], Sharma, et al. [24] Seedling fresh weight is the sum of root fresh weight and shoots fresh weight. The seedling fresh weight showed the decreasing trend with advancement of storage periods. The entries differed significantly and the highest value was recorded by JS9305 followed by JS335 respectively. The minimum value was observed in the JS9752. Seedling fresh weight has also reported by kandil *et al,* (2013) and Kamble (2015). Seedling dry weight is the summation of root and shoot dry weight which differed significantly due to entries and decreased with the increase in the storage period. The entries differed significantly and the highest value was recorded by JS9305 followed by JS335 respectively. The minimum value was observed in the JS9752. Similar findings were also reported by Kamble, (2015), kandil *et al,* (2013) and Vange (2015). A critical appraisal of root moisture data indicated that entries, storage period differ significantly. There was an increase in root moisture percentage with advancement of storage period. The highest root moisture was recorded in the entries MAUS-158 followed by JS9752 respectively. Similar findings were reported by Kamble (2015). Just like root and shoot moisture, the moisture of seedling as whole differed significantly both due to entries and storage period. The trends of seedling moisture in entries were almost like shoot moisture. Seedling moisture also increased significantly as the storage period advanced. The moisture content represents the vitality in terms of moisture holding capability of living system. The increasing seedling moisture percentage with seed ageing signifies that the dry weight accumulation was affected more adversely than the fresh weight The highest seedling moisture was recorded in entries JS9305 followed by JS335 and MAUS81 respectively**.** These results are in close findings of Kamble (2015).

Looking to the importance of seed vigour in field performance of a seed lot, vigour indices are used to assay the physiological quality of the seed. Vigour index-I is such an attempt to assess the seed quality which is a unit-less expression derived from the multiplication of germination percentageand mean seedling length (ISTA 1976). vigour indices based on germination percentage after various intervals have attempted *viz.* 24, 36, 48 and 72 hours and 7 days. All the vigour indices-1 i.e. based germination percentage taken at 24, 36, 48 and 72 hours and 7 days were found to differ significantly among entries, different storage period. The highest vigour index I was recorded in entries JS9305 followed by JS335 and MAUS81 respectively. Similar to that of vigour indices I, vigour indices-II were also calculated based on integration of germination percentage at different periods and the seedling dry weight. A cultivar with greater speed of germination (uniformity of germination) may not necessarily have the greater seedling length or seedling dry weight. Hence, an integration of germination percentage and seedling dry weight of length depicted as vigour index will give the better idea of physiological quality of seed in terms of seedling vigour. Vigour index-II was calculated as per (ISTA 1976). The highest vigour index II was recorded in entries JS9305 followed by JS335 and MAUS81 respectively**.**

Table No.1 Root length (cm) of soybean after different periods of storage

Treatment	Dates of Sampling			
	Dec -2	Jan-1	Feb-1	Mar-1
MAUS158	8.30	7.63	7.63	6.90

MAUS162	8.00	7.13	7.10	6.78
MAUS71	8.60	7.73	7.73	7.13
MAUS81	9.10	8.33	8.18	7.25
JS335	9.20	8.58	8.38	7.90
JS9305	9.23	9.03	8.78	8.38
JS9752	7.28	7.13	6.53	6.58
Mean	**8.53**	**7.93**	**7.78**	**7.27**
S.Em.±	0.44	0.30	0.28	0.24
C.D at 5 %	1.31	0.91	0.85	0.71
C.V %	10.44	7.74	7.42	6.65

Table No.2 Shoot length (cm) of soybean after different periods of storage.

Treatment	Dates of Sampling			
	Dec -2	Jan-1	Feb-1	Mar-1
MAUS158	8.48	6.98	6.50	5.85
MAUS162	8.25	6.78	5.75	5.70
MAUS71	8.90	7.85	6.95	6.50
MAUS81	9.55	8.48	7.70	7.33
JS335	9.58	9.05	7.78	7.50
JS9305	10.40	9.75	8.80	8.03
JS9752	7.70	6.38	5.50	5.53
Mean	**9.06**	**7.89**	**7.00**	**6.63**
S.Em.±	0.37	0.28	0.23	0.20
C.D at 5 %	1.10	0.84	0.68	0.61
C.V %	8.29	7.19	6.59	6.23

Table No.**3 Root shoot length ratio of soybean after different periods of storage.**

Treatment	Dates of Sampling			
	Dec -2	Jan-1	Feb-1	Mar-1
MAUS158	0.98	1.09	1.17	1.18
MAUS162	0.97	1.05	1.23	1.19
MAUS71	0.97	0.98	1.11	1.10
MAUS81	0.95	0.98	1.06	0.99
JS335	0.96	0.95	1.08	1.05
JS9305	0.89	0.93	1.00	1.04
JS9752	0.94	1.12	1.19	1.19
Mean	**0.96**	**1.02**	**1.12**	**1.11**
S.Em.±	0.04	0.04	0.05	0.04
C.D at 5 %	NS	0.11	NS	0.13
C.V %	9.61	7.78	9.61	8.34

Table No.4 Seedling fresh weight (mg 10 shoot $^{-1}$) of soybean after different periods of storage

Treatment	Dates of Sampling			
	Dec -2	Jan-1	Feb-1	Mar-1
MAUS158	779.75	778.50	774.00	770.75
MAUS162	773.00	774.50	772.50	767.00
MAUS71	792.00	787.00	785.00	781.00
MAUS81	812.25	804.00	802.00	797.50
JS335	813.50	810.50	807.25	803.00
JS9305	817.25	814.25	811.75	807.75
JS9752	741.25	742.25	740.25	739.50
Mean	**789.86**	**787.29**	**784.68**	**780.93**

S.Em.±	9.54	7.31	6.46	6.68
C.D at 5 %	28.24	21.64	19.13	19.79
C.V %	2.41	1.85	1.64	1.71

Table No.5 Seedling dry weight (mg 10 shoot^{-1}) of soybean after different periods of storage

Treatment	Date of Sampling			
	2 Dec	1 Jan	1 Feb	1 March
MAUS158	106.25	106.50	102.00	97.00
MAUS162	106.00	103.75	101.75	101.25
MAUS71	111.25	108.50	105.75	105.75
MAUS81	114.25	111.50	108.50	106.25
JS335	117.75	116.00	115.25	114.50
JS9305	122.25	119.75	118.00	118.00
JS9752	100.25	100.00	95.00	90.00
Mean	**111.14**	**109.43**	**106.61**	**104.68**
S.Em.±	3.24	3.02	3.44	4.34
C.D at 5 %	9.61	8.94	10.21	12.86
C.V %	5.84	5.52	6.47	8.30

Table No. 6 Vigour index - I 7 day of germination in seed of soybean after different periods of storage

Treatment	Dates of Sampling			
	Dec -2	Jan-1	Feb-1	Mar-1
MAUS158	1408.85	1198.35	1135.70	1011.78
MAUS162	1339.18	1135.85	1034.30	963.75
MAUS71	1513.13	1313.53	1210.55	1103.40
MAUS81	1624.10	1433.80	1337.08	1195.15
JS335	1645.20	1509.45	1372.95	1275.33
JS9305	1783.47	1669.93	1507.20	1366.15
JS9752	1235.13	1062.93	941.28	899.38
Mean	**1507.01**	**1331.98**	**1219.86**	**1116.42**
S.Em.±	73.46	46.85	31.94	37.00
C.D at 5 %	217.50	138.71	94.58	109.57
C.V %	9.74	7.03	5.23	6.63

REFERENCES

1. Bass, L. N. and Janick, J. 2011. Seed viability during long term storage. *Horticultural Reviews.* **2**(2): 35-38.
2. Gomez, K. A. and Gomez, A. A. 1983. Statistical procedure for Agril. Res. (2nd Ed.) A wiley interscience publication. pp 8-19.
3. Harrington, J.F. 1972**,** Seed storage and longevity. *In Seed Biology,* **3**, *ed. T.T. Kotowski. Academic Press, New York. pp.* 142-145
4. Hopper, J. 2000. Certain seed technological studies in sunflower hybrid KBSH-1.
5. ISTA 1976 International rules for seed testing, *annexure seed science and technology*. 4.180. supplement.
6. Jaya, Singh. Seema, P. and Ravi, M. 2016 Effect of storage on germination and viability of soybean (*Glycine Max)* and Niger (*Guizotia abyssica***)** seed. *Int. J. curr. Microbiol. App. Sci.,* **5**(7):484-491.
7. Kakde, R.B. and Chavan, A.M. 2012. Nutritional changes in soybean and safflower oil due to storage fungi. *Current Botany.* **3**(4): 18-23.
8. Kakde, R.B. Badar, K.V. Pawar. S.M and Chavan, A.M. 2012. Storage mycoflora of oilseeds. *International multidisciplinary Research Journal.* **2**(3):39-42.
9. Kamble, B. G. 2015. Germinative and non Germinative evaluation for physiological quality of seed in pearl millet. College of agriculture Junagadh. Ph.D thesis.
10. Kandil, A. A. sharief, A. E**.** and shetelwy, M. S. 2013. Seedling parameters of soybean cultivars as influenced with seed storage periods, conditions and materials. .*Int. Journal of Agri.sci.***, 5**(1)330-138
11. Mohammadi, H. Soltaul, A. Sadeghlpour, H.R. and Zeloali, E. 2011. Effects of seed aging on subsequent seed reserve utilization and seedling growth in soybean*. International Journal of Plain Production.* **5** (1): 65-70.

12. Shelar, V.R. Mali, M.S. and Nagawade, D.R. 2015, Influence of storage conditions on quality of soybean (*Glycine max* (L.) Merill) seeds. *Journal of Food Legumes.* **28**(2): 67-71.
13. Vange, T. Ikyeleve and Okoh. 2016 Effect of packaging materials and storage condition on soybean germination and seedling vigour in markudi**.** *Res.J.of seed science.* 1819-3552.

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