



Effect of Relative Humidity on Seed Quality Parameters of Soybean During Storage

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ABSTRACT

The effect of relative humidity on moisture content, viability, seedling length, seedling dry weight and field emergence of soybean varieties, viz., MACS-13, Monetta, PBN-104, JS46-75 and Gaurav were studied during 2016-17. Seeds of soybean varieties could safely be stored under dry conditions (32% RH) up to next plantation. The humid storage conditions (63 and 92% RH) were detrimental to the seed viability and vigour. During storage, the viability, seedling length, seedling dry weight and field emergence of all the varieties were found to be decreased while the moisture content was found to be increased.

KEYWORDS: Relative humidity, Soybean, Storage, germination, moisture, seedling length, seedling dry weight, field emergence.

INTRODUCTION

It has long been known that the major factors influencing the longevity of seeds in storage and relative humidity and temperature (Barton, 1960). Of these, relative humidity has a greater influence on longevity of seed storage because moisture content is directly related to the atmospheric humidity. (Delouche et al., 1973). The quantity of water thus influence the storage behavior of seeds and other biological agencies dependent on them (Yadav and Pant, 1979). Hence, in the present investigation studies on effect of relative humidity on moisture content, viability, seedling length, seedling dry weight and field emergence during storage were undertaken.

MATERIAL AND METHODS

Seeds of five varieties of soybean viz., MACS-13, Monetta, PBN-104, JS46-75 and Gaurav were used in the present study (2016-17). Seeds were cleaned and dried at 40°C in hot air oven to moisture content level of 9%. The soybean seeds were stored at 32%, 63% and 92% RH. Thirty-two percent RH was adjusted by preparing the saturated solution of magnesium chloride (Stokes et al., 1949), 63% RH by saturated solution of sodium nitrate (Carr and Harris, 1949) and 92% RH by saturated solution of sodium sulphate (Delouche, 1965). The range of relative humidity was maintained in desiccator separately. The seed samples were stored in cloth bags over the saturated solution in desiccator for 18 months. The observations on seed moisture content, germination, seedling length, seedling dry weight and field emergence were recorded at trimonthly intervals.

The moisture content of the seed was determined by the air oven method (Anon, 1985). Four replicates of 100 seeds were used for germination at 25 ± 2°C. The germination percentage was evaluated on the value for percent normal seedlings (Anon, 1985). Seedling length and seedling dry weight was determined on the 8th day of germination count from 10 randomly selected normal seedling. For field emergence test, sowing was done in randomized block design, with four replications with inter-row spacing of 1 ft and 6 inch, respectively. Observations for field emergence were recorded daily and finally the established seedlings were counted after one month of sowing.

The statistical analysis was carried out with the help of randomized block design.

RESULTS AND DISCUSSION

Storage of seeds at lower RH (32%) caused desiccation, while at higher RH (63 and 92%) soybean seeds of all varieties under investigation exhibited higher moisture absorption (Table 1). Thus, it is observed that seed moisture content decreased from the initial moisture at 32% RH in all varieties and it is increased proportionately as 63 and 92% RH, respectively. Paricha et al. (1977) have also reported that in rice, mean moisture equilibrium value decreased with the decrease in RH of the ambient atmosphere. The higher seed moisture seems more detrimental to the seed viability during storage. The results obtained are in agreement with the earlier reports of Shelar and Bapat (1991) in Sorghum and Gadewar et al. (2009) in oil seeds.

Table No. 1: The Effect of relative humidity on moisture content and germination of soybean seed during storage.

Variety	Storage (Months)	% Relative			Humidity		
		32	63	92	32	63	92
		% Moisture			% Germination		
MACS- 13	0 Jan 2016	17.43	17.43	17.43	75.91	75.91	75.91
	3 Mar	15.06	18.48	25.27	74.46	59.18	-
	6 Jun	14.65	18.02	25.64	72.63	39.37	-
	9 Sep	14.80	19.16	26.97	68.90	16.38	-
	12 Dec	14.94	18.60	26.67	54.03	-	-
	15 Mar 2017	14.74	18.50	26.36	33.72	-	-
	18 Jun	14.45	18.38	26.00	29.15	-	-
	S \bar{E} m \pm	0.04	0.05	0.04	0.76	0.55	-
	CD 5%	0.12	0.15	0.12	2.26	1.69	-
	MONETTA	0 Jan 2016	17.43	17.43	17.43	71.60	71.60
3 Mar		14.86	18.29	25.92	73.17	63.68	28.97
6 Jun		14.54	18.15	25.70	70.66	51.36	-
9 Sep		14.77	18.88	27.15	68.26	33.03	-
12 Dec		14.89	18.72	26.58	64.01	10.25	-
15 Mar 2017		14.68	18.53	26.38	52.70	-	-
18 Jun		14.51	18.25	25.94	42.56	-	-
S \bar{E} m \pm		0.04	0.04	0.03	0.71	0.51	0.68
CD 5%		0.13	0.12	0.10	2.14	1.53	2.06
PBN-104		0 Jan 2016	17.43	17.43	14.43	54.79	54.79
	3 Mar	15.14	18.55	23.26	53.14	47.87	-
	6 Jun	14.82	18.41	25.89	53.74	31.24	-
	9 Sep	15.11	19.41	27.31	51.06	-	-
	12 Dec	15.34	19.02	27.07	47.72	-	-
	15 Mar 2017	15.06	18.90	26.06	36.10	-	-
	18 Jun	14.80	18.53	26.09	25.25	-	-
	S \bar{E} m \pm	0.05	0.03	0.03	0.66	0.50	-
	CD 5%	0.17	0.90	0.11	1.98	1.48	-
	JS 46-75	0 Jan 2016	17.43	17.43	17.43	78.48	78.48
3 Mar		14.94	18.46	26.08	78.09	62.92	-
6 Jun		14.62	18.26	25.86	78.30	45.00	-
9 Sep		14.94	19.28	27.09	71.66	24.23	-
12 Dec		15.11	19.14	26.58	56.98	-	-
15 Mar 2017		14.91	18.83	26.07	45.71	-	-
18 Jun		14.60	18.46	26.56	31.94	-	-
S \bar{E} m \pm		0.05	0.04	0.04	1.49	0.87	-
CD 5%		0.15	0.11	0.13	4.42	2.58	-
Gaurav		0 Jan 2016	17.43	17.43	17.43	80.80	80.80
	3 Mar	14.91	18.17	25.86	77.43	64.91	12.51
	6 Jun	14.48	18.12	25.77	79.04	52.54	-
	9 Sep	15.11	19.00	27.23	72.34	29.97	-
	12 Dec	15.11	18.88	26.86	65.48	-	-
	15 Mar 2017	14.386	18.65	26.50	45.85	-	-
	18 Jun	14.53	18.43	26.18	38.41	-	-
	S \bar{E} m \pm	0.04	0.05	0.05	1.08	0.83	0.87
	CD 5%	0.14	0.14	0.17	3.23	2.47	2.59

Table No. 2: The Effect of relative humidity on seedling length, dry weight and field emergence of soybean seed during storage.

Variety	Storage (Months)	% Relative Humidity								
		32	63	92	32	63	92	32	63	92
		SDL Length (cm)			SDL Dry wt (g)			% Field emergence		
MACS- 13	0 Jan 16	31.40	31.40	31.40	1.05	1.05	1.05	69.39	69.39	69.39
	3 Mar	27.20	20.26	-	0.96	0.75	-	65.68	52.09	-
	6 Jun	28.01	18.80	-	0.97	0.59	-	65.49	28.79	-
	9 Sep	23.11	12.75	-	0.89	0.39	-	61.87	-	-
	12 Dec	21.41	-	-	0.84	-	-	48.88	-	-
	15 Mar 17	21.21	-	-	0.83	-	-	34.28	-	-
	18 Jun	20.21	-	-	0.74	-	-	22.13	-	-
	SEm+	0.73	0.53	-	0.02	0.02	-	0.98	0.72	-
	CD 5%	2.17	1.59	-	0.07	0.07	-	2.93	2.16	-
MONETTA	0 Jan 16	33.00	33.00	33.00	1.34	1.34	1.34	68.61	68.61	68.61
	3 Mar	33.01	26.22	16.20	1.38	1.04	0.68	65.30	55.44	19.81
	6 Jun	30.61	21.41	-	1.26	0.89	-	65.02	43.27	-
	9 Sep	27.90	15.21	-	1.21	0.81	-	62.58	24.12	-
	12 Dec	22.62	10.52	-	1.07	0.53	-	57.16	-	-
	15 Mar 17	21.22	-	-	0.88	-	-	45.28	-	-
	18 Jun	18.61	-	-	0.77	-	-	34.43	-	-
	SEm+	0.73	0.52	0.43	0.04	0.48	0.02	0.90	0.55	1.05
	CD 5%	2.18	1.56	1.28	0.09	0.24	0.06	2.69	1.63	3.12
PBN-104	0 Jan 16	27.70	27.70	27.70	0.99	0.99	0.99	48.01	48.01	48.01
	3 Mar	25.09	16.05	-	0.84	0.44	-	44.14	38.64	-
	6 Jun	23.20	13.64	-	0.73	0.27	-	46.29	18.65	-
	9 Sep	20.21	-	-	0.63	-	-	45.43	-	-
	12 Dec	18.22	-	-	0.55	-	-	39.38	-	-
	15 Mar 17	17.11	-	-	0.39	-	-	27.60	-	-
	18 Jun	15.39	-	-	0.32	-	-	15.32	-	-
	SEm+	0.68	0.30	-	0.02	0.02	-	0.60	0.36	-
	CD 5%	2.04	0.91	-	0.06	0.04	-	3.16	1.09	-
JS 46-75	0 Jan 16	32.81	32.81	32.81	1.32	1.32	1.32	71.61	71.61	71.61
	3 Mar	30.20	25.25	-	1.19	0.77	-	64.77	57.76	-
	6 Jun	27.20	17.20	-	1.09	0.71	-	69.98	39.22	-
	9 Sep	24.12	12.60	-	0.94	0.62	-	64.00	15.47	-
	12 Dec	23.22	-	-	0.79	-	-	50.49	-	-
	15 Mar 17	19.40	-	-	0.72	-	-	35.51	-	-
	18 Jun	16.60	-	-	0.58	-	-	26.16	-	-
	SEm+	0.71	0.34	-	0.03	0.02	-	1.01	0.73	-
	CD 5%	2.13	1.01	-	0.10	0.06	-	3.01	2.19	-
Gaurav	0 Jan 16	35.70	35.70	35.70	1.24	1.24	1.24	73.95	73.95	73.95
	3 Mar	32.62	22.10	10.25	1.08	0.67	-	64.77	56.95	-
	6 Jun	28.36	19.12	-	1.00	0.56	-	69.79	33.98	-
	9 Sep	27.42	17.27	-	0.97	0.42	-	64.35	19.48	-
	12 Dec	25.19	-	-	0.80	-	-	57.74	-	-
	15 Mar 17	22.11	-	-	0.71	-	-	33.36	-	-
	18 Jun	20.80	-	-	0.60	-	-	32.40	-	-
	SEm+	0.78	0.44	0.34	0.02	0.01	-	1.24	0.98	-
	CD 5%	2.33	1.32	1.01	0.08	0.04	-	3.69	2.91	-

All the seed samples stored at 32, 63 and 92% RH showed decrease in germination with corresponding increase during storage (Table 1). All the chosen varieties when stored at 32% RH, showed significant higher germination percentage than 63 and 92% RH. At 32% RH, seeds of all varieties were found to retain germinability during experimentation. At 63% RH, PBN-104 lost its germinability before nine months, while others after nine months. Similarly, at 92% RH,

all varieties except Monetta lost its germinability before 3 months. Khanna and Yadav (1979) observed that the viability of wheat, maize, barley and bajra seeds deteriorated rapidly, hence stored at 75 and 90% RH. The falling germination of soybean seeds during storage could be ascribed to deterioration or ageing of the seed. In general, the seed viability of Monetta was found to be more in all storage periods. It was also observed that

the germination percentage of soybean seeds was the best at lower relative humidity (32%).

It is clear from Table 2 that during storage seedling length and seedling dry weight of soybean varieties decreased significantly with corresponding increase in storage period and relative humidity. Verma and Gupta (1975) correlated decline in length of seedling of soybean with increase in storage period. In general, it could be seen that at 32%RH, seedling length and dry weight were considerable higher throughout the storage.

Field emergence of soybean varieties decreased with corresponding increase in storage period and relative humidity (Table 2). However, the field emergence of Monetta was higher than other varieties during storage. Similar findings were reported by Arunandhy and Senanayake (1988) in soybean and Gadewar et al. (2009) in oil seeds. . At 32% RH the field emergence was considerably higher throughout the storage. Thus, it can be concluded that soybean seeds, if well dried at 9% moisture with proper storage conditions of lower humidity, can retain viability up to next plantation.

REFERENCES

- Anonymous, 1985. International rules for seed testing and annexes. Seed Sci. Technol. 13 : 299-513.
- Arunandhy, V. and Y.D.A. Senanayake, 1988. Deterioration of soybean seed stored in different containers under ambient conditions. Seed Res. 16 (2): 183-192.
- Barton, L.V. 1961. Seed preservation and longevity. Leonard Hill (Books) Ltd., London, pp. 216.
- Carr, D.S. and B.L. Harris, 1949. Solutions for maintaining constant relative humidity. Industr. Engg. Chem. 41: 2014-2015.
- Delouche, J.C. 1965. Deterioration of crimson clover seed in storage. Proc. Asso. Off. Seed Anal. 55 : 66-74.
- Delouche, J.C., R.K. Matthes, G.M. Dougherty and A.H. Boyd, 1973. Storage of seed in subtropical and tropical regions. Seed Sci. and Technol. 1 : 671-700.
- Gadewar R., Charde P. and Charjan s. 2009. Impact of relative humidity on viability and moisture content in some oil seeds during storage J. Phytol. Res. 22(1): 167-169.
- Khanna, S.C. and T.D. Yadav, 1979. Effect of relative humidities on viability of cereal seed during storage. Seed Res. 7 (2): 103-106.
- Parich, P.C., A.M. Rath and J.K. Sahoo, 1977. Studies on the hygroscopic equilibrium and viability of rice stored under various relative humidity. Seed Res. 5(1) : 1-5.
- Shelar, V.R. and d.R. Bapat, 1991. Effect of storage conditions on viability and bigour in Sorghum. Ann. Plant Physiol. 5 (2) : 176-182.
- Stokes, R.H. and R.A. Robinson, 1949. Standard solution for humidity control at 25°C. Industr. Engg. Chem. 41: 2013.
- Verma, R.S. and P.C. Gupta, 1975. Storage behavior of soybean varieties vastly different in seeds sizes. Seed Res. 31: 39-44.
- Yadav, T.D. and N.C. Pant, 1979. Moisture content- relative humidity relationship of legume seeds. Seed Res. 7 (1) : 11-17.

