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Impact of seed moisture on efficacy of seed treatment with accelerated ageing in soybean (*Glycine max* (L.) Merrill)

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Abstract
The present investigation was carried out with the objective on evaluation of treated and untreated seeds of soybean with different seed moisture contents for seed quality parameters *viz.,* germination, seedling vigour index and electrical conductivity following accelerated ageing. Soybean seeds with 7%, 9%, 11% and 13% were treated with a combination fungicide Carboxin 37.5% + Thiram 37.5% (Vitavax power) @ 3g/kg seed and were subjected to accelerated ageing at 24, 48, 72 and 96 hours along with their respective untreated seeds. Among the moisture contents and across the ageing periods, the highest germination was recorded after 24 hours ageing in treated seeds of 7% moisture content (62.75%), while the lowest was observed in untreated seeds of 13% moisture content (53%). However, the treated seeds with high moisture content of 11% were found practically approximate and performed close to the untreated seeds with low moisture content (7 and 9%) even after accelerated ageing and thus it is concluded that drying can be avoided by opting seed treatment of seeds with 11% moisture content.

Keywords: Soybean**,** seed quality, seed moisture content, accelerated ageing

Introduction
Soybean (*Glycine max* (L.) Merrill) is considered as the 20th century "golden bean" because of its nutritive value, economic importance and diverse domestic usage. It is a significant species of legume inhabitant to East Asia, popularly known as "Chinese Pea" or "Manchurian Bean". It possesses a very high nutritional value and ranks first among oilseed crops in the world consisting of protein (42-45%), oil (22%) and starch contents (21%). It is a good source of vitamin-B complex, thiamine and riboflavin. Soybean is also rich in amino acids like lysine (Venugopal, 2015) [14].

Soybean is classified as a poor storer due to various physiological and physical properties (Delouche and Baskin 1973) [2]. The annual loss due to soybean diseases are estimated to the tune of 12% of the total production in which fungal diseases alone can cause up to 6-8% damage. The poor storability of soybean seeds is accounted for high oil content, physiological fragility, thin seed coat structure and its chemical composition that affect the rate of water absorption and retention by seeds (Shelar *et al.,* 2008) [12].

Seed treatment with fungicides was found effective as it suppress various seed borne diseases and enhance seed germination under *in vitro* conditions with higher emergence in field soil than untreated seeds. (Ellis *et al*., 1975 [3]. Rajeswari and Meena kumari 2009) [10]. In addition, due to environmental concerns the use of seed treatments is preferred over soil applications of pesticides (Munkvold2009) [9]. Diseases can be economically controlled by giving pre-harvest fungicidal spray and post-harvest seed dressing which again depends on the seed moisture content and this is an attempt to study the effect of post-harvest fungicidal treatment on seed quality in soybean seeds with different moisture contents.

Material and Methods
The present experiment was conducted at Seed Research and Technology Centre, PJTSAU, Rajendranagar, Hyderabad during *Rabi* 2019-20.Freshly harvested seeds of the soybean variety JS- 335 were collected from Agriculture Research Station, Adilabad. Immediately after receiving the kharif produce, the seeds with highest moisture content were sun dried to achieve desired initial seed moisture contents i.e., 13%, 11%, 9% and 7%. These were treated with a combination fungicide Carboxin 37.5% + Thiram 37.5% (Vitavax power) @ 3g/kg seed and subjected to storage in polylined jute bags along with each of their respective controls

(Untreated seeds) for studying the effect of accelerated ageing (AA) on seed quality parameters. Seed germinator was used for conducting the germination test of the aged seeds. The treated and untreated seeds of soybean with different seed moisture contents were subjected for accelerated ageing for 24, 48, 72 and 96 hours at a temperature of 45ºC and Relative humidity of 100%. Forty milliliter of distilled water was added into each accelerated ageing box. Forty-two grams of seed samples were weighed and placed on the surface of screen tray (in single layer) and closed with lid. Then the AA boxes were placed in ageing chamber for 24, 48, 72 and 96 hours. Within 1 hour after removal of samples from ageing chamber germination test was conducted with 3 replicates of 100 aged seeds each (ISTA, 2016) [6].

Germination

Three replications of 100 seeds each were counted in random and were placed between two layers of germination paper towels with uniform spacing between the seeds. The paper towels with seeds were rolled and placed vertically in a cabinet of seed germinator at a temperature of 25 ± 1º C and relative humidity of 95 ± 2%. The number of normal seedlings were recorded on eighth day and expressed as seed germination in percentage. The germination percent was calculated as per the following formula.

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

Seedling Vigour Index

The Seedling vigour indices *viz*., Seedling Vigour Index I (SVI-I) and Seedling Vigour Index II (SVI-II) were calculated by using the formulae suggested by Abdul-Baki and Anderson (1973) [1] as given below

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

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

Electrical conductivity

Four replicates of 50 aged seeds from each treatment along with respective control were taken at random and the seeds were completely immersed in 50 ml of deionized water for 24 hours and placed in the incubator at 20±1^{0}C in beakers covered with aluminium foil. The seed leachate was decanted and electrical conductivity was measured in digital conductivity meter. The electrical conductivity values were expressed in $dSm^{-1}g^{-1}$. The electrical conductivity was calculated as per the following formula.

$$\text{Electrical Conductivity } (dsm^{-1}g^{-1}) = \frac{\text{Conductivity reading } (dsm^{-1}) - \text{Background reading}}{\text{Weight of the replicate (g)}}$$

The replicated data were subjected to statistical analysis following the procedure given by Gomez and Gomez (1984) [4].

Results and Discussion

In the present study, the seed quality parameters declined progressively with the increase in seed moisture contents and ageing period. It was observed that, the germination percentage was gradually decreased with the advancement of ageing duration from 24hours to 96hours and was ranged between zero percent in untreated seeds of 13% moisture to 84% in treated seeds of 7% moisture (Figure1). Among the seed moisture contents and ageing durations, the treated and untreated seeds exhibited significant differences with one another (Table 1). Across the ageing durations, the treated seeds with 7% seed moisture contents exhibited significantly highest mean germination percentage (62.75%), while the lowest of that was recorded in untreated seeds of 13% moisture content (16.00%). Across the seed moisture contents evaluated, the seeds at 24 hours ageing recorded significantly highest mean germination percentage (68.75%) followed by 48 hours (63.00%) and the lowest of that was observed in seeds stored at 96 hours (16.50%). The results obtained were in agreement with Mohmmadi*et al.* (2012) [8] which confirmed that seedling growth decreased with the advance of deterioration. Mali *et al.* (2014) [7] also noticed the linear decrease in seed germination after 24 hours accelerated ageing in soybean. The decrease in seed germination which may be due to sub cellular changes that might have taken place due to exposure of seeds to adverse conditions of temperature and moisture for a longer period which in turn might have affected seed viability (Tirakannanavar *et al.*, 2006) [13].

The data pertaining to the effect of seed moisture content in treated and untreated seeds of soybean under accelerated ageing on seedling vigour index SVI-I (Table. 2). It is evident from the results that, across the moisture contents and ageing periods under study the mean SVI- I was ranged between zero in untreated seeds of 13% moisture to 1929 in treated seeds of 7% seed moisture. The treated seeds of 7% moisture content recorded significantly highest mean vigour index (1343), while the lowest of that was observed in untreated seeds of 13% moisture content (287). Among the seed moisture contents evaluated, the seeds moisture content at 24 hours recorded significantly highest mean SVI-I (1445) followed by 48 hours (1291) and the lowest of that was observed in seeds stored at 96 hours (179).

With regards to SVI-II, the data recorded was ranged between zero in untreated seeds of 13% moisture to 104.24 in treated seeds of 7% moisture content (Table. 3). Among the seed moisture contents and ageing periods, the treated and untreated seeds exhibited significant differences with one another. Across the ageing periods, treated seeds with 7% seed moisture content exhibited significantly highest SVI-II (73.86), while the lowest of that was recorded in untreated seeds of 13% moisture content (13.43). Of all the seed moisture contents evaluated, the seeds at 24 hours recorded significantly highest mean SVI-II (70.55) followed by 48 hours (62.70) and the lowest of that was observed in seeds stored at 96 hours (14.99). The interaction effect between seed moisture contents, ageing period and fungicide treatment was found statistically significant. The SVI-II decreased with increase in both seed moisture content and also to the ageing hours the seed was subjected.In the present study, as the moisture content increased and ageing process progressed, there was a decline in germination in soybean seeds with different moisture contents which could be attributed to irreversible phenomenon of characteristics of all living organisms causing deteriorative changes in physical, physiological and biological conditions of the seed (Abdul Baki and Anderson, 1973) [1]. The above findings are also similar to the studies conducted by Rastager*et al.* (2011)**[11]** in soybean where germination per cent, means of daily germination and germination index were decreased as the ageing period increased.

The data pertaining to the effect of seed moisture content in treated and untreated seeds of soybean on EC of seed leachates under accelerated ageing is presented in Table. 4. The results indicated that, the EC was gradually decreased with the advancement of ageing duration from 24 to 96 hours and ranged between 0.105dsm^{-1}g^{-1}in treated seeds of 7% moisture content to 0.282dsm^{-1}g^{-1}in untreated seeds of 13% moisture content. Among the seed moisture contents and ageing durations, the treated and untreated seeds exhibited significant differences with one another (Table 4). Across the ageing durations, the treated seeds with 7% moisture content exhibited significantly lowest mean EC (0.142dsm^{-1}g^{-1}), while the highest of that was recorded in untreated seeds of 13% moisture content (0.314dsm^{-1}g^{-1}). Among the seed moisture contents evaluated, the seeds at 24 hours ageing recorded significantly highest mean EC (0.113 dsm^{-1}g^{-1}) followed by 48 hours (0.119 dsm^{-1}g^{-1})and the lowest of that was observed in seeds stored at 96 hours (0.266dsm^{-1}g^{-1}). The fungicide treatment was found effective in controlling seedborne infections and resulted in good germination percentage as compared to untreated seeds which resulted in maximum mean EC of seed leachates.

Irrespective of seed moisture contents, the treated seeds of soybean recorded lowest EC of seed leachates than untreated seeds under accelerated ageing. It clearly indicated that, loss of membrane integrity which is one of the early symptoms of seed which was faster in seeds with highest seed moisture contents. It was also understood that, the fungicidal seed treatment prevented the seed deterioration by maintaining high membrane integrity and suppressed seed associated mycoflora which might have reduced lipid peroxidation and prevented release of the free radicals. The negative relationship between EC and seed germination indicated that, more cell leachates escaped from low quality seed and lowered the germination capacity of soybean seed and these findings were in agreement with the findings of Halim *et al.* (2012) [5] in onion seeds.

From the present study, among the different seed moisture contents, the treated seeds of 7% moisture had shown highest germination after 24 hours of ageing, while the lowest was exhibited by untreated seeds of 13% seed moisture content after 96 hours of ageing. The interaction effect between the seed moisture content, ageing period and fungicide treatment remained statistically significant. Generally, the treated seeds of 13% and 11% seed moisture were significantly superior for the quality parameters over untreated seeds of 9% moisture which were also found at par with the untreated seeds of 7% moisture. However, across the ageing periods, majorly the treated seeds with 11% moisture content were found to be significantly superior over treated seeds of 13% moisture content. As the treated seeds with high moisture content (11%) were found practically approximate and performed close to the untreated seeds with low moisture content (7 and 9%) even after accelerated ageing, it is concluded that, drying can be avoided by opting seed treatment of seeds with high moisture content (11%).

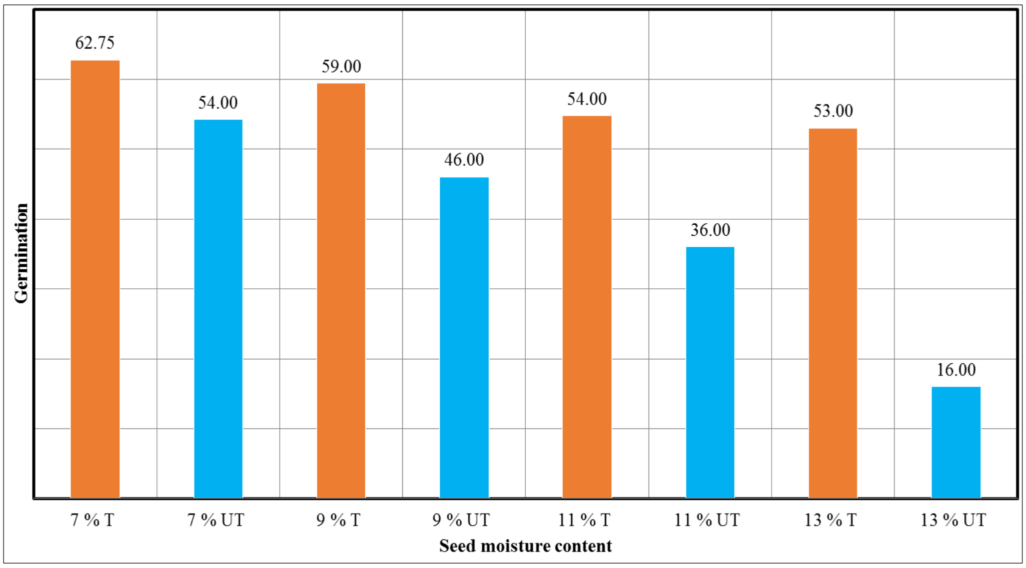

Fig 1: Effect of seed moisture on mean germination percent of treated (T) and untreated seeds (UT) of soybean due to accelerated ageing

Table 1: Mean germination (%) of soybean seeds with different seed moisture contents after accelerated ageing under laboratory conditions.

Ageing period (hours)	Germination (%) 7% T	7% C	9% T	9% C	11% T	11% C	13% T	13% C	MEAN
24	84 (66.50)	76 (60.65)	80 (63.41)	68 (55.54)	78 (62.14)	62 (51.93)	76 (60.65)	26 (30.64)	68 (56.57)
48	79 (62.79)	67 (54.94)	77 (61.34)	61 (51.34)	75 (60.05)	49 (44.41)	74 (59.34)	22 (27.95)	63 (52.77)
72	61 (51.34)	50 (44.98)	55 (48.24)	40 (39.20)	46 (42.69)	28 (31.93)	46 (42.68)	16 (23.54)	42 (40.57)
96	27 (31.28)	24 (29.30)	25 (29.99)	15 (22.78)	20 (26.48)	5 (12.87)	16 (23.54)	0 (4.05)	16 (22.03)
Mean	62 (52.98)	54 (47.47)	59 (50.74)	46 (42.21)	54 (47.84)	36 (35.29)	53 (46.55)	16 (20.53)	
Mean	58 (50.22)		52 (46.48)		45 (41.56)		34 (33.54)		
CV (%)	4.558								
CD	Seed moisture content		Ageing period		Fungicide			Interactions	
	1.133		1.133		0.801			3.204	

*Figures in parenthesis are angular transformed values.

Table 2: Effect of different seed moisture contents on seedling vigour index I of treated and untreated seeds of soybean after accelerated ageing

Seedling vigour index I									
Ageing period (hours)	**7%**		**9%**		**11%**		**13%**		**MEAN**
	T	**C**	**T**	**C**	**T**	**C**	**T**	**C**	
24	1929	1535	1904	1373	1645	1179	1494	496	1445
48	1771	1385	1705	1199	1551	906	1398	407	1291
72	1333	906	1177	671	979	451	820	244	823
96	340	236	293	140	220	44	158	0	179
Mean	1343	1016	1270	846	1099	645	968	287	
Mean	1179		1058		872		627		
CV (%)	5.822								
CD	Seed moisture content		Ageing period		Fungicide		Interactions		
	40.03		40.03		25.58		114.35		

Note: T- Treated, C- Control

Table 3: Effect of different seed moisture on seedling vigour index II of treated and untreated seeds of soybean after accelerated ageing

Sseedling vigour indexII									
Ageing period (hours)	**7%**		**9%**		**11%**		**13%**		**MEAN**
	T	**C**	**T**	**C**	**T**	**C**	**T**	**C**	
24	104.24	76.91	87.36	67.25	74.57	59.58	71.29	23.19	70.55
48	95.75	66.53	81.00	58.32	69.30	46.50	65.27	18.92	62.70
72	68.38	47.90	55.45	37.12	41.45	25.90	38.36	11.60	40.77
96	27.05	21.31	24.23	13.13	17.94	4.51	11.76	0.00	14.99
Mean	73.86	53.16	62.01	43.95	50.81	34.12	46.67	13.43	
Mean	63.51		52.98		42.47		30.05		
CV (%)	5.120								
CD	Seed moisture content		Ageing period		Fungicide		Interactions		
	3.004		3.004		2.124		8.498		

Note: T- Treated, C- Control

Table 4: Effect of different seed moisture on electrical conductivity ($dsm^{-1}g^{-1}$) of treated and untreated seeds of soybean after accelerated ageing

Electrical conductivity									
Ageing period (hours)	**7%**		**9%**		**11%**		**13%**		
	T	**C**	**T**	**C**	**T**	**C**	**T**	**C**	**MEAN**
24	0.105	0.113	0.109	0.121	0.111	0.127	0.113	0.163	0.113
48	0.110	0.122	0.116	0.128	0.118	0.132	0.119	0.171	0.119
72	0.158	0.169	0.164	0.179	0.173	0.191	0.173	0.203	0.173
96	0.255	0.258	0.257	0.267	0.262	0.277	0.266	0.282	0.266
Mean	0.142	0.141	0.157	0.208	0.162	0.258	0.207	0.314	
Mean	0.141		0.182		0.210		0.260		
CV (%)	3.612								
CD	Seed moisture content		Ageing period		Fungicide		Interactions		
	0.002		0.002		0.001		0.005		

References

1. Abdul Baki AA, Anderson JD. Vigour determination in soybean seed by multiple criteria. Crop Science 1973;13:630-633.
2. Delouche JC, Baskin CC. Accelerated ageing techniques for predictingthe relative storability of seed lots. Seed Science and Technology 1973;14:427-452.
3. Ellis MA, Ilyas MB, Sinclair JB. Effect of three fungicides on internally seed-borne fungi and germination of soybean seeds. Phytopathology 1975;65(5):553-556.
4. Gomez KA, Gomez AA. Statistical Procedures for Agricultural Research (2 ed.). John wiley and sons, New York 1984, 680.
5. Halim MA, Hossain MM, Haque MM, Solaiman ARM. Seed quality of onion as influenced by maturity stage. Seed Technology Journal 2012;3:9-12.
6. ISTA. International Rules for Seed Testing. Published by International Seed Testing Association, Zurich, Switzerland, 2016.
7. Mali MS, Shelar VR, Nagawade DR. Effect of accelerated ageing on seed storage potential of soybean [*Glycine max* (L.) Merill]. Journal of Food Legumes 2014;27(3):192-196.
8. Mohammadi H, Soltani A, Sadeghipour HR, Zeinali E. Effects of seed ageing on subsequent seed reserve utilization and seedling growth in soybean. International Journal of Plant Production 2012;5(1):65-70.
9. Munkvold GP. Seed pathology progress in academia and industry. Annual Review of Phytopathology 2009;47:285-311.
10. Rajeshwari B, Meena Kumari KVS. Bioagents and fungicides for the management of seed and seedling diseases of soybean. Indian Journal of Plant Protection 2009;37(2):121-131.
11. Rastegar Z, Sedghi M, Khomari S. Effects of Accelerated ageing on soybean seed germination indexes at laboratory conditions. Notulae Scientia Biologicae 2011;3(3):126-129.
12. Shelar VR, Shaikh RS, Nikam AS. Soybean seed quality during storage: A Review. Agricultural Reviews 2008;29(2):125-131

13. Tirakannanavar S, Shekhargouda M, Merwade MN, Kukanoor L, Bellad SB. Seed Quality as Influenced by Accelerated Ageing and Natural Ageing in Bitter Gourd (*Momordica charantia* L.). Seed Research 2006;34(1):66.
14. Venugopal Rao T, Rajeshwari B, Keshavulu K, Sandeep Varma V. Studies on seed borne fungi of soybean. International Journal of Agrilculture and Environmental science 2015;2(1):16-24.