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To study field emergence and laboratory evaluation with respect to physiological quality of soybean genotype (*glycine max (*L*)* Merril)

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ABSTRACT
Evaluating of seed viability by Lab. germination and Tetrazolium tests were a valuable approach to predict the number of emerging and surviving plants in the field. The present investigation aimed to determine the value of lab. seeds under field conditions .The results showed highly significant correlation between the numbers of seeds capable of producing normal seedlings under lab. Conditions (germination percentage) and those emerged and Germination as prerequisite requirement to sale or purchase the seed in the market from one hand, and determine the value of electrical conductivity and tetrazolium as a quick and suitable lab. tests to predict the performance of soybean surviving plants in the field (field emergence and survival percentages) indicating the important of sowing seeds of high germination capacity to achieve a good field establishment. The correlation coefficient for the relationship between the number of stained seed due to TZ treatment and those resulted in the field was also significant, indicating that the TZ test can provide more quick evaluation of soybean seed quality and be considered at calculating seeding rate. 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.
Keyword: *soybean seed ,germination ,tetrazolium test, field emergence*

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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. Seed protein contains all the essential amino acids required for animal and human consumption. The traditional black seeded soybean known as Bhatt in the hills is mainly used as pulse.

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 oilseed crop next to groundnut and mustard (Kakde ***et al.,*** 2012). Soybean is 'miracle golden bean' of 21st century which possesses potential to revolutionized Indian economy by correcting the health of human being and soil. Soybean being a global crop, India ranks fifth in area and production of soybean in world after USA, Brazil, China and Argentina.

Quality parameters of seed such as oil content, fatty acid composition and protein content are significantly influenced by storage conditions and lime (Ghasemnezhad and Honermeier, 2007).

Peroxidation of unsaturated fatty acids is considered to be one of the main reasons for poor storability of soybean seeds, which also results in the production of high level of volatile aldehydes during the course of aging (Dadlani, 1999). During storage, seed absorb or lose moisture until the vapour pressure of seed moisture and atmospheric moisture reach in equilibrium. The seed moisture attained under these conditions is referred to as equilibrium moisture content.

Soybean is an orthodox seed and has short storage life. In orthodox seeds (i.e. seeds which tolerate dehydration), accelerated aging can be artificially induced at high temperature and high relative humidity (RH) (Priestley. 1986). Seed aging had significant effects on electrical conductivity and seed germination traits (Mohammadi ***et al.,*** 2011). The rate at which seed aging take place depend on ability of seeds to resist degradation changes, specific to each plant species (Tubic ***et al.,*** 2010).

Storability of seeds is mainly a genetically regulated character and is influenced by quality of the seed at the time of storage, pre-storage history of seed (environmental factors during pre and post-harvest stages), moisture content, relative humidity & temperature of storage environment and biotic causes (Shelar ***et al.,*** 2008).

MATERIAL AND METHODS

The experiment entitled "Germinative Evaluation for Physiological Quality of seed in soybean Genotypes (*Glycine max* (L.) Merril) was conducted during the year *kharif* 2016 at Department of agricultural Botany VNMKV Parbhani. The details of materials and method used in the experiment. 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.

NO	Name of the entries	Year of release	Zone
1.	MAUS158	2010	Marathwada region
2.	MAUS162	2014	Maharashtra
3.	MAUS71	2002	Maharashtra region
4.	MAUS81	2004	Central Zone
5.	JS335	1994	Central Zone
6.	JS9305	2002	Central Zone
7.	JS9752	2010	Central Zone

RESULT AND DISCUSSION

Field emergence

One hundred seeds of each entry in four replications at different intervals were grown in field. Emergence percent at 3rd day and 7th day as first and final count respectively, were taken (ISTA, 1985) after 3 and 7 days total number of plants emerged out of 100 plants were recorded and averages of four repetitions are presented.

Table 1. Field emergence first count (%) (3rd day) in seed of soybean different periods of storage.

Treatment	**Dates of Sampling**			
	Dec -2	**Jan-1**	**Feb-1**	**Mar-1**
MAUS158	41.00	39.00	36.00	36.00
MAUS162	36.25	33.50	32.50	31.00
MAUS71	41.25	40.00	38.00	36.00
MAUS81	42.25	40.00	38.00	33.50
JS335	43.25	43.00	40.50	38.50
JS9305	46.75	44.50	42.50	40.25
JS9752	30.00	29.00	28.50	30.25
Mean	**40.11**	**39.30**	**37.50**	**35.07**
S.Em.±	2.35	2.18	1.96	1.91
C.D at 5 %	6.91	6.45	5.76	5.61
C.V %	11.74	11.38	10.74	10.91

Table 2. Field emergence final count (%) 7th day in seed of soybean different periods of storage.

Treatment	Dates of Sampling			
	Dec -2	Jan-1	Feb-1	Mar-1
MAUS158	80.00	78.00	77.00	73.50
MAUS162	79.00	77.75	77.00	77.00
MAUS71	77.75	78.00	77.00	77.00
MAUS81	79.00	79.50	79.00	77.25
JS335	79.25	79.75	80.25	79.50
JS9305	83.00	80.50	80.75	80.25
JS9752	68.75	68.00	67.00	67.00
Mean	**78.11**	**77.36**	**76.86**	**75.93**
S.Em.±	2.88	2.50	2.38	2.72
C.D at 5 %	8.52	7.42	7.05	8.06
C.V %	7.36	6.52	6.16	7.17

In soybean field emergence first count is taken at 3rd day after planting the seed (ISTA, 1985), which is an initial assessment of seed vigour under field conditions. Usually, when field emergence is compared with laboratory germination, later is over estimated. In the present investigation also the laboratory germination after three days (72 hours) is greater them field emergence. It is quite obvious that laboratory germination is under optimum conditions, while field emergence does not experience such a favourable situation. In the present investigation the differences with regard to field emergence first count due to entries and storage period both were significant. Increasing storage period resulted in significant reduction in first count field emergence percentage. The highest field emergence third day was recorded in entries JS9305 followed by JS335 and MAUS81 respectively. These results are in close conformity with findings of Reddy *et al*, (2012), Schuab. (2006) and Elmanzlway , (2010).

In soybean field emergence final count is taken after 7 days of planting the seed (ISTA 1985). Field emergence represents the actual physiological quality of a seed lot since the field condition are always sub optimal and the germination percentage recorded in standard germination test (SGT) taken under favourable and optimal laboratory conditions are always higher than those obtained under field condition. This necessitates the development identification of criterion which matches the actual field performance taking into consideration the seed vigour characteristics which are reflected directly or indirectly by some Germinative criteria. As in case of field emergence first count, this parameter also registered values when compared with the final count laboratory germination taken under more congenial condition. The field emergence differed significantly due to entries storage period also had an adverse effect on the field emergence, obviously reflecting deterioration of physiological quality of seed lot.

Tetrazolium test

One hundred seeds from each seed lot of soybean were used for this test in four replications of 100 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 coloration with the help of magnifying glass and the pattern of each individual seed was recorded under three staining categories, completely colored embryos (viable), partially colored (potentially viable) and completely colorless embryos (not viable). Jaya singh *et al*, (2016).

Table 3 Qualitative Tetrazolium test (% stained seed) in seed of soybean after different periods of storage.

Treatment	Dates of Sampling			
	Dec -2	Jan-1	Feb-1	Mar-1
MAUS158	88.75	84.75	81.75	79.75
MAUS162	87.75	83.75	80.75	78.75
MAUS71	89.50	85.50	82.50	80.50
MAUS81	91.25	87.25	84.25	82.25
JS335	92.75	88.75	85.75	83.75
JS9305	93.25	89.25	86.25	84.25
JS9752	84.50	80.50	77.50	75.50
Mean	**89.68**	**85.68**	**82.68**	**80.68**
S.Em.±	1.19	1.19	1.19	1.19
C.D at 5 %	3.53	3.53	3.53	3.53
C.V %	2.66	2.78	2.88	2.96

Germination Percentage (%)

The entries and storage period were significant with regard to germination percentage recorded after increasing germination time *i.e.* after 24, 36, 48 and 72 hours of germination. However, germination percentage recorded after 7 days had significant effect (Table 4.6, 4.7, 4.8, 4.9, 4.10 and Fig. 4.6, 4.7, 4.8, 4.9, 4.10). Although seed technology point of view the germination percentage is considered on the basis of fully established normal seedlings but never the less initial germination is very vital in depicting the vigour of the seed lot. Hence in the current investigation germination percentage was recorded right from 16 hours onwards but the germination was seen only after 24 hours of incubation time. The entries and the storage period differed significantly with respect to germination percentage after 24, 36, 48, and 72 hours and 7 days. Overall the entries JS9305 recorded the highest germination percentage followed by JS335, MAUS81 and MAUS71 respectively.

Table 4.Germination (%) at 24th hour in seed of soybean after different periods of storage.

Treatment	Dates of Sampling			
	Dec -2	Jan-1	Feb-1	Mar-1
MAUS158	14.75	12.25	12.50	10.25
MAUS162	13.75	11.75	11.75	9.50
MAUS71	14.75	13.25	13.00	11.00
MAUS81	15.25	13.75	13.25	11.50
JS335	16.50	15.00	13.50	12.25
JS9305	21.75	17.50	19.00	18.25
JS9752	12.50	11.25	9.00	8.50
Mean	**15.61**	**13.54**	**13.14**	**11.61**
S.Em.±	1.19	0.96	0.85	0.73
C.D at 5 %	3.53	2.86	2.53	2.17
C.V %	15.30	14.30	13.02	12.64

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.

RESULT AND DISCUSSION

The results for the present investigation on "Germinative evaluation for physiological quality of seed in soybean genotypes (*Glycine max* Merril (L.) are presented in this chapter. The basic spirit of the investigation was to find out and predict the field performance of seed lot by evaluating a number of germinative parameters. The study was under taken to assess the germinablity particularly under hostile conditions of field. The aged seeds show decreased vigour and produce weak seedlings that are unable to survive and establish under field condition. That is the reason standard germination test (SGT) over-predicts the field performance of the seed lot there by creating discrepancy regarding the physiological quality of the seed. The physiological quality of the seed is one of the important pillars apart from the genetic quality, physical purity and seed health aspects. Here, studying mainly focus the physiological quality of the seed particularly trying to resolve the paradox of germinablity and the seed vigour issues. Various Germinative parameters studied in the present investigation using seven entries comprising to each other by subjecting their seeds to natural ageing. The various observations were taken at the initiation of storage (Dec-2016) and subsequent storage period by harvesting the samples at the intervals of one month *i.e.* the months of Jan-2017, Feb-2017 and March 2017.The results obtained and important considerations and discussion with regards to various parameters depicting the physiological quality of the seeds are presented here under.

Qualitative Tetrozolium Test (% Stained Seed)

Qualitative tetrazolium test refers to spectrum of colour development or topography of colour developed by 2, 3, 5 triphenyl tetrazolium chloride reduction in to formazan in the individual seed. The Qualitative tetrazolium (TZ) test requires highly skill assessment of individual seed to predict its vigour viablility. The highest viable seed was recorded in entries JS9305 followed by JS335 and MAUS81 respectively.

Table 5. Qualitative Tetrazolium test (% stained seed) in seed of soybean after different periods of storage.

Treatment	Dates of Sampling			
	Dec -2	Jan-1	Feb-1	Mar-1
MAUS158	88.75	84.75	81.75	79.75
MAUS162	87.75	83.75	80.75	78.75
MAUS71	89.50	85.50	82.50	80.50
MAUS81	91.25	87.25	84.25	82.25
JS335	92.75	88.75	85.75	83.75
JS9305	93.25	89.25	86.25	84.25
JS9752	84.50	80.50	77.50	75.50
Mean	**89.68**	**85.68**	**82.68**	**80.68**
S.Em.±	1.19	1.19	1.19	1.19
C.D at 5 %	3.53	3.53	3.53	3.53
C.V %	2.66	2.78	2.88	2.96

Qualitative tetrazolium test refers to spectrum of colour development or topography of colour developed by 2, 3, 5 triphenyl tetrazolium chloride reduction in to formazan in the individual seed. The Qualitative tetrazolium (TZ) test requires highly skill assessment of individual seed to predict its vigour viability. The highest viable seed was recorded in entries JS9305 followed by JS335 and MAUS81 respectively. Similar results was reported by Jantana yaja *et al*, (2005) and Jaya singh *et al*, (2016).

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