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Full Length Research

GERMINATION CHARACTERISTICS OF TWENTY VARIETIES OF SOYBEAN (Glycine max (L) merr STORED FOR SEVEN MONTHS

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Twenty soybean cultivars were grown at the University of Agriculture Makurdi Teaching and Research Farm in July 2006 and harvested October 5th and November 7th 2006 according to the time physiological maturity of the varieties. From each harvest population of the different culture, the moisture content and dry matter weight (oven method, 105°c for 72 hours) were determined for samples of 10 seeds per replicate. The seed were stored under normal environment condition in cotton bags which were tied and kept for 7 months. Seed moisture contents were determined at different stage of storage. The germination test was performing according to the International Seed Testing Association in the Crop Science Laboratory of the University of Agriculture Makurdi, Nigeria, located on longitude 8.37°N. Within the Southern Guinea Savannah agro ecological zone of Nigeria. The results indicated that TGX 1838-5E and TGX 1440-1E showed higher viabilities by recording greater germination percentage. Doko, TGX 1896.3F and Milena soybean varieties recorded higher germination index while lowest germination index occurred in TGX 1844 – 18E. The medium maturing type had the highest mean germination percentage (54.32%) followed by late maturing varieties.

Keywords: Characteristics, germination, varieties, soybean, stored.

INTRODUCTION

Oil seeds are very sensitive to the harsh environmental conditions. It is hypothesized that their oil content readily oxidize, which deteriorate the seed health in storage (Kausar et al., 2009).

One of the most important aspects for oil seed production is rapid emergence and good seedling establishment in field. In the other hand germination and emergence are important issues in plant production and they have significant effect on the next stages of plant growth in field. Rapid and uniform field emergence is essential to achieve high yield with having good quality and quantity in annual

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crops (Yari et al., 2010). Soybean which is described as wonder crop, golden crop, and the scene of life, belong to the family of Leguminosae and phaseuolene. Soybean is one of the most important legumes in the world, and its production dominates world oilseed followed by cotton seed, peanut and sunflower. Since 1970s soybean production have at least doubled that of any other oil seed (Singh et al., 1987). In Africa, Nigeria is one of the leading producers of soybean and its extensively grown in the country (IITA, 1990).

Seed storage conditions can determine germination characteristics and vigor potential of seeds (Mc Donald, 1999). Various factors such as weather conditions during seed producing stage, pests and diseases, seed oil and moisture content, mechanical damages, storage time and relative humidity of store can affect vigour of seeds (Krishnan et al., 2003; Marshal and Levis, 2004).

Consequently the seed storage environment greatly influences the period of seed survival (Ellis et al., 1982). Storage conditions and duration are important factors affecting germination parameters. Seed vigor is used as a measure of accumulated damage in seed as viability declines. Preservation of seed viability depended on storage condition and duration (Balesevic et al, 2010). The decline of germination is much more acute under tropical conditions. These environmental conditions make very difficult to maintain its viability during storage (Shelar et al, 2008). Seed deteriorated during storage is one of the basic reasons for low productivity in soybean. Changes that occur in seed during ageing are significant in terms of seed quality among other things, also implies seed longevity Kandil et al, 2013). Different periods of seed storage, as well as ageing conditions adversely affected the seed vigor (Tatic et al, 2012).

Seed quality is the basis of efficient crop production and farmers need high seeds for optimum yield production. Successful cultivation of soybean in the tropic requires the availability of high quality planting seeds.

Soybean develops well under a wide range of temperature, although regions in which the warmest mean monthly temperature is below 20^{o}C are considered inappropriate for soybean (Berlato, 1981). Very low soil temperature during germination extends the period from planting to emergence. Seed germination occurs at temperature from 5-40^{o}C however, for rapid germination the temperature should be around 30^{o}C (Delovche, 1953). According to (Cartter and Hoirwig, 1967), at 15. 5^{o}C emergence occurs in seven to ten day. In many tropical and subtropical area, soil temperature at the time planting is above 20^{o}C providing for emergence in three to five days (Mota, 1978). Berlato and Goncalves, 1978 observed that the number of days between planting and emergence decreased linearly as soil temperature at a depth of 5 cm increase. With average soil temperature of 12^{o}C emergence took 12 days, but a temperature of 17^{o}C emergence occurred in a week.

MATERIALS AND METHODS

Twenty soybean varieties were grown at the University of Agriculture Makudi Teaching and Research Farm in July 2006 and harvested October 5th and November 7th 2006 according to the time of physiological maturity of the varieties. From each harvested population of the different cultivar, the moisture content and dry matter weight (oven method, 105^{o}C for 72 hours) were determined for samples of 10 seeds per replicate. The seed were stored under normal environment condition in cotton bags which were tied and kept for 7 months. Seed moisture contents were determined at different stage of storage. The germination test was performing according to the International Seed Testing Association in the Crop Science Laboratory of the University of Agriculture Makurdi, Nigeria, located on longitude 8.37^{o}N. Within the Southern Guinea Savannah agro ecological zone of Nigeria.

Seeds of 20 soybean cultivars were evaluated

using the following tests: seedling emergence on the Laboratory (G %), standard germination (first and final count), speed of emergence (GI), speed of emergence index (GRI). The seeds were examined physically with unaided eyes and were satisfied okay.

Two hundred and fourty Petri-dished were immersed in water containing Omo (detergent) for some hours, to allow all foreign bodies to dissolve. The dishes were properly washed and later soaked in another water containing Jik (parazone or Sodium hypochloride solution for twenty four (24) hours, to help in removing stubborn stains that may have eluded the Water continuing the detergent and to further serve as a sterilizer.

Disinfectant was prepared using 300mls of distilled water and 700mls of alcohol (ethanol). This measurement was carried out with a conical flask. This was poured into a measuring cylinder to give the 70% alcohol (disinfectant), then used in disinfecting the Petri-dishes to avoid contamination of dishes or to kill foreign bodies` organism that may contaminate the seed before planting. The seed were placed in well soaked filter paper placed inside the sterilized Petri-dishes using the blotter method.

The varieties of soybean used are:

Varieties

1. TGX 1805 – 31F (M)
2. TGX 1844 – 18E (L)
3. TGX 1890 - 7F (M)
4. TGX 1838 – 5E (M)
5. TGX 1844 – 4E (L)
6. TGX 1895 – 35F (L)
7. TGX 1869 35F (L)
8. TGX 1842 – 1E (M)
9. TGX 1802 – 3F(M)
10. TGX 1896 – 3F (L)
11. TGX 1880 – 3F (M)
12. TGX 194 – 3F (M)
13. TGX 923 – 2E (L)
14. TGX 1873 – 16E (M)
15. TGX 1866 – I6E (M)
16. DOK0 (B)
17. TGX 1802 – 1F (M)
18. TGX 1878 – 7E (M)
19. MILANA (B5)
20. TGX 1802 – 3F (M)

Using Completely Randomized Design (CRD) with three replicates with a factor at 20 levels, there were 60 units replicated three times. Four Petri-dishes represent a unit. Each Petri-dish has twenty five (25) seeds arranged on a filter paper. A total number of 100 seeds were used for a treatment in a replicate.

Data Collection

Daily observation was done on the seed and germination counts until there was no further germination occurred.

Observation was also taken on the seeds to identify infected soybean seeds, type of infection, percentage and frequencies of infected seeds. The infected seeds were cultured using media of potatoes, Dextrose Agar to identify the organisms. In the laboratory, ten (10) seeds were used to determine moisture content using the direct method. Sample collected from each variety were weighted immediately and oven dried at 60^{o}C to a constant weight. The percentage moisture content was then calculated using the formula below:

$$\frac{\text{Loss in weight}}{\text{Initial weight}} \times 100$$

Data Analysis

The data generated from the experiment were used to compute the Germination percentage (G %) Germination index (GI) and the Germination Rate Index (GRI). Following the procedures of Fakorede and Ayoola (1980); Fakorede and Ojo (1981):

$$G\% = \frac{\text{Number of seeds Germinated}}{\text{Number of Seeds Planted}} \times 100$$

Table 1. Mean Germination Characteristics of Twenty Varieties of soybean Stored for seven month in Makurdi.

Varieties	G%	GI	GRI
TGX1805- 31F	67.33	1.95	3.0
TGX 1844- 18	87.33	1.59	2.0
TGX 1890- 7F	17.67	1. 91	3.0
TGX 1838- 5E	92.67	1.86	2.0
TGX 1440 – 1E	92.67	1.86	2.0
TGX 1844- 4E	75.00	1.87	3.0
TGX 1895 – 35F	0.00	0.00	0.0
TGX1869-13E	68.67	1.85	3.0
TGX 1842-1E	79.00	1.73	2.0
MILENA	53.67	2.19	4.0
TGX 1880- 3E	37.33	1.97	50
TGX 1894-3F	80.33	1.93	2.0
TGX 9223- 2E	39.33	1.90	5.0
TGX 1873-16E	84.67	1.98	2.0
TGX 1866-12F	83.33	1.88	2.0
DOKO	24.0	2 .17	9.0
TGX 1802 – 1F	76.33	1.93	3.0
TGX 1802	75.67	189	3,O
TGX 1802	58.67	1.78	3.0
TGX 1896.3F	75.0	2.10	3.0
CV	0.67	0.28	3.73
LSD	7.49	0.12	1.83

$$GI = \frac{\text{No of Seeds Germinated on a day X Day after Germination}}{\text{Total No of Seeds that Germinated}}$$

$$GRI = \frac{GI}{\text{G\% (expressed on 0 - 1 scale)}}$$

Also data collected were subjected to analysis of variance, and means that showed significant difference were separated using the Duneon New Multiple Range Test (DNMRT) and F – L80 for data on germination.

RESULTS

The results indicated that TGX 1838-5E and TGX 1440-1E showed higher viabilities by recording greater and similar germination percentage. TGX 1844-18, TGX 1873-16E, TGX 1866-12F and TGX 1873-16E produced germination percentage of eighty percentages and above showing that storage condition has no negative effect on their viability. Germination capability of soybean varieties TGX 1895 – 35F, TGX 1890- 7F, DOKO, TGX 1880- 3E and TGX 9223- 2E were affected by storage which means that these varieties would not withstand long storage condition (Table 1). Germination index (GI) tells about the uniformity of the seed lot. It was indicated soybean germination index was significantly affected by storage condition in which soybean varieties exhibit different germination index. Highest germination index was obtained at Doko, TGX 1896.3F and Milena and lowest germination index occurred at TGX 1844 – 18E. That showed that there was highly significant difference among the variety (Table 1).

Germination rate index (GRI) showed the speed at which germination occurred. The result indicated that there was highly significant difference among the variety in which the highest germination rate index was recorded in Doko, TGX 1880 – 3E and Milena and lowest germination rate index occurred at TGX 1844 – 18E (Table 1).

When grouped into Early, medium and late maturity varieties, the medium maturing type had the highest mean germination percentage (54.32%) followed by late maturing material which the Early maturing type has the least germination percentage (Table 2). Highest germination index (GI) and germination rate index (GRI) was recorded in early maturing soybean varieties.

DISCUSSION

There was variation in soybean germination percentage this might be due to storage condition. The result agreed with the report of Balesevic et al., (2010) that storage conditions and duration are important factors affecting germination parameters. Preservation of seed viability depended on storage condition and

Table 2. Mean Germination characteristics of Soybean Type Stored for seven Months in Makurdi.

Variety type	G%	GI	GRI
Early maturing	38.84	2.18	6.5
Medium maturing	54.32	1.89	2.8
Late maturing	39.76	1.63	2.5

duration. Some soybean varieties recorded lower germination percentage which might be attributed to variation in withstanding environmental condition and the result is in consonance with findings of Shelar et al., (2008) that decline of germination is much more acute under tropical conditions. These environmental conditions make very difficult to maintain its viability during storage. Seed deteriorated during storage is one of the basic reasons for low productivity in soybean. Changes that occur in seed during ageing are significant in terms of seed quality among other things, also implies seed longevity (Kandil et al., 2013). Different periods of seed storage, as well as ageing conditions adversely affected the seed vigor (Tatic et al., 2012). Arif, (2006) reported that seed viability gradually decreased from 64.5 to 39.2% as the time of storage increased, from 2 to 12 months. Changes occurring in seed during ageing are very significant with regard to quality and longevity of seed. Seed composition characteristics of oily plants are related to specific processes occurring in seed during storage (Ghasemnezhad and Honermeier, 2007). The result was also in line with the report of Indrakumar and Chauhan (2010). The varietal differences contributed substantially to variation in germination index. Germination index decreased with increase in germination percentage. This is to say that viability plays a major role in determining the speed at which germination takes place. More so, lowest germination index occurred on the in all the varieties exception of Doko and Milena that has highest germination index after planting. The differences between genotypes in terms of germination percentage, germination index and germination index rate might be due to the genetic factors and seed chemical composition. This is consistent with the findings of that differences between genotypes might be due to the genetic factors and seed chemical composition influence the expression of seed deterioration and vigor decline. In addition, El-Abady et al., (2013) stated that assessment of some soybean cultivars seed viability during storage by monitoring germination and germination after ageing percentages. Moreover, Doijoide (1988), stated that the storability of different soybean cultivars is also regulated by initial seed quality, physical and chemical composition of seed as different cultivars possess different physical structure and chemical composition which determine the viability of seed in storage. These results are in good accordance with those obtained by (Tatic et al., 2012).

CONCLUSION

Overall, the results obtained in this study show that seed storage reduces all the studied germination characteristics such as: germination percentage, germination index and germination index rate. Early, medium and late maturing exhibits different germination percentage, germination index and germination index rate after storage. According to these observations it is necessary to keep seeds out of deterioration conditions to achieve vigorous seedlings with the highest uniformity in emergence.

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