Viability and Vigour of Sesame (*Sesamum indicum* L) Seeds

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Keywords: maximum growth potency, sesame seeds, viability, vigour index.

Abstract**:** The aim of seed testing was to avoid planting seeds that do not have the ability to grow into expected plants. Seed germination testing is a method that provide to provide information for seed users about the seeds ability to grow into plants that have. The viability testing that usually used on sesame seeds is germination testing. The aim of germination testing is to detect seeds germination viability under optimum condition. This research has purpose to determine the correlation between germination, vigour index, and maximum growth potential of sesame seeds. Seeds that used in this research were Sumberejo 4 varieties which have been stored for 6 and 7 years. Seed germination testing was held based on ISTA Rules method. Germination testing were carried out on filter paper at temperature changes between 20ºC and 30ºC. Seedling evaluation was carried out on the 3 and 6 days. The vigour index evaluation was carried out on the 3 days. The criteria of sesame seedlings refers to ISTA Handbook on Seedling Evaluation with germination type E, A-2-1-1-1 seedling group. Abnormal seedlings that were found on the research categorized as rotten seedlings due to primary infection, damaged primary root, inhibited primary root development, no primary root or missing, and no hypocotyl. The results showed that seed germination was positively correlated with the vigour index (r = 0,912**) and maximum growth potential (r = 0,859**), and vigour index was positively correlated with maximum grwoth potential (r = 0,805**).

1 INTRODUCTION

Seed is one of the basic inputs in agricultural activities. It is part of plant that used for reproduction either vegetatively or generatively. The use of quality seed is one of the efforts in order to improve productivity. Therefore, the availability of quality seeds is one of the key to success farming (Kusandari and Muharram, 2005). Sesame is a plant that contains 50-53% vegetable oil. Sesame plants propagation through seeds that produce generatively. One effort to determine sesame seeds viability is seed testing.

The main purpose of seed testing is to avoid planting seeds that do not have the ability to grow into normal plants. Seed testing reffered to a germination test. Germination test is one of method to provide information to seed users about the seeds ability to grow into productive plants in optimum environmental conditions (BBPPMBTPH, 2012).

The germination test of seedling in optimum conditions sometimes show higher percentage of germination than sprouts in the field. Due to that conditions, according to Ilyas (2012), germination test can not provide information about the potential performance of the seed in the field accurately. Based on the circumstances, it require an additional test to obtain information about seed growth in the field and provide a more sensitive seed quality assessment.

The test that gives more sensitive seed quality assessment is vigor test. Vigour test can provide information about seed quality index; consistent levels of the potential physical and physiological quality of seed lots; seed growth on the field; and seed saving power from a lot. Vigor can be interpreted as a number of traits that indicate the activity and seed lots diversity that can grow in wider range of field conditions (ISTA, 2014).

Seeds that have high vigor will be able to grow in non optimum environmental conditions and will produce products above normal in the optimum environment. In addition, seeds that have high vigor will grow faster because relatively germination seeds require a short time (Sadjad *et al*, 1999).

One of the parameters of the vigour test is the vigour index. The vigour index can provide more information about seed vigor. The vigour index where the seeds have the first calculated value test

Hartati, P., Rosmayati, R. and Hanafiah, D.
Viability and Vigour of Sesame (Sesamum indicum L) Seeds.
DOI: 10.5220/0008547401310134
In *Proceedings of the International Conference on Natural Resources and Technology (ICONART 2019)*, pages 131-134
ISBN: 978-989-758-404-6

has a high vigour. One parameter of seed feasibility is maximum growth potential (Sutopo, 2004). The value of maximum growth potential shows a high condition of seed viability (Justice and Bass, 2002). The seeds used in this study were Sumberejo 4 sesame seeds varieties with two lots which had been stored for 6 and 7 years. The study aims to determine the correlation between germination test, vigour index and maximum growth potential of sesame seeds.

2 MATERIALS AND METHODS

2.1 Time and Location

The experiment was conducted in laboratory physics and biology, Seed Testing Laboratory Development Seed Agency of Quality Testing for Food Crops and Horticulture, Cimanggis Depok on November-Desember 2018.

2.2 Materials

Materials that used in this resarch were 2 lots of SBR 4 sesame seeds varieties. A1 seeds lot was seeds that have been stored for 7 years and A2 seeds lot was seeds that have been stored for 6 years. The seeds were stored in the seeds shed at temperature between 16-25ºC. This research was conducted with three approaches: germination test, vigour index, and maximum growth potential.

2.3 Methods

Germination test was conducted using ISTA Rules method in germinator with the temperature changes between 20ºC and 30ºC using filter paper. Sesame seeds were arranged on filter paper that had been moistened, then it were germinated in electric germinator. Germination test of sesame seeds was evaluated on the 3 and 6 days. Vigour index was evaluated on 3 days. The criteria for normal seedlings refer to ISTA *Handbook on Seedlings Evaluation* (2006) with germination type E, A-2-1-1-1seedlings group.

2.3.1 Observation Parameters

1. Germination (G)

The calculation of germination ability was based on the percentage of normal seedlings on the 3 and 6 days (ISTA, 2014).

$$G = \frac{\Sigma \text{normal Seedling evaluation (I+II)}}{\Sigma \text{ seed planted}} \times 100\%$$

2. Vigour index (VI)

Vigour index calculation was based on persentase the percentage of normal seedlings that grow on the 3 days.

3. Maximum Growth Potential (MGP)

Maximum growth population was calculated based on the percentage of all seedlings that grow both normal and abnormal until the end of the observation. Maximum growth potential was calculated using:

$$MGP = \frac{\Sigma \text{ seed grow until the end}}{\Sigma \text{ seed planted}} \times 100\%$$

2.3.2 Data Analysis

This research was conducted using Random Block Design (RBD), namely seed lot (A1 and A2). Statistical data processing was performed by analyzing the F test range at a 95% confidence interval to see the effect of treatment on the observed variables. If the treatment has a significant effect on the benchmark variable of observation, Duncan Test multiple range test (DMRT) is carried out at the level of 5%. A simple correlation test was carried out to see the relationship between the two variables.

3 RESULTS AND DISCUSSION

3.1 Time and Location

Germination is a series of complex physiological processes that begin with the process of taking water (imbibition) by the seed and ending with the appearance of primary roots penetrating the seed skin (ISTA, 2014). In the sesame seeds that had been tested, germination in the laboratory begins with the appearance of the primary roots penetrating the seed skin and ends when the seedling have developed to the phase where the seedlings can be evaluated according to the ISTA Rules, namely germination type E, A-2-1-1-1seedlings group.

Sesame seedlings that have reached a certain development phase, will be evaluated based on important structures and categorized as normal seedlings, abnormal seedlings and dead seeds. Seedlings that were not sufficiently developed,

weak, unbalanced, deformed and damaged, remain abandoned until the last calculation. ISTA Rules allow the testing period to be extended if there are doubts or a large number of seedlings are not normal (ISTA, 2014). The test can be extended for half the testing period for germination. Sesame seedlingstest can be extended for up to three days and evaluation is carried out on the 9 days.

The results of the study in Table 1, show that the A2 lot has a germination of 88% while the A1 seed lot has a germination of 70%. A2 seeds lot is significantly different from germination, vigour index and maximum growth potential with A1 seed lot. The higher the germination value, the greater the vigour index and the maximum potential for sesame seed growth in this study.

The vigour index calculation was performed on the 3 days. The vigour index is one of the parameters of seed vigour. In general, vigour is defined as the ability of seeds to grow normally in sub optimal environmental conditions. Seeds with high vigour will grow faster because the seeds germinate in a relatively short time (Sadjad *et al*, 1999). Data on Table 1 shows that A2 seed vigour index is significantly different from A1 lot seed. Although A2 seed lot was significantly higher than A1 seed lot, both seeds had a low vigour index.

Maximum growth potential is the sum of growing seedlings, both normal and abnormal. The magnitude of the maximum growth potential indicates a high condition of seed viability (Justice and Bass, 2002). A1 seed lot had a maximum growth potential of 90%, where as much as 20% of seedlings enter the abnormal seedlings category while A2 seed lot had a maximum growth potential of 97%, of which 9% in the category of abnormal seedlings. Abnormal seedlings that were found is in the category of rotten seedlings due to primary infection, primary roots damaged due to inhibition and none, and no hypocotyl (Figure 1).

Table 1:Effect lot of seed on germination, vigour indexand the maximum growth potential on two lots of sesame seeds

Seed Lot	Parameters		
	Germination (%)	Vigour index (%)	Maximum Growth Potential (%)
A1	70b	13b	90b
A2	88a	20a	97a

Note: The numbers followed by the same letter on the same line indicates a value not significantly different from DMRT at $\alpha = 5\%$.

The data in Table 2 shows the correlation coefficient of each test had strong correlations. The results of the correlation test between germination and the value of the vigour index and maximum growth potential gave the results of a real positive difference which shows that the higher the value of the vigour index and the maximum growth potential, the higher the germination value. The correlation between the vigour index and the maximum growth potential gave the results of a real positive difference indicating that the higher the maximum potential growth value, the higher the vigour index.

Figure 1: Sesame Seed Evaluation. Normal seedling (A); Seedling grown rudimentary (B); Abnormal seedling with no primary root criteria (C), no hypocotyl (D) dan decayed (E);

Table 2: The correlation coefficient (r) of the germination, vigour index and the maximum growth potential on two lots of sesame seeds

Parameter	Germination (%)	Vigour index (%)	Maximum Growth Potential (%)
Germination (%)	1		
Vigour index (%)	0,912**	1	
Maximum Growth Potential (%)	0,859**	0,805**	1

Note: **: different significantly at the 0.01 level

3.2 Discussion

Sesame in A1 seeds lot (stored 7 years) and A2 lot (stored 6 years) had a germination rate of 70% and 88%. Both sesame seed lots are able to maintain the germination of seeds. As for several factors that

affect seed germination during storage, namely seed vigor before storage, seed water content, storage environment conditions, and storage time (Kartono, 2004).

The data in Table 1 shows that germination,vigour index and maximum growth potential of A2 sesame seeds lot are significantly higher in value than A1 lots. In A1 seeds lot, the viability value is lower than A2. It can be seen from the value of germination and the value of the vigour index. Decreasing the germination of seeds and increasing the number of abnormal seedlings are one characteristic of physiologically decreasing seed vigor (Copeland and Donald, 2001). This is in line with the maximum growth potential in both seed lots. Maximum growth potential on A1 seeds lot were 90% where 20% were abnormal seedlings, on A2 lot was 97% with 9% were abnormal seedlings. This indicates that the two lots have experienced a decrease in vigour.

The high number of abnormal seedlings in A1 and A2 lots is due to the inability of seedlings to develop into normal seedlings due to seed decline. Decline in seed quality during storage can occur when food reserves for embryo growth are reduced or depleted due to metabolic processes of respiration (Roberts, 1972). During storage, seeds undergo a biological process, one of which is the metabolic process, especially the process of respiration associated with the process of deteriorating seed quality.

Seed storage for a long time has a negative impact on seed viability (Justice *et al*., 2002). In addition, seeds that experience a decline in seed quality will experience a loss of ability to germinate even though the seeds are in optimum conditions for germination (Copeland and McDonald, 1995).

The results of this research showed that germination was positively correlated with the vigour index (r = 0.912 **) and maximum growth potential (r = 0.859 *), and the vigour index was positively correlated with maximum growth potential (r = 0.805 **). The higher the value of the vigour index and the maximum growth potential, the higher the germination. Likewise with the vigour index, the higher the maximum growth potential of sesame seeds, the higher the vigour index.

4 CONCLUSIONS

Sesame seed that has been stored for 6 and 7 year olds were able to maintain germination respectively 88% and 70%. The germination of both sesame seed lots correlates with the vigour index and maximum growth potential.

REFERENCES

Balai Besar Pengembangan Pengujian Mutu Benih Tanaman Pangan dan Hortikultura. 2012. *Seed Germination Principe and Testing*. Kementerian Pertanian.

Copeland, L. O., McDonald M. B. 2001. *Seed science and technology.* Kluwer Academic Publishers. London.

Justice, O. L., Bass, L. N. 2002. *Principles and practices for seed storage.* Raja Grafindo Persada. Jakarta.

Ilyas S. 2012. *Seed Science and Technology*. Teori dan Hasil-hasil Penelitian. Bogor (ID): IPB Pr.

Kartono. 2004. *Techniques for storing wilis soybean varieties at different water levels and storage temperatures.* Buletin Teknik Pertanian (9):79–82.

Mattjik, A. A., Sumertajaya, I. M. 2013. Experimental design using SAS and Minitab application. *IPB Press*. Bogor Indonesia.

Roberts, E. H. 1972. *Viability of Seed.* illus. London.

Sadjad, S. E. Muniarti dan S. Ilyas. 1999. *Seed vigor testing parameters from comparative to simulation*. Grasindo. Jakarta. 184 hal.

Sutopo, L. 2004. *Seed Technology*. Revised Edition. Raja Grafindo Persada. Jakarta.

The International Seed testing association. 2006. *Handbook on Seedlling Evaluation.* 3th Edition. Zurich. Switzerland (CH): ISTA.

The International Seed testing association. 2014. *International Rules for Seed Testing.* Switzerland (CH): ISTA.