Using the Germination Method with Paper Media to Test the Viability of Sesame (*Sesamum indicum* L.) Seeds

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ABSTRACT

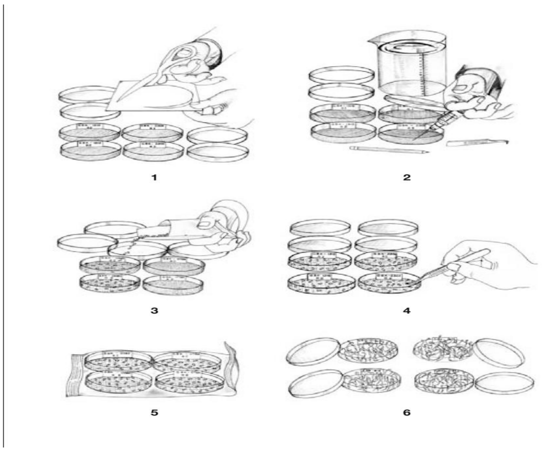
Seed viability is the ability of seed to germinate which is evidenced by a number of physiological or biochemical events. Paper media can be used for assessing seed viability. This study intended to discover the most effective technique of seed germination utilizing paper substrate for the viability of sesame seeds. The research was conducted at the Seed Laboratory of Directorate of rapeseed and mustard research centre, Bharatpur (Raj). The study approach used a two-factor factorial Completely Randomized Design. The first component was the sesame seed variety which consisted of RT-346, RT-127, RT-125, RT-103, RT-54, RT-46, TKG-308. The second factor was the seed germination procedure which comprised of a test on top of paper, a test on filter paper. Each treatment was reproduced four times, generating 8 experimental units. Sesame seed viability was greatly affected by the way of seed germination utilizing paper media, according to the findings. In compared to other treatments, sesame seeds of the RT-46 variety displayed the best percentages of simultaneous growth, germination, vigor index, normal seedling dry weight, hypocotyl length, and radicle length when tested on filter paper.

INTRODUCTION

Sesame is an oil-producing plant that may be grown in tropical and subtropical climates. Sesame seeds are made up of 50-53% vegetable oil, 20% protein, 7-8 crude fiber, 15% nitrogen-free residue, and 4.5-6.5% ash. Sesame seed oil is high in unsaturated fatty acids, mainly oleic and linoleic acids, anti-oxidants alanine or lignin, vitamins B and E, and cholesterol-free. In the meantime, protein can be extracted from sesame seed hulls and utilized as an animal feed ingredient. Therefore, sesame oil output in Indonesia needs to be expanded, one of which is through the use of high-grade seeds. High-quality seed is the most critical ingredient in agricultural production success because it delivers high yields of high-quality products (Wiguna, 2013). The quality of seeds comprises physical, genetic, and physiological properties. Physical quality is determined by the seeds' cleanliness, shape, size, color consistency, and absence of mechanical or pest-related damage. Genetic quality dependent on the level of purity. Meanwhile, physiological quality is determined from seed viability, moisture content, and seed storability. Seed viability is the ability of seeds to grow, as shown by a number of physiological and biochemical phenomena, which can be evaluated utilizing these phenomena. Through physiological, biochemical, and cytological techniques, the evidence of seed viability reveals that the seeds are alive (Widajati, E., Endang, M., Endah, R. P., Tatiek, K., Syhartanto, M. R., Abdul, Q., 2017).

The biochemical technique assesses the metabolic activity of seeds, including the capacity of enzymes to catalyze the metabolic processes of germination, respiration, ATP production, and other processes, whereas the physiological approach examines changes in growth. The state of mitochondria, cell membranes, chromosomes, and other components can be used to identify a cytological approach. However, the mathematical technique can be utilized to swiftly forecast viability because it is based on observations of seed viability benchmarks that have been converted into mathematical formulas (Widajati *et al*., 2017).

Although they can only measure the percentage of normal germination on ideal germination medium and frequently use paper or sand substrates, germination assays can be used to evaluate the physiology of seeds (Hidayat RS and Mayasari, 2019). Papers like towels, blotters, and filters are frequently used (ISTA, 2010). But obtaining the three substrates is quite expensive and requires importation. As a result, straw paper was used to create an alternate substrate medium, which is advised for use in Indonesian seed testing (Sadjad, 1972 in Hidayat RS and Mayasari, 2019). Straw paper has the highest degree of likeness, at 97.22 percent, followed by stencil paper at 88.87 percent, according to Purbojati and Faiza (2006).



Sesame Seed Germination
(Source: Kameshwara Rao et al)

According to Alimoeso and Sutarto (2006), the top of the paper (on paper), between the paper (between paper), or planted paper (between paper fans) could be used as a method for assessing germination or growth potential. For seed testing with parchment paper, the rolled-up paper established with plastic (UKDdp) test method is most frequently employed. Hapsari and Suwarno (2008) state that stencil paper can be used in place of straw paper when confirming the viability of seeds using the UKDdp method. According to Suwarno and Deni (2009), utilizing two sheets of parchment paper for germination factors can effectively assess the viability of both large and tiny seeds. Using the test procedure, the viability of E. pellita seeds was considerably impacted by the germination technique and the paper substrate. increased the germination values of E. pellita seeds by a large amount when using the test technique on paper (UDK) (Yuniarti, N., Megawati, Budi, L., 2017). Using the UDK, Udk, and UKDdp procedures, the germination of maize seeds of the Anoman, Bisman, and Srikandi types was equivalent (Nurhafidah., Abdul, R., Abbas, K., Hasyim, H.J., 2021).

Sesame seeds classified as dormant or having a long shelf life were tested for viability based on how well they germinated before being used. RT-346, RT-127, RT-125, RT-103, RT-54, RT-46, TKG-308 are sesame germplasm that are ranked as superior. TKG-308 a local sesame variety, is the outcome of negative mass selection. This type may be harvested at 105 DAP, grows well in dry soil and in rice fields with little water, and has an oil content of 55–58 percent. With a potential output of 2.2 tons per hectare, an oil content of more than 50%, drought tolerance, and early maturity, the Wirnas is a wonderful sesame cultivar. Thus, crop rotation can be used to grow this variety in paddy fields.

The objectives of this study are to ascertain the viability response of sesame seeds on filter paper paper, to find a seed germination technique on filter paper that effectively counteracts the viability of sesame seeds, and to acquire the most viable types of sesame on filter paper.

METHOD AND MATERIAL

In the Seed Laboratory of the Directorate of rapessed and mustard research centre,Bharatpur (Raj) this study was carried out from March to June of 2024. Sesame seeds variety RT-346, RT-127, RT-125, RT-103, RT-54, RT-46, TKG-308 along with Filter paper, petri dishes, plastic, scissors, rubber, and a germinator, were the tools and materials used.

A two-factor factorial completely randomized design (CRD) was used in this investigation. Sesame seed variety variety RT-346, RT-127, RT-125, RT-103, RT-54, RT-46, TKG-308, which includes, was the first variable. The second was the straw paper method of seed germination, which involved experiments on paper, rolled paper, folded paper, and in between papers. Filter paper was used for the paper test, and it was placed in a 9 mm-diameter petri dish. In the straw paper test, seeds germinated and grew on the paper that was rolled and constructed during the germination stage. Sesame seeds were planted between straw paper to test the seeds' compatibility with one another.

The seeds sprouted on folded paper and a structure resembling a fan while being tested between folded paper. There were eight treatment combinations and four replications in the experiment, totaling 8 experimental units. A total of 24 seedlings were used to test each treatment (ISTA, 2010). The temperature range for germination in a type 72 IPB germinator was 25°c to 30°c degrees Celsius.

The following factors were noted: normal seedling dry weight (g), germination (%), growth speed (% KN/etmal), hypocotyl length (cm), radicle length (cm), and percentage of simultaneous growth (%). After germination, the first observation was made on the third day, and the second on the sixth (Balittas, 2016). SAS 9.1 software was used to analyze the experimental data using the analysis of variance (F test). The Duncan Multiple Range Test (DMRT) was used at the 5% level to further test the F test results that showed a significant difference.

RESULT AND DISCUSSION

Two measures of a healthy seed are simultaneous growth and growth rate. The capacity of seeds to grow quickly and produce healthy plants in unfavorable circumstances is known as seed vigor (Asra, 2014). The strength of vigor needed to create seeds that can survive in unsuitable environmental conditions is shown by the speed at which seeds grow (Fatikhasari, Z., Intani, Q.L., Dian, S., Muhammad, A.U., 2022).

Table 1 shows the percentage of types and germination techniques for sesame seeds (Sesamum indicum L) that exhibit simultaneousness and rapid seed growth.

Treatments		Germination (%)	Vigour index (%)	Normal seedling
Variety	Germination method			
RT-346	Test on filterpaper	92.4	91.2	0.1248
RT-127	Test onfilter paper	93.6	97.2	0.1292
RT-125	Test onfilter paper	93.2	94.5	0.1182
RT-103	Test onfilter paper	93.1	85.1	0.1043
RT-54	Test on filterpaper	91.2	96.1	0.1104
RT-46	Test on filterpaper	96.3	97.5	0.1416
TKG-308	Test onfilter paper	97.6	97.2	0.1401
Coefficient of variation	8.26			

The variety RT-46 that produced the maximum vigor index, normal seedling dry weight, and percentage of germination were 96.3 percent, 97.5 percent, and 0.1416 grams, respectively. The characteristics of a vigorous seed show that it may develop quickly, regularly, and consistently. Fatikhasari *et al.* (2022) state that a drop in germination and the vigor index is a physiological indicator of declining seed quality. Biochemical signs in the interim include a decrease in enzyme activity, an increase in conductivity levels, and food reserves. According to Purbojati and Faiza (2006), using straw paper medium resulted in the best germination and vigor indices for sesame seed germination, which were 97% and 96.70%, respectively. According to Rahayu and Titiek (2015), there was no discernible difference between filter paper and straw paper substrate while using the former.

The portion of the embryonic axis that lies between the cotyledons and the major root, which develops into the sprout's stem, is called the hypocotyl. Table 2 displays the radicle, which is the embryo's lower end of the hypocotyl that will grow into the main root of the sprout. Table 2 demonstrates that the RT-103 variety produced the best hypocotyl and radicle lengths, measuring 3.83 cm and 6.33 cm, respectively.There has been no tissue damage, and the hypocotyl development is perfect and healthy. The growth of plumules is optimal since they have green leaves and grow nicely inside or outside of coleoptile, or possesses normal buds and full epicotyl development. Wibowo (2023) states that the parameters of the average length of the radicle and plumule are influenced by the filter paper.

Table no 2 Sesame seed variants' hypocotyl and radicle lengths, as well as their germination processes (*Sesamum indicum* L.)

Treatments		Hypocotyl length(cm)	Radicle length(cm)
varieties	Germination method		
RT-346	Test on filterpaper	2.73	3.30
RT-127	Test onfilter paper	2.90	4.73
RT-125	Test onfilter paper	3.85	4.68
RT-103	Test onfilter paper	3.87	6.33
RT-54	Test on filterpaper	3.83	3.50
RT-46	Test on filterpaper	3.67	4.76

TKG-308	Test onfilter paper	3.68	3.86
Coefficient of variation	8.44		

According to Hidayat RS and Marjani (2020), the creation of new cells in the embryo will be followed by the process of cell differentiation. This leads to the creation of the radicle, or root, and the plumule, which is made up of the stem and leaves. When water is absorbed into the seed coat, the skin swells and breaks, signaling the start of the radicle's development from the seed. Germination, which is indicated by the release of the radicle, comes next.

CONCLUSION

The method of germination of seeds employing paper media had a major impact on the viability of sesame seeds. The Winas 1 sesame seeds had the greatest percentage of simultaneous growth (97.5%), germination (98.5%), vigor index (98%), normal seedling dry weight (0.1418 g), hypocotyl length (3.87 cm), and radicle length (8.3 cm) when compared to other treatments.

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