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THE EFFECT OF COATING FORMULATION AND STORAGE PERIODS ON THE QUALITY AND GROWTH OF TSS (TRUE SHALLOT SEED) ONION (Allium cepa L.)

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Abstract

Efforts to improve the provision of quality TSS seeds are by doing seed coating. Seed coating is a seed coating technique using a coating agent that aims to maintain seed viability. Vigor tss seeds often decrease due to the length of time the seeds are stored. So that the length of seed storage until the seed will affect the quality of the seeds produced. Seed coating on TSS seeds and determining the right storage duration are expected to be able to maintain the quality of TSS seeds. The research will be carried out from January to April 2024 in the Laboratory, Green House, and UPT land. Development of Rice and Palawija Seeds, Randuagung, Singosari, Malang, East Java. This study was prepared using a factorial Complete Randomized Design (RAL) that was repeated four times. The first factor is a coating material with 4 levels (without coating, CMC 1.5% + Humic Acid 0.6% + Liquid Smoke 0.5% + Gypsum 10 grams, CMC 1.75% + Humic Acid 0.6% + Liquid Smoke 0.5% + Gypsum 10 grams and CMC 2% + Humic Acid 0.6% + Liquid Smoke 0.5% + Gypsum 10 grams) and the second factor is the storage periods with 3 levels (no storage, storage periods 2 weeks and storage periods 4 weeks). The results showed that the combination of CMC coating formulation 1.5% + Humic Acid 0.6% + Liquid Smoke 0.5% + Gypsum 10 grams with a storage period of 4 weeks (F1M4) is the best combination for coating onion TSS seeds. The combination differs markedly from growth speed, coarseness, germination rate, vigor index, plant length, and number of leaves.

Keywords: Onion, Seed Coating, Storage Periods

INTRODUCTION

Shallots are one of the leading horticultural commodities that have long been cultivated by farmers in Indonesia. Based on data from the Central Statistics Agency, shallot production always increases and in 2021 it reached more than 2 million tons. Shallots are included in the group of spices that can be used as a spice in cooking, as industrial raw materials, and as a source of biopharmaceuticals. This causes the need for shallots will continue to increase.

Onion propagation can be done in two ways, namely propagation by planting material, seedling bulbs, and TSS seeds. According to Basuki (2009), shallot production is considered more profitable if the production uses planting material derived from seeds (TSS or true shallot seed) compared to using planting material for seedling bulbs. TSS seed productivity is higher when compared to tubers that tend to decline easily.

The problem faced in providing quality TSS seeds is storage. One effort to overcome this problem is to do seed coating or can be called seed coating. Seed coating or seed coating is a seed wrapping technique by covering the entire surface of the seed using a coating agent that aims to maintain seed viability. The seed coating material used consists of adhesives and additives. Adhesives

commonly used for seed coating include alginate, Carboxylmethyl Cellulase (CMC), tapioca flour, and arabic gum. While additives include pesticides, nutrients, growth regulators (ZPT), repellent, antioxidants, and vitamins. Carboxylmethyl cellulase (CMC) is one of the materials that is often used as a seed coating and is usually combined with additives such as gypsum that are suitable for seeds, so that seed quality is maintained. According to Maulana, Ida and Nova (2022), the best coating material formulation for the quality and growth of onion TSS seeds (Allium cepa L.) is CMC 1.5% + Humic Acid 0.6% + Gypsum 20 grams.

The storage periods of TSS seeds according to Siregar (2020) is fairly long, which is 1-2 years which causes the vigor of the seeds owned to decrease. Rahmi, Ahmad and Wulandari (2016) also stated that the longer the seeds are stored, the percentage of seed germination after storage decreases. In addition, it will further increase the degree of deterioration. Seed deterioration leads to low seed viability and vigor. Deterioration of seed quality is a process of deterioration in the physiological quality of seeds that causes complete changes in seeds both physically and physiologically. Therefore, the length of seed storage until the seeds are planted will greatly affect the quality of the seeds produced. Seed coating on TSS seeds and determining the right storage duration are expected to be able to maintain the quality of TSS seeds. Seed coating has a positive influence on the quality of TSS seeds so further research is needed.

METHOD

The research will be carried out from January to April 2024 in the Laboratory, Green House, and UPT land. Development of Rice and Palawija Seeds, Randuagung, Singosari, Malang, East Java from January to April 2024. The tools used in the study were rotary coater machines, moisture meters, magnetic stirrers, petri dishes, beakers, analytical scales, tweezers, filters, spoons, hand sprayers, germination baths, drills, shovels, hoes, rulers and cameras. The materials used in the study were onion TSS seeds, aquades, Carboxylmethyl Cellulase (CMC), humic acids, gypsum, sand, polybags, soil, compost, NPK 16:16:16 fertilizer, ZA fertilizer, glass jars, label paper and water. This study used a Factorial Complete Randomized Design (RAL) with two treatment factors, namely coating formulation and storage periods. The first factor of the coating formulation consists of 4, namely, F0 = No Coating, F1 = CMC 1.5% + Humic Acid 0.6% + Liquid Smoke 0.5% + Gypsum 10 grams, F2 = CMC 1.75% + Humic Acid 0.6% + Liquid Smoke 0.5% + Gypsum 10 grams, and F3 = CMC 2% + Humic Acid 0.6% + Liquid Smoke 0.5% + Gypsum 10 grams. The second factor of storage periods consists of 3 levels, namely, M0 = No Storage, M2 = Storage periods 2 Weeks, and M4 = Storage periods 4 Weeks. The results of the study were analyzed using the 5% BNJ Test.

RESULTS AND DISCUSSION

Seed Moisture Content

The results of variety analysis showed that the combination treatment of coating formulation and storage periods did not have a real effect on the moisture content of onion TSS seeds. The average moisture content of onion TSS seeds in the combination treatment of coating formulation and storage periods is shown in Table 1.

Table 1. Average Seed Moisture Content Due to Coating Formulation Treatment and Storage periods

Treatment	Water Content (%)
Coating Formulation	
F_0	7.03
F_1	7.02
F_2	7.03
F_3	7.07
BNJ 5%	tn
Storage periods	
M_0 (No Storage)	7.01 a
M_2 (2 Weeks)	7.02 a
M_4 (4 Weeks)	7.08 b
BNJ 5%	0.04

The highest average yield of TSS coating seed moisture content in a single treatment of CMC coating formulation 2% + Humic Acid 0.6% + Liquid Smoke 0.5% + Gypsum 10 grams (F3) was 7.07%. This result was obtained because the high content of Carboxylmethyl cellulase (CMC) is as much as 2% so that the coating layer is too thick and increases the water content in the seeds. The results of Setiadi's research (2012) stated that Carboxylmethyl cellulase (CMC) which is dispersed in water, then Carboxylmethyl cellulase (CMC) grains are hydrophilic will absorb water and swelling occurs. This is directly proportional to the addition of water content in the seed.

The highest average yield of TSS coating seed moisture content at a single treatment storage periods of 4 weeks (M4) was 7.08%. High water content can be caused because the longer the storage, the more water content can be absorbed. Water vapor will stick to the surface of the seed which will then be absorbed by the seed, resulting in an increased water content in the seed. According to Purba, Sitepu and Haryati (2013) the higher the moisture content of seeds, the faster the respiration rate and the more CO2, water and heat generated during storage. As a result, there will be a deterioration of seeds during storage.

Seed Germination

The results of variety analysis show that the combination treatment of coating formulation and storage periods has a very real effect on the germination of onion TSS seeds. The average value of germination of onion TSS seeds, a combination of coating formulation and storage periods is shown in Table 2.

Table 2. Average Germination Due to Coating Formulation Treatment and Storage periods

Coating Formulation	Seed Germination (%)		
	Storage periods		
	M_0 (No Storage)	M_2 (2 Weeks)	M_4 (4 Weeks)
F_0	91.50 cd	86.50 bcd	78.50 abcd
F_1	90.50 abcd	86.00 bcd	95.00 d
F_2	81.50 abcd	90.00 cd	78.00 abc
F_3	71.50 ab	71.00 ab	68.50 a
BNJ 5%	14.73		
Note:	The average number followed by the same letter in the same column showed no real difference in the 5% BNJ test.		

High-quality seeds are seeds that have high viability and vigor. Factors that affect the viability of seeds are the initial viability of seeds, the maturity rate of seeds at harvest, the environment before harvest, and the environment during the seed storage period. Seed quality consists of physical quality, physiological quality and genetic quality. Seeds that have high physical quality can be seen from their clean, bright and uniformly sized physical appearance. The physiological quality of seeds is reflected in viability values (such as germination and maximum growth potential) and vigor values (such as germination rate, growing speed, coarseness and storage periods). Genetic quality is indicated by high genetic uniformity and is not mixed with other varieties. The coating formulation factor and storage periods have a noticeable influence on the germination and maximum growing potential of onion TSS seeds. The average yield of germination and the highest maximum growth potential in onion TSS seed coating is 95.00%. These results meet the seed quality standards set by Kepmentan 1316/HK.150/C/12/2016, that seed quality standards for seed germination are at least 80%. The percentage value of normal sprouts in the germination test can be a benchmark in determining the ability of seeds to grow and germinate in the optimum environment.

Growing Speed, Growing Agility, and Vigor Index

The results of variety analysis show that there is an interaction in the combination treatment of coating formulation and storage periods on growing speed, coarseness, and vigor index of onion TSS

plants. The average value of growing speed, coarseness of growth, vigor index of onion TSS plants in combination of coating formulation and storage periods is shown in Table 3.

Table 3

Average Growing Speed, Growing Agility, Vigor Index Due to Coating Formulation Treatment and Storage periods

Coating Formulation	Growing Speed (%)		
	Storage periods		
	M_0 (No Storage)	M_2 (2 Weeks)	M_4 (4 Weeks)
F_0	25.49 d	17.94 bc	15.16 ab
F_1	22.33 cd	12.16 ab	27.55 d
F_2	23.24 ab	13.32 ab	10.98 a
F_3	9.81 a	9.93 a	9.32 a
BNJ 5%	5.67		
Coating Formulation	Growing Agility (%)		
	Storage periods		
	M_0 (No Storage)	M_2 (2 Weeks)	M_4 (4 Weeks)
F_0	87.50 de	83.50 cde	68.00 abc
F_1	89.00 e	66.50 ab	91.00 e
F_2	64.50 ab	73.00 bcd	65.00 ab
F_3	55.50 a	56.00 a	57.00 a
BNJ 5%	14.06		
Coating Formulation	Vigor Index (%)		
	Storage periods		
	M_0 (No Storage)	M_2 (2 Weeks)	M_4 (4 Weeks)
F_0	84.50 ef	70.50 d	51.50 c
F_1	74.50 ef	28.50 b	87.00 e
F_2	24.00 ab	27.00 ab	11.50 a
F_3	21.50 ab	12.00 a	15.00 ab
BNJ 5%	14.17		

The vigor index value can represent the speed of seed germination. The speed of growth indicates vigor has the strength to grow, while the coarseness of growth indicates vigor has storage

periods. The average yield of vigor index, growing speed and the highest growing speed of coating seeds was obtained in CMC treatment 1.5% + Humic Acid 0.6% + Liquid Smoke 0.5% + Gypsum 10 grams with a storage period of 4 weeks (F1M4). The average vigor index produced is 87%, while the average growth speed is 27.55%. The higher the growth speed value, the higher the vigor of the seed. Growing speed is one of the benchmarks to see the strength of growing seeds. The speed of growth can be seen from the rate of germination process in a shorter time. The highest average yield of cohesiveness growth is 91%. These results show that vigor has high growing strength, thus illustrating the potential of seeds that are able to grow quickly. According to Ningsih, Raka, Siadi and Wirya (2018) the value of coarseness grows between 40-70%, where if the value of coarseness grows greater than 70%, it indicates vigor, strength grows very high and coarseness less than 40% indicates a less vigorous seed group. High seed cohesiveness indicates high absolute vigor of growth strength because a seed group that shows simultaneous and strong growth will have high growing strength.

Germination Rate

The results of variety analysis showed that there was an interaction in the combination treatment of coating formulation and storage periods on the germination rate of onion TSS plants. The average value of germination rate of onion TSS plants in combination of coating formulation and storage periods is shown in Table 4.

Table 4

Average Germination Rate Due to Combination Treatment of Coating Formulation and Storage periods

Coating Formulation	Germination Rate		
	Storage periods		
	M_0 (No Storage)	M_2 (2 Weeks)	M_4 (4 Weeks)
F_0	62.95 def	58.36 cde	51.18 bcd
F_1	66.25 ef	46.80 abc	72.08 f
F_2	47.78 abc	66.76 ef	47.55 abc
F_3	44.43 ab	38.40 a	48.66 abc
BNJ 5%	10.83		
Note:	The average number followed by the same letter in the same column showed no real difference in the 5% BNJ test.		

The highest average germination rate was 72.08. At storage of such seeds can maintain the average yield of germination speed during the storage period. This shows that room temperature and coating material can affect the maximum growth potential value, germination and germination rate

during storage. This result is in line with Agustiansyah (2016) stating that coating materials are able to maintain and improve seed quality due to the protection layer on the surface of the seeds, resulting in optimal germination. Proper coating materials can support seed germination and increase the number of normal sprouts produced.

Plant Length

The results of the variety analysis showed that there was an interaction between the combination of coating formulation treatment and storage periods at the length of onion plants 7-35 HST. The average value of the length of onion TSS plants in the combination of coating formulation and storage periods is shown in Table 5.

Table 5

Average Plant Length Due to Combination Treatment of Coating Formulation and Storage periods

Age	*Coating* Formulation	Plant Length (cm)		
		Storage periods		
		M_0 (No Storage)	M_2 (2 Weeks)	M_4 (4 Weeks)
7 HST	F_0	9.50 bc	8.25 abc	8.19 abc
	F_1	9.13 abc	8.06 abc	9.81 c
	F_2	7.75 ab	8.75 abc	7.75 ab
	F_3	9.44 bc	7.94 abc	7.25 a
	BNJ 5%	2.01		
14 HST	F_0	14.44 b	12.19 ab	12.00 ab
	F_1	13.13 ab	11.00 ab	14.69 b
	F_2	10.63 a	13.50 ab	11.31 ab
	F_3	14.31 ab	12.31 ab	10.56 a
	BNJ 5%	3.78		
21 HST	F_0	20.06 c	17.06 abc	15.13 ab
	F_1	17.13 abc	15.56 abc	20.25 c
	F_2	12.81 a	18.56 bc	14.56 ab
	F_3	19.25 bc	15.13 ab	13.69 a
	BNJ 5%	4.83		
28 HST	F_0	26.19 b	22.56 ab	21.38 ab
	F_1	22.19 ab	20.75 ab	26.50 b
	F_2	17.75 a	23.19 ab	20.44 ab
	F_3	24.38 ab	19.94 ab	18.13 a

	BNJ 5%	6.89		
35 HST	F_0	33.50 b	29.50 ab	28.06 ab
	F_1	27.50 ab	25.88 a	34.19 b
	F_2	23.94 a	26.69 ab	25.44 a
	F_3	30.19 ab	24.31 a	24.94 a
	BNJ 5%	7.46		
Note:	The average number followed by the same letter in the same column showed no real difference in the 5% BNJ test.			

Number of Leaves

The results of the variety analysis showed that there was an interaction between the combination of coating formulation treatment and storage periods on the number of leaves of onion plants 7 – 35 HST. The average value of the number of leaves of onion TSS plants in combination between coating formulation and storage periods is shown in Table 6.

Table 6

Average Number of Leaves Due to Combination Treatment of Coating Formulation and Storage periods

Age	Coating Formulation	Number of Leaves (sheet)		
		Storage periods		
		M_0 (No Storage)	M_2 (2 Weeks)	M_4 (4 Weeks)
7 HST	F_0	2.50 bc	2.25 b	2.00 a
	F_1	2.00 a	2.00 a	2.75 d
	F_2	2.00 a	2.38 bc	2.25 b
	F_3	2.50 bc	2.00 a	2.00 a
	BNJ 5%	0.18		
14 HST	F_0	2.88 b	2.38 ab	2.00 a
	F_1	2.13 ab	2.00 a	2.88 b
	F_2	2.00 a	2.63 ab	2.38 ab
	F_3	2.75 ab	2.00 a	2.00 a
	BNJ 5%	0.76		
21 HST	F_0	3.63 cd	3.25 bcd	3.00 ab
	F_1	3.00 ab	3.13 bc	3.75 d
	F_2	3.00 ab	3.50 bcd	3.13 bc
	F_3	3.63 cd	3.00 ab	2.50 a
	BNJ 5%	0.62		

28 HST	F_0	3.88 b	3.63 ab	3.25 ab
	F_1	3.00 a	3.50 ab	3.88 b
	F_2	3.38 ab	3.75 ab	3.13 ab
	F_3	3.75 ab	3.25 ab	3.00 a
	BNJ 5%	0.76		
35 HST	F_0	4.50 d	4.25 c	3.75 b
	F_1	3.88 b	3.88 b	4.63 d
	F_2	3.50 a	4.25 c	3.75 b
	F_3	4.25 c	3.63 ab	3.63 ab
	BNJ 5%	0.26		
Note:	The average number followed by the same letter in the same column showed no real difference in the 5% BNJ test.			

The combination treatment of the coating formulation and storage periods showed a noticeable effect on plant length and leaf count. The results of fingerprint analysis showed that the combination treatment between coating formulation and storage periods differed markedly on plant length and number of leaves at the age of 7-35 HST. The average yield of plant length and the highest number of leaves was obtained at CMC treatment 1.5% + Humic Acid 0.6% + Liquid Smoke 0.5% + Gypsum 10 grams with a storage period of 4 weeks (F1M4). This is due to the role of humic acids which are one of the ingredients that can improve plant performance. According to Puspitasari and Lukito (2019), humic acids are decompositions of organic matter that are relatively resistant and colloidal. The administration of humic acids can increase nutrient uptake, increase root respiration, protein synthesis and increase the rate of photosynthesis of plants. Adewole (2012) also explained that sam humate has the potential to help soil health, especially increasing C-Organic storage, increasing the efficiency of nutrient absorption along with water during the imbibition process and increasing root growth. The growth results are in line with the results of seed viability where Wulananggraeni, Damanhuri, and Purnamaningsih (2016) said that the value of seed germination can be a benchmark in determining the ability of seeds to grow in the field.

CONCLUSION

Based on the results of the study, the conclusions that can be drawn are:

1. The combination of CMC coating formulation 1.5% + Humic Acid 0.6% + Liquid Smoke 0.5% + Gypsum 10 grams with a storage periods of 4 weeks (F1M4) is the best combination for coating onion TSS seeds. The combination differs markedly from growth speed, coarseness, germination rate, vigor index, plant length, and number of leaves.

2. CMC coating formulation 1.5% + Humic Acid 0.6% + Liquid Smoke 0.5% + Gypsum 10 grams (F1) is the best coating formulation for coating onion TSS seeds. The coating formulation differs markedly from germination, maximum growth potential, growing speed, coarseness, germination rate, vigor index, and plant length of 35 HST.
3. The storage periods of 4 weeks (M4) is the best storage periods for onion TSS seed coating. The storage periods differ markedly from moisture content, growing speed, and vigor index.

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