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Growth and production evaluation of corn varieties and genotypes grow from seed with different storage ages

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Abstract. Quality seeds are one of the important elements in maintaining plant potential. One of the factors that can affect the growth potential and production of corn for each variety or genotype is the storage ages of the seeds. The purpose of this study was to obtain varieties or genotypes of corn that have the ability to grow and produce optimally from seeds that have been stored for one and six months. The research was conducted from August to December 2020 at the Cereal Research Institute, Maros, South Sulawesi, Indonesia. The seeds used were Variety of Srikandi Putih, Waxy Corn and Genotype of BC2F1. This study was designed using a randomized block design (RBD) with a two-factor. The first factor is the type of variety/genotype (V) consisting of Srikandi Putih (V1), Waxy Corn (V2) and Genotype of BC2F1 (V3). The second factor is seed storage ages (U) consisting of: 1 month (U1) and 6 months (U2). From these two factors, 6 treatment combinations were obtained which were repeated three times to obtain 18 experimental units. The data were analyzed with the SAS 9 for windows program. The results showed that the seed storage ages of 1 month could maintain the potential for plant height growth, and the weight of 100 seeds in the Variety of Srikandi Putih, Waxy Corn and Genotypes of BC2F1. Seed storage ages of 1 and 6 months did not affect the number of leaves and flowering time, but only 1 month of seed storage ages that could maintain the potential for seed production in Variety of Srikandi Putih, Waxy Corn and Genotypes of BC2F1.

1. Introduction

Corn is one of the agricultural products whose seeds are used as food, feed and industry. In Indonesia, corn is the second important food crop after rice. Corn plays an important role in meeting the basic food needs of the community. Therefore, quality seeds must be available at all times. Seed is an important component in increasing maize yields. Many important roles of corn that encourage the need for the availability of quality seeds and superior varieties that can meet the quantity, quality, and continuity [1].

The availability of seeds with maintained seed quality is a problem faced by the high demand and demand for corn. Seed storage is a post-harvest handling activity carried out to maintain the quality and quality of the seeds in good condition and condition, until the seeds arrive in the hands of farmers and are ready to be planted in the field [2]. The problem that is often encountered in storage is the decline in seed quality that occurs quickly, while the storage period of the seeds is not too long. Several factors that affect the quality and strength of seeds include: (a) genetic composition, consisting of seeds such as mechanical integrity, protein content, disease resistance, and seed size; (b) environmental conditions at the time of seed development, including soil fertility and moisture,



environmental conditions after ripening or before harvesting; (c) seed storage, including storage time, type of storage device, and storage environment (temperature, relative humidity, oxygen content) [3].

To determine the quality of seeds, seed content and weight of 1000 grains can be tested [4]. Water content is the dominant factor affecting seed quality. In addition, the resistance of a strain or genotype can be known through physical differences and physiological seeds. Decreasing viability and strength can be seen through the higher electrical conductivity value along with the storage period [5].

Different protein content affects the quality or the quality and storage ages of each genotype. Likewise, the size and shape of the seeds that can affect the quality and quality and durability of seed storage. Larger seed size resulted in higher germination percentage, germination dry weight, and 1000 grain weight higher [6]. Decreasing seed quality can cause overall physical, physiological, and biochemical changes so that seed viability decreases [7]. The aging process or physiological decline in seed vigor can be seen from a decrease in germination, an increase in the number of abnormal sprouts, inhibition of plant growth and development, a decrease in germination, and an increase in seed growth in extreme environments that can reduce plant production [8].

The description above is very limited because the number of studies on the relationship of seeds to their growth and production in the field is also limited. Therefore, more complete research is needed as has been done in this study. The purpose of this study was to obtain varieties or genotypes of corn that have the ability to grow and produce optimally which are grown from seeds that have been stored for one and six months.

2. Materials and Methods

The study was conducted from August to December 2020 at the Cereal Crop Research Institute Maros, South Sulawesi, Indonesia. The materials used were seeds of Srikandi Putih Variety, Waxy Corn, and Genotype of BC2F1. The seeds used were seeds with a water content of 14% that had been stored in plastic packaging that had previously been given saromyl, then tightly closed and placed at room temperature (28-30°C) for 1 month and 6 months.

This study was designed using a Randomized Block Design (RBD) with a two-factor. The first factor is the type of variety/genotype (V) consisting of Srikandi Putih Variety (V1), Waxy Corn (V2) and BC2F1 Genotype (V3). The second factor is seed storage ages (U) consisting of: 1 month (U1) and 6 months (U2). From these two factors, 6 treatment combinations were obtained which were repeated three times to obtain 18 experimental units. The data is processed using the SAS 9 for Windows program. Observation parameters include plant height, number of leaves, male flowering age, female flowering age, weight of 100 seeds, seed weight per plot and seed production per hectare.

3. Results and Discussion

3.1. Plant height

The analyses of varians showed that there was an interaction effect between the treatment of seed storage ages and maize varieties/genotypes on plant height. The LSD test results of 5% showed that the highest average plant height in the Srikandi Putih Variety with a storage ages of 1 month (V1U1) was significantly different from all treatment combinations except for Waxy Corn with a Storage ages of 1 month (V2U1) and Genotype of BC2F1 with a storage ages of 1 month (V3U1). Seed storage ages of 6 months (U2) generally inhibited plant height growth in all varieties/genotypes tested.

Table 1. Plant height on seed storage ages treatment and corn variety/genotype (cm)

Treatment	Srikandi Putih (V1)	Waxy Corn (V2)	Genotype of BC2F1 (V3)	Average
Storage ages 1 month (U1)	145.40a	142.03a	140.90a	142.78
Storage ages 6 months (U2)	120.21c	133.86b	124.38c	126.15
Average	132,81	137.95	132.64	
LSD _{0.05}	6.10			

Note: Values followed by the same letter in rows and columns are not significantly different at the LSD_{0.05}

The results showed that there was an interaction between the varieties/genotypes and the storage ages of the seeds. The seed storage ages of one month gave optimal plant height growth compared to the seed storage ages of six months for both the Srikandi Putih Variety, Waxy Corn and BC2F1 Genotypes. This is in line with the results of the study which stated that the storage period and seed size significantly affected the location of the cobs and plant height. Seeds with a longer storage period produce lower plants with shorter cobs [9].

3.2. Number of leaves

The analyses of varians showed that the treatment of seed storage ages on the varieties and genotypes of maize tested had no significant effect on the number of leaves.

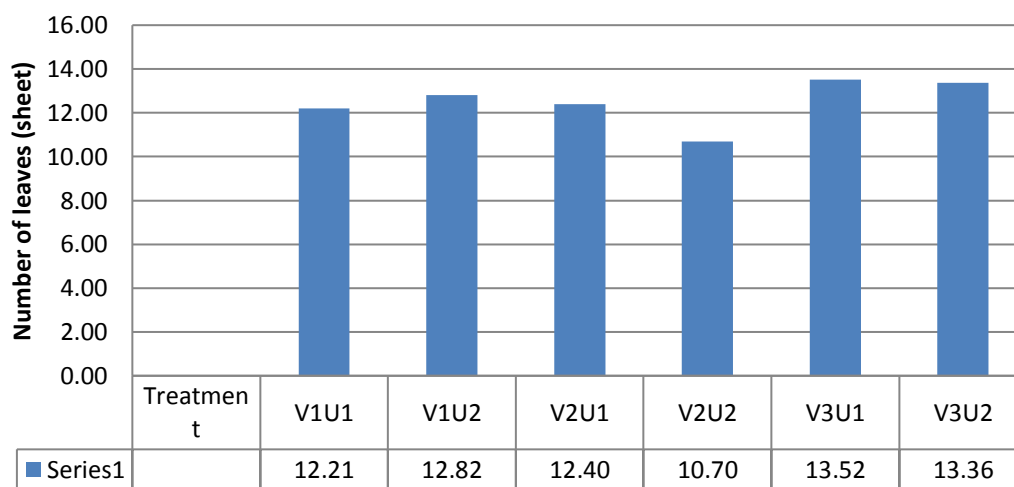


Figure 1. Number of leaves in the treatment of seed storage ages and maize varieties/genotypes
Note: V1=Srikandi Putih Variety; V2=Waxy Corn; V3= BC2F1 Genotype; U1= Storage ages of 1 month; U2= Storage ages of 6 months

Figure 1 shows that the effect of seed storage ages of 1 month and 6 months has the same effect on the number of leaves in all varieties/genotypes tested. The only difference is the size of the leaves. The number of leaves of Srikandi Putih Variety, Waxy Corn and BC2F1 Genotypes was not affected by the storage of the seeds. The number of leaves of the Srikandi Putih Variety, Waxy Corn and BC2F1 Genotypes were relatively the same. This is in line with the results of the study which stated that the number of leaves of the Srikandi Putih Variety, Waxy Corn and their progeny yields were not significantly different [10]. In addition, the difference lies only in the size of the leaves. Leaves derived from seeds with storage ages of one month were greater than six months. This indicates that the low initial vigor of the seed will affect plant growth through weak germination growth. Weak sprout growth can inhibit the ability of young plants to absorb nutrients. As a result, the supply of nutrients to support plant growth including leaves is limited [9].

3.3. Male flowering age

The analyses of varians showed that the treatment of seed storage ages on the varieties and genotypes of maize tested had no significant effect on the parameters of male flowering age. Figure 2 shows the age of male flowering in all treatment combinations is relatively the same. In general, between treatment combinations, the effect was not constant on male flowering age.

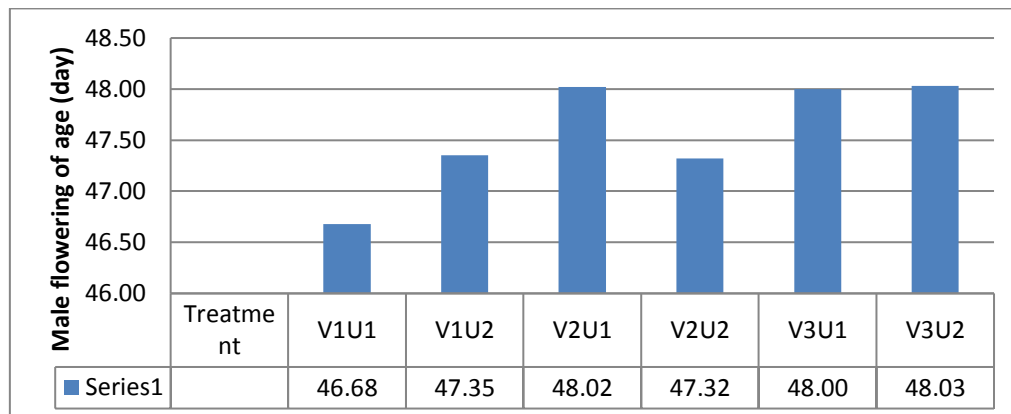


Figure 2. Male flowering age on seed storage ages treatment and maize varieties/genotypes

Note: V1=Srikandi Putih Variety; V2=Waxy Corn; V3= BC2F1 Genotype; U1= Storage ages of 1 month; U2= Storage ages of 6 months

The age of male flowering in Srikandi Putih Variety, Waxy Corn and BC2F1 Genotypes was not affected by the storage ages of the seeds. Although there was a tendency for the Srikandi Putih variety and the BC2F1 genotype to produce male flowers more slowly at a storage of 6 months than at a storage ages of 1 month. This is in line with the results of research which states that the flowering age tends to be influenced by the storage ages of the seeds, the longer the storage ages of the seeds the slower the release of flowers [9].

3.4. Female flowering age

The analyses of varians showed that the treatment of seed storage ages on the varieties and genotypes of maize tested had no significant effect on the parameters of female flowering age. Figure 3 shows the age of female flowering in all treatment combinations is relatively the same. In general, the treatment combinations tend to have a not constant effect on the female flowering age.

The age of female flowering in Srikandi Putih Variety, Waxy Corn and BC2F1 Genotypes was not affected by the storage ages of the seeds. The age of female flower release on Waxy Corn and BC2F1 genotype tends to be slower at 6 months of seed storage ages than 1 month. This is in line with the results of research which states that the flowering age tends to be influenced by the storage ages of the seeds, the longer the storage ages of the seeds the slower the release of flowers [9].

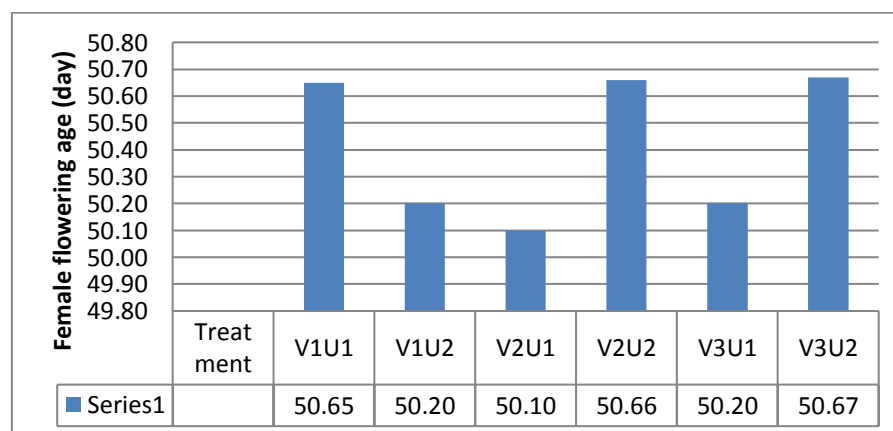


Figure 3. Age of female flowering in the treatment of seed storage ages and maize varieties/genotypes

Note: V1=Srikandi Putih Variety; V2=Waxy Corn; V3= BC2F1 Genotype; U1= Storage ages of 1 month; U2= Storage ages of 6 months

3.5. Weight of 100 seeds

The analyses of variances showed that there was an interaction effect between the treatment of seed storage ages and maize varieties/genotypes on the weight of 100 seeds.

Table 2. Weight of 100 seeds in the treatment of seed storage ages and maize varieties/genotypes (g)

Treatment	Srikandi Putih (V1)	Waxy Corn (V2)	Genotype of BC2F1 (V3)	Average
Storage ages 1 month (U1)	30.86a	31.26a	31.66a	31.26
Storage ages 6 months (U2)	28.47b	31.22a	31.27a	30.32
Average	29.67	31.24	31.47	
LSD _{0.05}	2.08			

Note: Values followed by the same letter in rows and columns are not significantly different at the LSD_{0.05}

The results of the LSD_{0.05} test showed that the lowest average weight of 100 seeds in the Srikandi Putih Variety with a Storage ages of 6 months (V1U2) was significantly different from all treatment combinations. Other treatment combinations were not significantly different between varieties/genotypes and different storage ages.

The results showed that the weight of 100 seeds was influenced by the variety/genotype and the storage ages of the seeds. The data in Table 2 shows that the storage ages of seeds of 1 and 6 months has different effects only on the Srikandi Putih variety, while the Waxy Corn and BC2F1 genotypes have no different effects. This indicates that the storage ages of seeds to a certain extent depends on the variety or genotype.

3.6. Weight of seeds per plot

The analyses of variances showed that the storage ages of seeds had a significant effect on the parameters of seed weight per plot, while the variety/genotype and their interactions had no significant effect.

Table 3. Seed weight per plot on seed storage ages treatment and maize variety/genotype (kg)

Treatment	Srikandi Putih (V1)	Waxy Corn (V2)	Genotype of BC2F1 (V3)	Average
Storage ages 1 month (U1)	10.86	6.77.	12.41	10.01a
Storage ages 6 months (U2)	10.10	4.08	10.73	8.30b
Average	10.48	5.43	11.57	
LSD _{0.05}	1.51			

Note: Values followed by the same letter in rows and columns are not significantly different at the LSD_{0.05}

The results of the LSD_{0.05} test showed that the average seed weight per plot was highest in the 1 month seed storage ages treatment (U1), which was significantly different from the 6 month seed storage ages (U2). This shows that seed storage ages has an effect on production yield per plot.

Seed weight per plot of Srikandi Putih Variety, Waxy Corn and BC2F1 genotype were affected by seed storage ages. Seeds as the forerunner of plants contribute to growth and production. Seed storage ages of 1 month can maintain the potential yield of Srikandi Putih Variety, Waxy Corn and Genotype of BC2F1, while the seed storage ages of 6 months has decreased potency. This is in line with the results of research which states that storage of seeds for too long can result in a decrease in germination potential, seedling development and seed production [11].

3.7. Production per hectare

The analyses of variances showed that the seed storage ages had a significant effect on the parameters of seed weight per hectare, while the variety/genotype and their interactions had no significant effect.

The results of the $LSD_{0.05}$ test showed that the average seed production per hectare was highest in the 1 month seed storage ages (U1) and significantly different from the 6 month seed storage (U2). This shows that seed storage ages has an effect on production yield per hectare.

Table 4. Production per hectare on seed storage ages treatment and maize variety/genotype (t/ha)

Treatment	Srikandi Putih (V1)	Waxy Corn (V2)	Genotype of BC2F1 (V3)	Average
Storage ages 1 month (U1)	8.40	5.24	9.60	7.75a
Storage ages 6 months (U2)	7.81	3.16	8.30	6.42b
Average	8.11	4.2	8.95	
$LSD_{0.05}$	1.15			

Note: Values followed by the same letter in rows and columns are not significantly different at the $LSD_{0.05}$

Seed production per hectare of Srikandi Putih Variety, Waxy Corn and BC2F1 genotype were affected by seed storage ages. Seeds as the forerunner of plants contribute to growth and production. Seed storage ages of 1 month can maintain the potential yield of Srikandi Putih Variety, Waxy Corn and Genotype of BC2F1, while the seed storage ages of 6 months has decreased potency. This is in line with the results of research which states that storage of seeds for too long can result in a decrease in germination potential, seedling development and seed production [11].

4. Conclusion

Seed storage ages of 1 month can maintain the growth potential of plant height, and weight of 100 seeds on the Srikandi Putih Variety, Waxy Corn and BC2F Genotypes. Seed storage ages of 1 and 6 months has no effect on the number of leaves, male flowering age and female flowering age. Seed storage ages of 1 month can maintain the potential for seed production in Srikandi Putih Variety, Waxy Corn and BC2F1 Genotype.

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