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Effect of Different Desiccants on Preserving the Germination Capacity of Yard Long Bean (*VIGNA UNGUICULATA SESQUIPEDALIS*), After Storage

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Abstract: **The study was conducted to determine and find the significant difference among various desiccants applied in Yard Long Bean. The treatments were: TI – control (no desiccant), T2 - seeds with 3 grams silica desiccant, T3 – seeds with 6 grams silica desiccant, T4 – seeds with 9 grams silica desiccant, T5 – seeds with 3 grams charcoal desiccant, T6 – seeds with 6 grams charcoal desiccant, T7 – seeds with 9 grams charcoal desiccant.**
The study used Complete Randomized Design (CRD) with seven treatments and three replications. Duncan Multiple Range Test (DMRT) was used to compare treatment means with significant results. This is to determine which among the treatment means are significantly different from each other.
The results revealed that treatment 7 (9 grams charcoal) again gave the highest percentage of germination capacity having a mean of 98%. Using the DMRT, Treatment 7 (9 grams charcoal) was found to be significantly different to Treatment 1 (Control – No desiccant), but not significantly different to Treatment 2 (3 grams silica), Treatment 3 (6 grams silica), Treatment 4 (9 grams silica), Treatment 5 (3 grams charcoal), and Treatment 6 (6 grams charcoal).
It was observed that all treatments were found no significant difference among each other except for the Control (T1). As such, it is concluded that charcoal desiccant can be used as substitute of silica in the storage of Yard Long Bean seed. Aside from control, all other treatments are found to have the same effect. For economic purpose, 3 grams of charcoal desiccant can be used with the same performance in storage of Yard Long Bean seeds.
Finally, this study concludes that the use of the three grams charcoal can be as effective as to 9 grams of charcoal and 3 to 9 grams of silica gel. This study, therefore, recommends the use of 3 (three) grams of charcoal in the storage of 10 grams Yard Long Bean seeds.

Keywords: **desiccants, silica, charcoal, organic agriculture, yard long bean.**

1. INTRODUCTION

The Province of Apayao was identified as a viable source of agri-based products and one of the country's 170 priority sites for biodiversity conservation. PAGASA also identified Apayao Province as type III Climate, where rainfall is often and parallel to high humidity [1]. This scenario served as challenge to the farmers to preserve seeds for the next cropping season.

Farmers are keeping traditional seeds and they store for the next planting season. They plant different vegetables alternately. Since vegetable seeds are highly perishable, the high humidity affects the storage life of seed as seed absorb water it will facilitate physiological changes in seeds and also favorable for the organism that make the seed to perish. Germination rate of vegetable seeds that were stored is very low so they need to store huge amount of seeds to cover up seed losses.

The rationale for drying seeds is to reduce their moisture content to a level which prolongs longevity during storage of seeds and maintain high germination percentage by maintaining the low moisture content (lower than 20% MC in vegetable seeds maintain high seed viability [2]. Regular regenerations of accessions are needed to ensure that the seeds stored in base collections do not fall below acceptable levels of viability and yet minimize the number of regeneration cycles to ensure that the genetic integrity of accessions is maintained.

In conventional storage of seeds, desiccants such as silica gel seeds are not readily available and accessible to farmers [3, 4, 5]. The traditional or indigenous practices used by our ancestors found in the locality for the storage of vegetable seeds for the next planting season and preserve the seeds viability is no longer practiced by the younger generation of farmers [6]. Organic Agriculture (2010) also encourages the use of indigenous desiccant and had its protocol not to use chemicals in storage of seeds [7].

Testing viable desiccant that are indigenous, effective, readily available, and affordable will help local farmers to preserve seeds that are not contaminated with chemicals [8]. This pave way to researchers, extension officers, academe, and other related agencies to validate traditional practice of local farmers in storage of vegetable seeds using locally available materials such as charcoal and proper drying method.

The use of indigenous materials such as charcoal will be tested as desiccant as it may have comparable effect with that of silica gel which may not be readily available and affordable for resource-limited seed storage facilities [9]. In this case, the use of indigenous materials may be found as an effective and affordable method for short-term storage, especially farm-saved seeds.

STATEMENT OF THE PROBLEM:

Farmers depend on the availability of quality seeds for better production, but are often bombarded by the frequent increase of farm expenses particularly the seeds needed for planting. Because of improper storage of seeds, more often than not, seeds stored by farmers have low germination capacity even for open varieties of vegetables.

This study concentrated on different treatments using silica and charcoal with different levels of weight (grams) used in Yard Long Bean seeds. Determining the best germination performance using different weights of desiccant in the storage of seeds will help them save their money in the purchase of expensive commercial seeds. The result of the study will serve as option for the farmer to store seeds with the right level of weight to prolong the viability of the seeds for the next cropping.

Thus, it was the objective of the study to have information on desiccants to be considered in order to prolong the storage of vegetable seeds and maintain its high germination percentage.

2. METHODOLOGY

Materials:

Materials used in this study were: 620 pieces (210grams) of Yard Long Bean seeds, 54 grams of silica gel, 54 grams of charcoal, 21 plastic jars, petridish, cloth, thermometer, net, and metal flat sheet, ball pen, forceps, pale, strainer, screen, mortar and pestle, marker, calculator, paper bag, and record book. Other equipment include refrigerator, weighing scale, and camera.

Methods:

Seed Gathering Procedures:

Matured Yard Long Bean pods were gathered using blade cutter to separate the pod from the plant. The pods were sundried for four days from 9AM to 4PM by hanging in an open area using a tie wire. Individual pods were arranged in a single pile to facilitate direct exposure of pods to sunlight. The pods were weighed on the second, third, and fourth day to monitor the dryness of the seeds. On the 4^{th} day of sun drying, the seeds were removed from the pods and viable looking seeds were selected and stored in a jar, then sealed. The temporary storing of seeds were immediately done to avoid absorption of moisture.

Preparation of Experimental Jars and Desiccants:

Twenty-one jars were washed with soap and water and set for sun drying. Silica was sundried for three days to ensure that any moisture absorbed by the desiccant were released, then immediately stored in a plastic jar while still hot. Plastic jars were then immediately sealed to avoid farther absorption of moisture from the air.

Charcoal desiccants were crashed into granules similar to the size of silica gels. The cracked charcoal was screened using 3/16 inch meshed screen to obtain similar sizes. Bigger sizes were handpicked and removed from the screen. The screened pieces of charcoals were further screened to reduce sizes using 1/8 inch size of meshed screen to separate the finer sizes of charcoal. The charcoals which passed 3/16 size meshed screen but cannot pass 1/8 inch meshed screen were collected and were used as desiccant.

The collected charcoals used as desiccants were exposed to strong sunlight in a flat tin sheet to remove moisture that was absorbed. This was done for five days, then charcoals were put in a big jar to avoid absorption of moisture.

Desiccants were weighed accordingly based on the assigned quantity per treatment and put in a jar. Jars were labeled accordingly.

All jars were tightly closed to avoid moisture entering the jars and to prevent desiccants to absorb moisture outside. Jars were properly labeled with specific seed family, treatments, and replications.

Based on charcoal and seed ratio, 30 seeds of Yard long bean have a total average weight of 10 grams. Using 3 grams charcoal desiccant ratio is 3:10 (3 grams charcoal:10 grams yard long bean), 6 grams charcoal desiccant ratio is 6:10 (6 grams charcoal : 10 grams yard long bean) 9 grams charcoal desiccant ratio is 9:10 (9 grams charcoal : 10 grams yard long bean.

Storage of Seeds:

The jars with desiccants and seeds were stored in a refrigerator at the laboratory. The refrigerator was maintained at an average temperature of 15 degrees Celsius. Storage of seeds in a refrigerator temperature ranging from 4^{o}C to 15^{o}C has high germination percentage. Also maximum germination percentages were obtained from different plant seeds stored in a refrigerator ranging from 10^{o}C to 20^{o}C.

Testing of Moisture Content:

Samples of seeds were brought to the laboratory for testing of moisture content. Two samples of Yard Long Bean seeds were tested and obtained an average moisture content of 13.1 %.

Monitoring of Stored Jars with Seeds and Desiccant:

Jars were regularly monitored and the temperature was maintained at 15 ^{0}C. Also, any insect damage and changes of the physical characteristic of the seeds were observed. The data were gathered from initial storage to final opening of jars and seed germination was recorded.

Germination Testing and Data Gathering:

The data gathered were the percentage of seed germination per treatment. After 105 days of storage in a refrigerator with maintained temperature, the seeds were subjected for germination testing. Petri dish method was used to test the seed germination. The Petri dishes were cleaned and sun dried.

Treatment Description:

Yard Long Bean seeds were subjected under seven treatments and were replicated three times. The following treatments were described as follows:

Treatment 1: Control (No desiccant), 10 grams Seeds
Treatment 2: 3 grams of silica desiccant, 10 grams Seeds
Treatment 3: 6 grams of silica desiccant, 10 grams Seeds
Treatment 4: 9 grams of silica desiccant, 10 grams Seeds
Treatment 5: 3 grams of charcoal desiccant, 10 grams Seeds

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Treatment 6: 6 grams of charcoal desiccant, 10 grams Seeds
Treatment 7: 9 grams of charcoal desiccant, 10 grams Seeds

Experimental Lay-out:

Analysis of variance using the Complete Randomized Design (CRD) as experimental lay-out was used in the study. The jars were stored in a refrigerator using a controlled condition.

T2R1	T4R2	T4R3
T4R1	T3R2	T6R2
T7R3	T1R1	T1R3
T5R2	T6R1	T5R1
T5R3	T3R3	T2R3
T2R2	T1R2	T6R3
T3R1	T7R2	T7R1

3. DATA ANALYSIS AND INTERPRETATION

The gathered data were subjected to statistical analysis following the one-way analysis of variance using the Completely Randomized Design. Comparison among treatment means on germination capacity of vegetable seeds was done using the Duncan's Multiple Range Test (DMRT) to determine further which among the treatment means are significantly different from each other.

4. RESULTS AND DISCUSSION

Germination Capacity:

Table 1 presents germination capacity of yard long bean seeds as affected by different desiccant. The result again revealed that T7 (9 grams of charcoal) got the highest germination capacity with 98%. This was followed by T4 (9 grams silica with 96%), T3 (6 grams of silica with 96%), T2 (3 grams of silica with 93%), T6 (6 grams of charcoal with 92%), T5 (3 grams of charcoal with 90%), and Control Treatment with 65%, respectively.

Table 1. Germination capacity of Yard Long Bean seeds as affected by different desiccants (%)

Treatment		Replication			MEAN
		I	II	III	
	T1	67	67	60	65^{b}
	T2	93	87	100	93^{a}
	T3	90	100	97	96^{a}
	T4	87	100	100	96^{a}
	T5	87	93	90	90^{a}
	T6	90	97	90	92^{a}
	T7	93	100	100	98^{a}

Analysis of variance showed that treatments were highly significant at 1% and 5% level as presented in Table 2. Using Duncan's Multiple Range Test (DMRT), T7 (9 grams of charcoal) is significantly different to T1 (Control), but not significantly different to T2 (3 grams of silica), T3 (6 grams of silica), T4 (9 grams of silica), T5 (3 grams of charcoal), T6 (6 grams of charcoal). result shows that charcoal has the same effect with silica in terms of germination capacity of yard long beans seeds.

The result from the experiment showed that the use of charcoal as desiccant had optimum effect on the seed germination percentage. It further revealed that the use of 9 grams of charcoal desiccant, 6 grams of charcoal desiccant and 3 grams of charcoal desiccant are not significantly difference from each other. This study further showed that 3 grams of charcoal can be as effective as 6 to 9 grams of charcoal in improving the germination percentage of yard long bean seeds.

Table 2. ANOVA of germination capacity of yard long bean seeds affected by different desiccants

Source of	Degrees of	Sum of	Mean	FC	FTAB	
Variance	Freedom	Square	Square		(5%)	(1%)
Treatments	6	0.234	0.0391	14.94**	3.55	6.01
Error	14	0.037	0.0026			
Total	20	0.271				

** highly significant

5. SUMMARY

This study was conducted to determine the effect of different desiccant to prolong the storage and germination capacity of yard long bean seeds. There were two desiccant used: Silica and charcoal with different levels of weight. Treatment 2 used 3 grams of silica, Treatment 3 used 6 grams of silica, Treatment 4 used 9 grams of silica, Treatment 5 used 3 grams of charcoal, Treatment 6 used 6 grams of charcoal and Treatment 7 used 9 grams of charcoal.

Result shows that T7 (9 grams of charcoal) has the highest percentage of germination capacity having a mean of 98%, T4 (9 grams of silica) and T3 (6 grams of silica) have a mean of 96% while T2 (3 grams of silica) has a mean of 93%. Six grams charcoal (T6) has a mean of 92%, and 3 grams of charcoal (T5) has a mean of 90%. Treatment without desiccant has the lowest mean of 65%.

ANOVA shows that the difference among treatment means was highly significant. T7 (9 grams of charcoal) found to be significantly different only to T1 (Control – No desiccant), but not significant different to all other treatments such as T2 (3 grams of silica), T3 (6 grams of silica), T4 (9 grams of silica), T5 (3 grams of charcoal) and T6 (6 grams of charcoal).

The result from the experiment showed that the use of charcoal as desiccant had optimum effect on the seed germination percentage of yard long bean seeds. However, the use of 3 grams of charcoal desiccant is found to be equally effective with the use of 6 to 9 grams of charcoal as desiccants,

6. CONCLUSIONS AND RECOMMENDATION

It was also observed that 9 grams of charcoal has the highest mean of germination percentage after 105 days of storage. It has a good performance in storing yard long bean seeds. Using DMRT, all treatments except T1 are not significantly different to each other. Therefore, this study concludes that using the least amount (3 grams), charcoal can be used as effective with the higher amount of charcoal desiccant.

Use 3 grams of charcoal for the storage of 10 grams yard long bean seeds (3:10 ratio of charcoal and long yard bean). This will prevent farmers from buying expensive silica gel.

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