Research Paper Agricultural Science

Indian Journal of Research PARIPEX

Physical Characteristics and Germination of Bitter Gourd (*Momordica Charantia Linn.*) Seeds

***Fernando Vicente Barraza-Alvarez**

Senior Professor, Departmentof Agricultural Engineering and Rural Development, Faculty of Agricultural Sciences.A. I., Ph.D. University of Córdoba

ABSTRACT

In order to meet some of the main seeds physical characteristics of bitter gourd it was conducted an investigation at the Universidad de Córdoba, Colombia. Experimental design was completely randomized with three treatments: T0 (control), T1 (seeds soaked in water for 24 hours) and T2 (seeds soaked in water at 50°C for one hour). The variables studied were: seeds index, weight of 100 seeds, dry matter of 100 seeds, moisture content and seed germination percentage. According to the obtained results it was found that one gram of seeds has18.5±1.28 seeds; 100 seeds weighed 5.35 ± 0.13g; dry matter of 100 seeds was 4.23± 0.12g and the moisture content was 1.12± 0.16%. Germination percentage was adjusted to the logistic model, and was 76 % for T1, 64 % for T2 and 62 % for T0.

KEYWORDS seed soaking, germination percentage, seeds index.

INTRODUCTION

M. charantia is a cucurbit used throughout the world for its nutritional, medicinal and ornamental properties (Braca et al., 2008; Duan et al., 2011; Rani et al., 2012.).

Recent research shows promise results for the future development of male contraceptive products (Patil and Patil, 2011; Ilyas, 2014). For the food industry has isolated a peptide that acts as bio-preservative food, especially in meat (Jabeen and Khanum, 2014).

At the industry level, the oil extracted from seeds is an ecological CO_2 inhibitor of pipes steel corrosion used in the fuel processing (Singh et al., 2013). For its quick drying properties also touch the oil industry is promising paint and coatings (Prashantha et al., 2009).

The main form of propagation of the specie is through sexual seeds, which has high rate of deterioration (Rahman et al., 2014) and a thick outer shell that induces lethargy and causes reduced germination, which is problem for emergency (Saleem et al., 2014). Sweet seeds arils likes snakes (Barraza, 2015).

The lack of knowledge of some physical and chemical properties of bitter gourd seeds and their germination process causes to farmers high production cost, reduced performance and obtaining seeds without appropriate quality parameters.

Considering the importance of bitter gourd as raw material for important products derived of seeds, this investigation had the objective of to know the percentage of seed germination in two pre-sowing treatments: soaking in tap water for 24 hours and soaking in water at 50° C for one hour. They were selected because their economy, safety, easy access and handling. Seeds index (number of seeds per gram), weight of 100 seeds, 100 seed dry matter and moisture content also were studied.

MATERIALS AND METHODS

The experiment was conducted between february 2 and march 9 of 2015 at the Plant Physiology Laboratory of the Universidad de Córdoba, Colombia. The test material was the locally collected bitter gourd "criollo".

Seedsindex

10 samples of 1g of seeds were taken, and the number of seeds per gram was counted. The average number of seeds of the 10 samples was calculated.

Weight of 100 seeds

10 samples of 100 seeds were taken, and weighed on Ex1103 Ohaus® Explorer electronic balance. The average of 100 seeds weight of the 10 samples was calculated.

Dry matter and moisture contents

10 samples of 100 seeds were dried at 85° C in Memmert® U10 oven until obtaining constant weight. It was calculated the average dry matter content of 100 seeds in the 10 samples (g), and it was expressed in percentage.

Moisture content was calculated at the 10 samples of seeds from the following equation: moisture content = fresh weight-dry seed weight of seeds. The average moisture content of 100 seeds of the 10 samples was calculated and expressed in percentage.

Germination percentage

It was made a bioassay in completely randomized experimental design with four replications. The treatments were as follows: To (control), T1(seeds soaked in tap water for 24 hours) and T2 (seeds soaked in tap water at 50 °C for one hour). Each repetition had 25 seeds placed in circular pattern on filter paper moistened with 15 mL of sterile distilled water (ISTA, 2013) in glass cases (Petri) of 90 mm diameter. In total 100 seeds were used.

They were counted daily the seeds that presenting radicle emergence until 6 days after sowing, and the germination percentage was calculated daily. Non-linear regression analysis with PROCNLIN procedure was done using SAS software version 9.1.3. This percentage was adjusted with the logistic model:

$$y = \frac{A}{(1 + B \cdot e^{-C \cdot x})}$$

Analysis of variance and means comparison test of Tukey (P ≤ 0.05) using the SAS software (PROC ANOVA) was made.

RESULTS AND DISCUSSION

Physical characteristics of the seeds

In Table 1 are presented the results obtained for the seed index, weight of 100 seeds, 100 seed dry matter and moisture content values.

Outperforms the seeds index, the results (Table 1) differ with data of Gölükcü et al. (2014), who reports average of 5.46 seeds per gram.

Among genotypes there are significant variations in the number of seeds per fruit, for example for *M. charantia* var. charantia, there is an average of 23 seeds per fruit, and *M. charantia* var. Muricata there are 4 (Bharathi et al., 2012).

For the weight of the fruit, there are also differences between genotypes. For example for the accession MaKeePaNok (Thailand) between20 and25 g, and for Vishesh (India) there are between 200 and 250g (Ebert et al., 2014).

Table 1. Some physical characteristics of "criollo" bitter gourd seeds. Montería, Colombia, 2015.

Physical seeds characteristics	Value[1]
Seeds index (number of seeds per gram)	18,50 ± 1.28
Weight of 100 seeds (g)	5,35 ± 0.13
Dry matter content (%)	79,06 ± 2,83
Moisture content (%)	20,94 ± 2,83

[1]Mean ± standard deviation

Based on the weight of 100 seeds, the data from Table 1 are different from Gölükcü et al. (2014), who says that 100 seeds weigh is 18.32g. These differences are possibly due to variation among genotypes for this feature, inherent to *M. Charantia* seeds, and also the data of Table 1 are consistent with those reported by Ebert et al. (2014) for the accession MaKeePaNok, with 5.3g disagree with those reported for Vishesh accession, with 24.7g, which has larger seeds.

With respect to dry matter content, the data of Table 1 are higher than the indicated by Gölükcü et al.(2014), who report 65.19±1.65%.

High dry matter content in seeds is associated with increased storage time and less loss of solutes, initial high rate of germination, ability to generate seedlings with longer length and greater accumulation of total dry matter, which favors obtaining more yield and better agronomic, nutritional and industrial seed quality (Hsu et al., 2003; Arvindkumar et al., 2012; Islam, 2012; Mehta, 2014; Kanwar et al., 2014).

Regarding the seeds moisture content (Table 1), there was concordance with the results of Bakare et al. (2010), who found 20.69 ± 5.85%. According to Ebert et al. (2014), *M. charantia* seeds can be dried to lower moisture levels (4 to 6% or less).

Between genotypes of *M. charantia*, different seeds moisture contents has been reported (Ali et al., 2008). For Goj, Guti and Majhari varieties, moisture contentsare 7.99 ± 0.12, 7.62 ± 0.11 and 8.20 ± 0.20%, respectively; for BGS-1 and BGS-2 strains, has been reported 22.91 and 29.32%, respectively (Anjum et al., 2013). For the following varieties Islam et al. (2012) has been reported: Indian Green (53.3 ± 0.5%), Chinese Green (67.1 ± 0.6%), Chinese White (71.8 ± 0.3%) and Indian White (75.9 ± 2.2%). These variations can be attributed to harvest at different maturity levels of fruits (Anjum et al., 2013).

Germination percentage

This variable had a sigmoidal path and was adjusted to the logistic model (Figure1 and Table 2). This result agrees with the reported by Fonseka and Fonseka (2011).

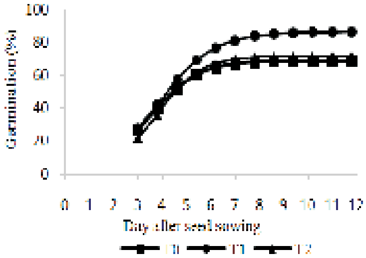

Figure 1. Germination percentage of "criollo" bitter gourd seeds. To (control). T1 (seeds soaked in tap water for 24 hours) and T2 (seeds soaked in tap water at 50 ° C for one hour). Montería, Colombia, 2015.

For all treatments germination began at the third day after sowing (das) and ended at 6 das (Figure 1), which disagreed with data from Crisan et al. (2008) and Islam et al. (2012), who report the onset of germination at 10 das without osmo-conditioning treatments (control).

The germination percentage data for T0 and T1 treatments were superior to those reported by Islam et al. (2012), who obtained for these treatments 40 and 66%, respectively.

Table2.Logistic models to estimate the germination percentage of "criollo" bitter gourd seeds. Montería, Colombia, 2015.

Treatment	Model	PV
T0	$y = 68{,}8333/(1-33{,}0275\ e^{1{,}0102*das})$	0,97
T1	$y = 86{,}4380/(1-30{,}1646\ e^{0{,}8871*das})$	0,99
T2	$y = 71{,}9336/(1-61{,}3789\ e^{1{,}0932*das})$	0,99

T0 (control), T1 (seeds soaked in tap water for 24 hours) and T2 (seeds soaked in tap water at 50 ° C for one hour. PV. proportion of variability indicating reliability model = sum of squares of regression/total sum of squares, das. days after sowing.

T1 data were similar to those obtained with the same treatment reported by Kanwar et al. (2014). Regarding T2, the data obtained (Table 3) were lower than those of Islam et al. (2012), who reported 96% in seeds sown at 20 °C, which may indicate the advantage of such treatment when *M. Charantia* seeds are sown at suboptimal temperatures.

Table3. Germination percentage of "criollo" bitter gourd seeds. Monteria, Colombia, 2015.

Treatment	Germination (%)	
T0 (control)	62	a[1]
T1 (Seeds soaked in tap water for 24 hours)	76	b
T2 (Seeds soaked in tap water at 50 ° C for one hour)	64	a

[1]Values of treatments with the same letter in rows are equal according to the Tukey test (P≤0.05)

Table 3 shows that the germination percentages corresponding to T0 and T2 were statistically equal, and that the treatment of seeds soaked in water for 24 hours exceeded the other treatments with statistically significant differences ($P \leq 0.05$).

Observed increase in germination percentage of T1 seeds may be related to stimulation of essential biochemical changes to start emergency: breaking of dormancy, hydrolysis, metabolism of growth inhibitors, embedding and activation of enzymes. This brings advantages as good germination, uniformity and increased emergence and vigor, plant establishment and protection of crop in the early stages of growth (Nerson, 2007; Islam, 2012; Rahman et al. 2014).

Other advantages of bitter gourd seed soaking in tap water, are given in terms of metabolic and enzymatic repair and recovery of cellular membranes in aged seeds during imbibition, which allows osmotic adjustments to enhance germination. Furthermore, it is favorable softening caused in the thick seed coat, thereby decreasing the mechanical restraint affecting embryo growth (Islam et al., 2012; Kanwar et al., 2014).

In addition to the above, Mehta et al. (2014) indicate that the percentage of germination of *M. charantia* increases as it does also the time soaking in water. For example, for the treatment with 72 hours of soaking, a germination rate of 92.5% was obtained, compared to the control treatment (no soaking) which was 78.9%.

CONCLUSIONS

The highest germination percentage of M. Charantia seeds (76%) was obtained with the treatment of soaking in tap water for 24 hours. In practical terms, without seeds soaking and seeds soaking in water at 50 °C for one hour, the same results (low percentage of germination) are obtained.

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