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QUALITY CHARACTERIZATION OF SEEDS AND PODS OF SNAKE BEAN (VIGNA UNGUICULATA L. (WALP.) SUBSP. SESQUIPEDALIS (L.) VERDC.)

KEY WORDS: Pods, Yield Components, Color Of Seed.

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ABSTRACT

Some characteristics of seeds and pods of three creole genotypes sown in Colombia (Long, Short and Retirement) were studied: germination percentage (GP), absolute velocity of germination (AVG), imbibition (I), absolute velocity of imbibition (AVI), humidity percentage of seeds (HPS), number of seeds in one gram (NSG), weight of one hundred seeds (WOS), dry matter of seeds (DMS), length and thickness of pods and seeds and color of pods and seed coats. The highest GP was 94% and it was obtained for the Long genotype. Likewise, the Long genotype had the highest HPS with 11.65%. Regarding the dimensions of the seeds, the Long genotype had the highest values, with a length of 11.90 mm and a thickness of 4.96 mm, for which it had the lowest NSG value, corresponding to 6.40. With respect to the length of the pods, the Long genotype had 61.56 cm, followed by Short, with 50.35 cm and Retirement, with 42.36 cm.

INTRODUCTION

The excellent export potential of pods and seeds, both fresh and frozen, of snake bean to many countries in the world is affected by the disuniformity that it is obtained in the length, diameter, color and characteristics of the seeds (Benchasri and Bairaman, 2010; Nokkoul *et al*., 2011; Khan *et al*., 2015), mainly because the farmers don't know with certainty the particularities of quality of the pods of each one of the genotypes planted.

It is necessary to characterize the accessions of germplasm, as the first step to obtain genotypes of high productivity and optimal growth in the production areas (Sarutayophat *et al*., 2007; Gul *et al*., 2019), thus achieving a greater scope in the genetic manipulation of this vegetable.

Because the quality of the seeds is a parameter that affects in several ways the growth and development of the crop both in field and storage conditions (Khan *et al*., 2015), the present work had as objectives to know some parameters of the morphological and physiological quality of seeds and pods of three creole genotypes of snake bean with export potential to international markets.

MATERIALS AND METHODS

Location and plant material: The experiment was carried out in the Experimental Horticultural Farm of the Universidad de Córdoba, Colombia from November to December of 2019.

Variables

Germination percentage (GP): A germination test was done with 100 seeds of each genotype, with four repetitions of 25 seeds each, placed in a circular pattern with 15mL of sterile distilled water in 90 mm diameter Petri dishes. Equation 1 was applied.

$$\mathrm{GP} = \frac{\text{number of seeds with emerged radicle}}{\text{number of sown seeds}} \mathrm{x}100 \qquad (1)$$

Absolute velocity of germination (AVG): It was calculated by equation 2, corresponding to the first derivative of the logistic model (*y'*) by the procedure PROC NLIN of SAS software.

$$\mathrm{y}' = (\mathrm{A} * \mathrm{B} * \mathrm{C} * \mathrm{e}^{-\mathrm{Cx}})^2 \ldots\ldots\ldots\ldots(2)$$

Imbibition (I) and absolute velocity of imbibition (AVI): For each genotype four samples of 100 seeds were taken, which were placed in 90 mm diameter Petri dishes, in a circular pattern on filter paper moistened with 15 mL of sterile distilled water. The initial weight *wi* of the seeds of each sample was taken and the magnitude of the weight continued every 2 hours, final weight, *wf* until constant weight was observed. Equation 3 was applied, and the AVI was calculated by equation 2.

$$I(\%) = \frac{wi - wf}{wi} * 100 \qquad (3)$$

Humidity percentage of seeds (HPS): In 10 samples of 100g of seeds of each genotype, the initial weight *(wi)* was taken. The samples were dried in an electric oven at 105°C for 24h and the final weight (*wf*) was taken. Equation 4 was applied.

$$HPS(\%) = \frac{wi - wf}{wi} * 100 \qquad (4)$$

Number of seeds in one gram (NSG): In 10 samples of one gram of seeds of each genotype, the number of seeds present in each sample was counted.

Weight of one hundred seeds (WOS): Weighed 10 samples of 100 seeds of each genotype.

Dry matter of seeds (DMS): Ten samples of 100g of seeds of each genotype were taken and dried in an electric oven at 105°C for 24h.

Length and thickness of pods and seeds, color of the pods and seed coats: In each plantation of each genotype, the length and thickness of the pods and seeds were measured in three randomly selected plants in the three central rows. The color of the pods and seed coats were determined by the Munsell color catalog for plant tissues.

RESULTS AND DISCUSSION

Germination percentage and absolute velocity of germination: A sigmoid graph was obtained (Figure 1). The Long genotype had the highest GP that surpassed the Short and Retirement genotypes (Table 1). The values obtained in the Long genotype surpass that found by Nokkoul *et al*. (2011), who reports a maximum of 91.50% for the Prince of Songkla University genotype. However, the GP can fluctuate between 0 and 83%, which can be taken as indicative of difference of vigor within and between cultivars (Abdullah *et al*., 1991).

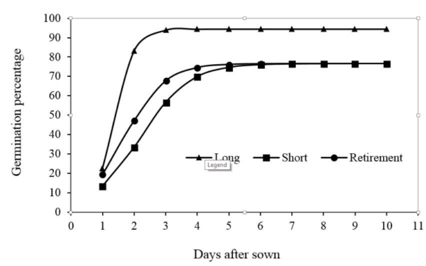


Figure 1: Seed germination percentage of three snake bean genotypes.

Table 1. Comparison of means of germination percentage, weight of 100 seeds, humidity percentage of seeds, dry matter of seeds and of three genotypes of snake bean.

Variable	Genotype		
	Long	Short	Retirement
Germination percentage (%)	94.00±2.31 a	71.00±3.83 b	71.00±3.83 b
Humidity percentage of seeds (%)	11.65±0.09 a	9.56±0.2 b	8.08±0.01 c
Number of seeds in one gram	6.40±0.52 a	7.70±0.48 b	7.60±0.52 b
Weight of 100 seeds (g)	16.02±0.01 a	14.31±0.01 b	14.31±0.05 b
Dry matter of seeds (g)	14.60±0.09 a	11.83±0.03 b	12.57±0.01 c

a,b,c represent means with different letters in a row differed significantly (P< 0.05).

Regarding AVG, the Long genotype had the highest magnitude, noting that more than half of the seeds germinated one day after sowing. Regarding the Short and Retirement genotypes, one day after sowing, they presented AVG values below 15 and 25%, respectively (Figure 2).

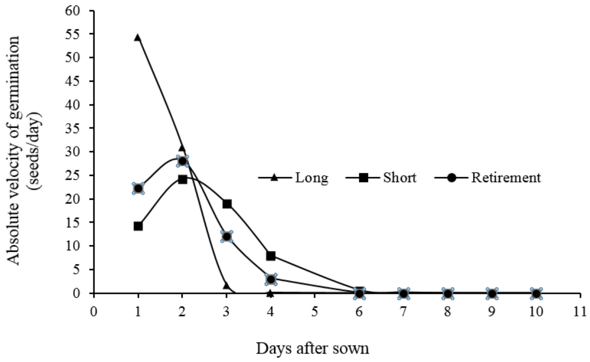


Figure 2: Absolute velocity of germination of three snake bean genotypes.

Imbibition (I) and absolute velocity of imbibition (AVI): it could be observed that as the time elapsed after sowing, the percentage of imbibition of the seeds of the three genotypes increased until it became constant from 18h onwards (Figure 3).

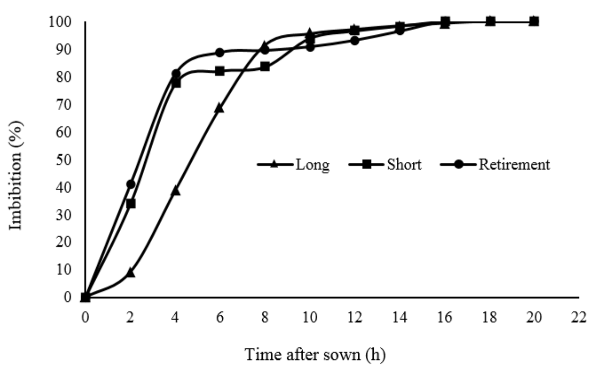


Figure 3: Imbibition of seeds of three snake bean genotypes.

With respect to the AVI, the genotypes Short and Retirement showed the highest AVI at three hours, with a greater magnitude for the case of the Short genotype. The Long genotype reached the highest AVI at 4h after sowing, and its magnitude was lower than that obtained for short and Retirement (Figure 4). The lower GP and the higher AVI observed for the Short and Retirement genotypes are related to the fact that seeds with low vigor present a rapid imbibition of water (Abdullah *et al.*, 1991).

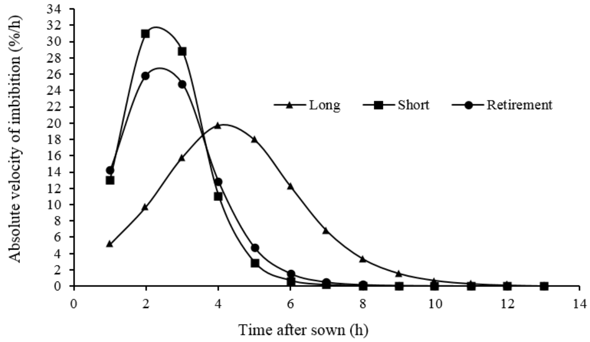


Figure 4: Absolute velocity of imbibition of seeds of three snake bean genotypes.

Humidity percentage of seeds: The highest HPS corresponded to the Long genotype seeds, followed by the HPS values of the Short and Retirement genotypes (Table 1). According to the results, while the seeds of snake beans presented higher HPS, there was also a higher GP and vice versa, and the data obtained agree with those reported for *Glycine max* by Lozano *et al.* (2017).

Number of seeds in one gram: The Short and Retirement genotypes had the greatest magnitude for NSG and were statistically equal to each other. The lowest value of NSG was obtained for seeds of the Long genotype. The seeds of the Long genotype were larger compared to the Short and Retirement genotypes. Therefore, with a larger seed size, the Long genotype had a lower number of seeds in one gram (Table 1).

Weight of one hundred seeds: The Long genotype had the highest magnitude of WOS and surpassed the Short and Retirement genotypes, which presented the same magnitude of WOS (Table 1).

Dry matter of seeds (DMS): The greatest magnitude of DMS was presented with the Long genotype, followed by the Short and Retirement genotypes (Table 1).

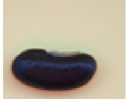
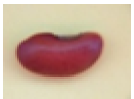
Length and thickness of pods and seeds, color of the pods and seed coats:

The longest pod length was observed for the Long genotype, followed by the Short and Retirement genotypes. Regarding pod thickness, the Short and Retirement genotypes were statistically equal and they were exceeded in magnitude by the Long genotype (Table 2).

With respect to the length and thickness of seeds, the Long genotype surpassed the Short and Retirement genotypes. These two genotypes were equal to each other in what has to do with length and thickness of seeds (Table 2)

The different magnitudes found for the morphological characteristics of pods and seeds confirm that the pressure of selection in this crop has been intense, which has generated large phenotypic differences between genotypes (Lovely *et al.*, 2017; Vaz *et al.*, 2017). It is important to consider that snap bean genetic diversity in regard to the length of pods has suffered a severe loss, since in the search for greater length of pods in cowpea beans to increase yield, it has reached the snake bean that is currently known (Xu *et al.*, 2017).

Table 2. Mean values of length and thickness of pods and seeds of three snake bean genotypes.

Genotype	Pods			Seeds		
	Length (cm)	Thickness (mm)	Color	Length (mm)	Thickness (mm)	Color
Long	61.56±0.90 a	4.95±0.07a	7.5GY 3/6	11.90±0.32a	4.96±0.07a	2.5RP 1/1
						
Short	50.35±0.56 b	3.91±0.11b	7.5GY 3/8	8.60±0.52b	3.95±0.16b	2.5RP 1/1
						
Retirement	42.36±0.78 c	3.89±0.13b	7.5GY 3/8	8.55±0.50b	3.96±0.08b	7.5R 3/6
						

a,b,c represent means with different letters in a column differed significantly (P< 0.05)

CONCLUSION

Important findings of morphological and physiological characteristics of pods and seeds were established through which a wide phenotypic variability can be glimpsed, underpinning a rich genetic base that has favorable prospects for selecting different snake bean materials according to the characteristics of seeds and pods requested by the numerous national and international markets through the varied forms of consumption and tastes of the consumer that presents this important vegetable of great global acceptance.

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