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Effect of Seed Coat Colour on the Seed Quality of Water Melon (Citrullus Lanatus)

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Abstract

Water melon is one of most cultivated vegetable fruit crop in the world. In Kenya the demand for this fruit for both local and export markets outstrips the supply. For Kenya to meet the high demand for water melon, quality seed is paramount since it guarantees high germination rate and vigor and on sequential high crop yields. However, it has been observed that water melon seeds have different seed coat colours even in the same growing season. The aim of this study was to establish to what extent seed colour affects seed viability (measured by % germination) and vigor (measured by absorption of water and electrical conductivity) of water melon (sugar baby variety). The study was conducted at University of Eldoret seed science laboratory. Seeds were obtained from the Kenya Genebank whose colour was determined using Munsell colour chart for plant tissues. Water absorption, electrical conductivity and germination percentage of seeds were determined using recommended methodologies. Complete random design was used and data collected was subjected to ANOVA and Duncan Multiple Range Test (DMRT) test at 5% level of significance using the GENSTAT version 14.2. The correlation between water absorption, germination and electrical conductivity was determined by Pearson Product moment correlation coefficient and regression analysis. It was found that water absorption, germination percentage and electrical conductivity significantly differed between the dark brown, light brown, brown and yellow seeds. Seed quality was highest for dark brown, followed by brown, light brown and finally yellow seeds. There was negative correlation between water absorbed and germination but positive correlation between water absorbed and electrical conductivity. It was concluded that seed companies should consider seed colour as one of the parameter during grading of water melon seeds. This would improve the quality of seed sold to farmers and consequently water melon yields in Kenya.

Keywords: ***Water melon, seed quality, seed colour***

Introduction

Water melon is one of the most cultivated fruit crop (Itoh, 2008) in the world. Its global consumption is greater than any other cucurbit. This fruit originated from West Africa and later spread to the rest of the world. There are over 1200 varieties of water melon worldwide and of these 700 varieties are grown in Africa. Watermelon fruits are nutritious. They contain vitamins such as A, C, B1 and B6; minerals like calcium, potassium, manganese and iron (Issac, 2009). Water melon seeds also contain fats and amino acids, (MNBVC).

In Kenya the popular varieties grown include Sugar Baby, Crimson Sugar, Tom

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Watson and Carleston Grey. They grow well from the mid hot coastal area to the dry eastern plains and hilly midlands. They thrive in areas like Machakos, Kirinyaga, Nyeri, Meru, Isiolo, Kerio valley, Loitoktok and Garissa. In Kenya the demand for this fruit for both local and export markets outstrips the supply. A past study by Amiran Kenya indicates that water melon production in Kenya is stagnant at 600 – 663 000 tons (HCDA, 2006). Production of watermelon therefore needs to be increased (HCDA, 2006). One of the factors that has led to low water melon production in Kenya is poor quality seed that guarantees high germination and vigor and consequently high yields.

Water melon seeds even in the same growing season may have different seed colours (Demir, Mavi & Duncan, 2004). Seed colour in water melon is controlled by genes where a certain colour is dominant over the others. There are 6 base colours (white, yellowish white, reddish brown, reddish orange, black and yellowish green) and 5 patterns. Seven pairs of genes have been proposed to control seed coat colour in water melon. Seed coat affects various factors like water uptake (Desouza & Marcos, 2001), seed dormancy and germination (Baskin, Baskin, Li, 2000). Seed coat colour may indicate the degree of water up take as well as dormancy levels and germination ability. Seed production by various seed companies involves mixing seeds of different colours from the same or different seasons.

Seed quality is the possession of required genetic and physical purity accompanied by physiological soundness and good health status. This paper concentrates on physiological quality which comprises of seed viability and vigor (Bweley & Black, 1994). Seed viability is defined as the capacity of the seed to germinate and produce normal seedling under optimum conditions. Seed vigor is the sum total of those properties of seed which determines the level of activity and performance of the seed or seed lot during germination and seedling emergence under field conditions. Seed viability is measured by germination percentage of the seed under the optimum conditions. Seed vigor is measured using many methods which include electrical conductivity (EC) of the seed (ISTA, 2004). The current study focused on how seed coat colour affects seed quality parameters of percent germination and EC. Moisture absorption was also measured to investigate how it relates to percent germination. This study therefore focused on the relationship between seed colour and seed quality (water uptake, percent germination and electrical conductivity) of sugar baby water melon variety.

Materials and Methods

Source of Seed

Water melon (Sugar baby variety) seeds were obtained from gene bank at Mugaga, Kenya. Seed colour was determined using Munsell colour chart for biological tissues. Four seed colours were identified: dark brown, light brown, brown and yellow.

Study Area

The experiments were carried out in the University of Eldoret Seed Science Laboratory.

Germination Experiment

The experiment was a completely randomized design with 100 seeds for each seed colour (dark brown, light brown, brown and yellow) which were divided into 4 replicates of 25 seeds each. The seeds were put on 3 filter papers moistened with distilled water and placed in Petri dishes. All the petri dishes were then placed in a growth chamber set at 250C and 70% relative humidity as recommended by ISTA, (2004). The substratum was kept moist by addition of small amount of distilled water every 2 days. Number of seeds that germinated was counted and recorded daily. This was done for 14 days.

Electricity conductivity. The experiment was a CRD with 3 replicates of 30 seeds each for the four seed colours (dark brown, light brown, brown and yellow). The seeds were placed in a beaker containing 50 ml of deionized water. The beakers were then placed in an incubator set at 250C for 12 hours. Specific conductivity in each of the beakers was measured using electrical conductivity meter.

Water absorption experiment. A sample of 10 seeds from each of seed colour was weighed on the electrical balance and initial weight noted (W1). The weighed seeds were placed on 3 filter paper moistened with distilled water. After 24 hours the final weight (W2) was measured for each sample. Water absorbed was determined by formulae: W2-W1 = water absorbed. This process was replicated 3 times for each seed colour.

Data Analysis

Each of the parameters (germination percentage, electrical conductivity and moisture absorbed) was subjected to one way Analysis of Variance (ANOVA) as far as the seed colour is concerned. The means were separated by Duncan Multiple Range Test (DMRT) at 5% level of significance using GENSTAT version 14.3. Regression and correlation analysis was done using Excel package to investigate the relationship between the 3 parameters (germination percentage, electrical conductivity and moisture absorbed) for the different coloured water melon seeds.

Results and Discussion

There was significant difference between seed lots as far as percent germination, electrical conductivity and water absorbed was concerned at $P<0.05$ (Table 1). The dark brown coloured seed lot had the highest percent germination followed by brown then by light brown and lastly yellow. Dark brown seeds also had the lowest EC and moisture absorption followed by brown, light brown and yellow seeds (Table 1). This indicates that dark brown seeds had undergone less deterioration compared to the other seed lots. Seed deterioration causes cellular membranes lose their selective permeability, permitting the cytoplasmic metabolites to leach into the intercellular spaces. This results in high values of electrical conductivity. Deterioration also causes mitochondrial changes, chromosomal aberrations and free radicals in seed lots (Mavi, 2010). Seed vigor therefore decreases with an increase in electrical conductivity.

Table 1 *Germination, Electrical Conductivity and Moisture Absorption of Different Coloured Water Melon (Sugar Baby Cultivar) Seed Lots*

Seed Lot	Percent Germination	Electrical Conductivity	Moisture
Brown	77.33 b	0.50 a	0.043 b
Light	69.33 c	0.80 b	0.056 c
Yellow	60.33 d	0.90 b	0.059 c
Mean	72.83	0.675	0.046
Probability	<0.01	< 0.04	<0.01
S.E	3.317	0.118	0.00481
S.E.D	2.708	0.0913	0.00393
% CV	4.6	16.6	10.4

Similar results have been found for rape seed. Seed lots having red and black seed coat were found to have higher melanin pigment and slow water uptake, low electrical conductivity value and high tolerance to slow water uptake. In yellow-coloured seeds with low melanin content and faster water uptake were observed (Zhang et al. 2006, Zhang et al. 2008).

Table 2 *Correlation between Moisture absorbed, Electrical Conductivity and Percent Germination*

	Pearson Product movement Correlation Coefficients		
	Moisture Absorbed	**Mean Germination**	**Electrical Conductivity**
Moisture Absorbed	1.0		
Mean Germination	-0.8	1.0	
Electrical Conductivity	1.0	-0.8	1.0

There was a strong correlation between moisture absorbed and percent germination. As the seeds absorbed more moisture, the percent germination reduced. This could be due to imbibition injury associated with high and fast absorption of water. Fast and high absorption of water causes food assimilates needed for germination leach out of the seed compromising germination (Bweley & Black, 1994). Percent germination also reduced as electrical conductivity increased (Table 2). This indicated that membrane degradation and other cellular damage had occurred in the seed lots. Colour of seed coat therefore can be used to indicate seed quality of the water melon.

Regression (R) Analysis

In Figure 1, y = -595x + 100.3; R2 =0.705. R2 was positive indicating that percent germination decreased as moisture absorption increased. This can be attributed to imbibition injury caused by excessive absorption of water during germination (Bweley & Black, 1994).

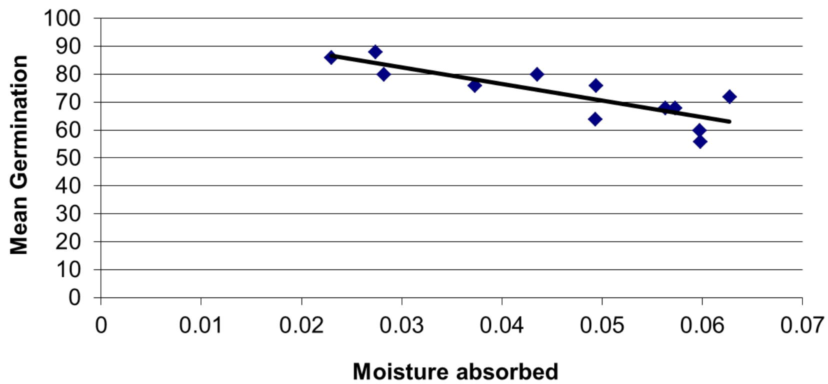

Figure 1. *Regression analysis of % germination and moisture absorbed by different coloured seed lots of water melon*

In Figure 2, y = -38.44x + 98.78; R2 = 0.648. Positive R2 between percent germination and electrical conductivity indicated that percent germination decreased as electrical conductivity increased.

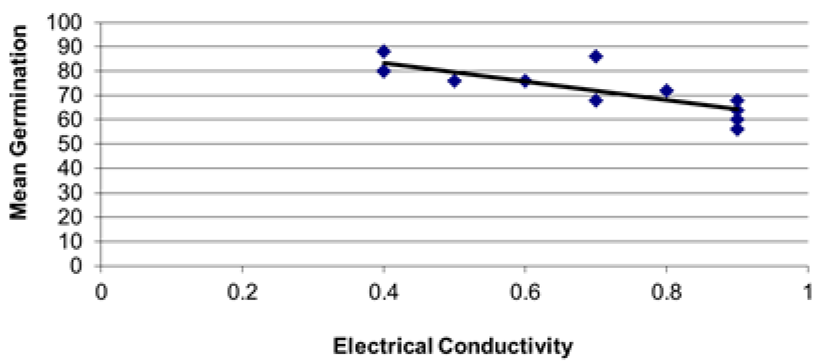

Figure 2*. Regression analysis of percent germination and electrical conductivity of different coloured seed lots of water melon*

In Figure 3, y = 10.61x + 0.185; R2 =0.510. As moisture absorbed increased electrical conductivity also increased. Both variables are measures of seed vigor.

Seed lot with high absorption rates also leak a lot of electrolytes. Seed quality (viability and vigor) of such a seed lot is low.

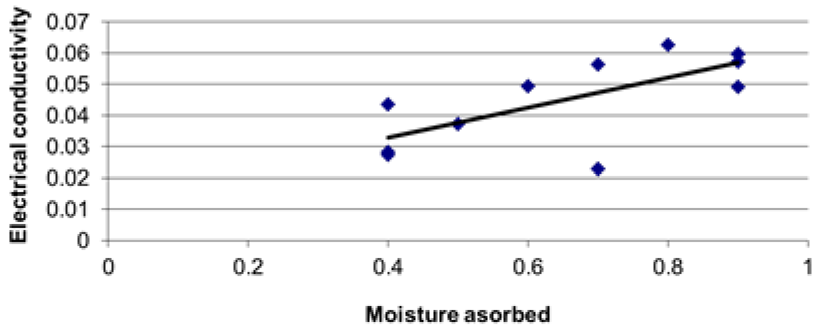

Figure 3. *Regression analysis of electrical conductivity and moisture absorbed by different coloured seed lots of water melon*

Conclusion

Percent germination significantly differed among the different coloured seeds with the dark brown seed showing the highest germination. Electrical conductivity and water absorption also significantly differed among the different seed lots. Brown coloured seeds had the lowest electrical conductivity and water absorption and therefore the highest seed vigor. The current study therefore recommended that seed companies should grade water melon seeds (Sugar baby var.) according to colour. This would ensure high quality seeds get to the farmers and therefore enhance production of water melon. For areas with less moisture the high moisture absorbing seed (yellow and light brown) can be planted.

References

Baskin, J., Baskin, C., & Li, X. (2000). Taxonomy, anatomy and evolution of physical dormancy of seed. *Plant Species Biology*, 15. 139-152.

Bweley, J. D., & Black, M. (1994). *Seeds: Physiology of development and germination*. 2nd Edition. New York: Plenum Press

Demir, I., Mavi, T., & Duncan, G. (2004). Changes in germination and potential longevity of water melon seeds during development. *Journal of New Zealand of Crop and Horticultural Science,* 13 (4).43-8.

Desouza, F., & Marcos, J. (2001). Seed coat s a modulator of environment relationship in Fabacaea. *Journal of Revista de Botanica*, 4 (31). 88-97.

HCDA. (2006). Fruit and vegetable horticultural crop development authority. *Technical Bulletin*.

Issac, M., (2009). Nutritional value of vegetable fruit. *Journal of Food and Nutrition of Africa*.

ISTA. (2004). *Seed science and technology*. Zurich, Switerland: The International Seed Testing Association.

Itoh, P. (2008). Vegetable fruit overview. *Journal of Horticultural Produce*.

Mavi, K. (2010). Relationship between seed coat colour and seed quality in watermelon crimson sweet. *Hort. Sci.* Vol. 37, No. 2. 62–69.

Zhang, X. K., Yang, G. T., Chen, L., Yin, J. M., Tang, Z. L., & Li, J. N. (2006). Physiological differences between yellow-seeded and black seeded rapeseed (Brassica napus L.) with different testa characteristics during artificial ageing. *Seed Science and Technology,* 34. 373–381.

Zhang, K., Wang, Z., & Chen, L. (2008). Imbibition behavior and flooding tolerance of grape seed with different testa colour. *Genetic Resources Crop Evolution.* 55. 1175-84.

