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SEED PROPERTIES OF THREE PROMISING EGYPTIAN SUGAR BEET GENOTYPES.

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ABSTRACT

Sugar beet breeding program started in Egypt during the last two decades of past century by several Egyptian investigators and breeders, the data was very encouragement. There were three promising multigerm Egyptian sugar beet genotypes (Eg. 6 , Eg. 26 and Eg. 27) have showed good root weight and good sugar percentage at several studied locations. The goal of any sugar beet breeding program is to develop varieties with higher root yield and higher sugar content, better extraction yield (juice purity), higher seed germination percentages, lower tendency to “bolt” and higher resistance to diseases and pests.

The objective of this study was to investigate seed properties of the three promising Egyptian sugar beet genotypes (Eg. 6, Eg. 26 and Eg. 27). Seed samples were divided into five fractions according to their size (<3.35, 3.35, 4.0, 5.6 and 6.3 mm). The data cleared that "Size 3 = 4.0 mm" the most abundant size in all studied samples with average (70.0, 71.1 and 58.5%) in (Eg. 6, Eg. 26 and Eg. 27), respectively. Hundred seed Weight (2.86, 2.90 and 2.54 g), while unit seed Weight values were (0.028, 0.029 and 0.027 g) for (Eg. 6, Eg. 26 and Eg. 27), respectively. Germination percentage, faster germination and seedling vigor were the best in large seed size compared with small seed size.

INTRODUCTION

Sugar content remains generally the most important property in sugar beet breeding, but breeders have really shifted their focus on to seed quality following the introduction of genetically monogerm seed in the early 1970s. Physical properties of kernels, grains, and seeds have been studied by several researchers in recent years, (Baryeh 2002; Özarslan 2002; Aydin 2003; Sacilik *et al.,* 2003; Vilche *et al.,* 2003; Amin *et al.,* 2004; Paksoy and Aydin, 2004 and Haciseferogullari *et al.,* 2005).

Sugar beet seeds provided for growers for commercial production need to be highest biological quality, uniformity and good seed vigor to ensure rapid seedling growth to avoid pest and diseases and allow the crop to compete effectively with weeds. Rapid seedling development is also important to establish leaf area, provide early leaf cover to fully intercept incident radiation and maximize crop dry matter and sugar production.

In sugar beet Kasap and Altuntas (2006) studied physical properties of sugar beet varieties such as (unit seed Weight, thousand-seed Weight, bulk density, true density, seed volume, angle of repose, and coefficient of friction on various surfaces).

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They found that the average unit seed mass and 1000-seed mass in monogerm sugar beet varieties ranged from 0.0117 to 0.0133 g and from 10.77 to 12.00 g, as the moisture content increased from 8.55% to 17.14%.

Rajic *et al.* (1998) examined the genetic control of characters determining seed viability and vigor of seed and seedling in sugar beet. Six characters including percentage of germination, seedling establishment, weight of 1000 germs, seedling vigor, speed of germination, and monogermity (monogerm seeds produced by multigerm plants) Sadeghian and Khodaii (1998) studied the effects of cutting back flowering stems on seed yields and seed size in sugar beet. They reported that both studied treatments (cutting the stem down to 15 cm) and (cutting down to 30 cm) produced a significant increase in seed yield and increased the proportion of smaller seeds (<3.5 mm).

The aim of this study was to investigate seed properties of the three promising Egyptian sugar beet genotypes (Eg. 6 , Eg. 26 and Eg. 27) to provided for growers for commercial production in highest biological quality, uniformity and good seed vigor.

MATERIALS AND METHODS

1. Sugar beet materials:

Sugar beet multigerm seeds used in this study were obtained from Egyptian Sugar Beet Breeder Team, El-Sabahia, Agricultural Research Station, Alexandria. Sugar Crop Research Institute, Agricultural Research Center, Ministry of Agriculture, Egypt.

2. Methods:

In the present study sample seed of the three promising multigerm Egyptian sugar beet genotypes were divided into five fractions according to ISO/DIS 7256/1.

Sugar beet seeds, according to ISO/DIS 7256/1, are specified for single-purpose (monogerm) and multi- purpose (multigerm) drills.

For multi- purpose drills they are differentiated between

Type a: medium round seed 3± 0.75 mm;

Type b: small seed of regular shape of diameter less than 3 mm;

Type c: large irregular seed of diameter greater than 6 mm;and

Type d: most difficult seed permitted by the manufacturer (e.g. unpelleted genetically monogerm beet seed).

2.1. Seed fraction:

Seed bulk of the three examined genotypes (Eg. 6, Eg. 26 and Eg. 27) were divided into 5 fractions according to their size (<3.35, 3.35, 4.0, 5.6 and 6.3 mm), the initial 100 seeds, weight of these genotypes were 2.74, 2.30 and 2.14 g. with c.v. % (10.0, 18.9 and 9.9) for Eg.6, Eg.26 and Eg.27 genotypes, respectively according to Saleh *et al*. (2008).

Figure 1 illustrates the five sizes of sugar beet examined seeds. Two different experiments were used to study seed properties for the three examined sugar beet genotypes in Petri dishes and germination trays (Figure 2).

2.2. Petri dishes experiment:

Seeds of the three sugar beet examined materials (Eg. 6, Eg. 26 and Eg. 27) were soaked in running tap water for twenty four hours and then were planted on moistened filter paper in Petri dishes (each Petri dish contains 100 seeds). Three replicates were used. Sugar beet seeds were allowed to germinate at 23º C in an incubator. The germinated sugar beet seeds were counted and germination percentages were recorded after every four days at three periods and monogermity were measured also.

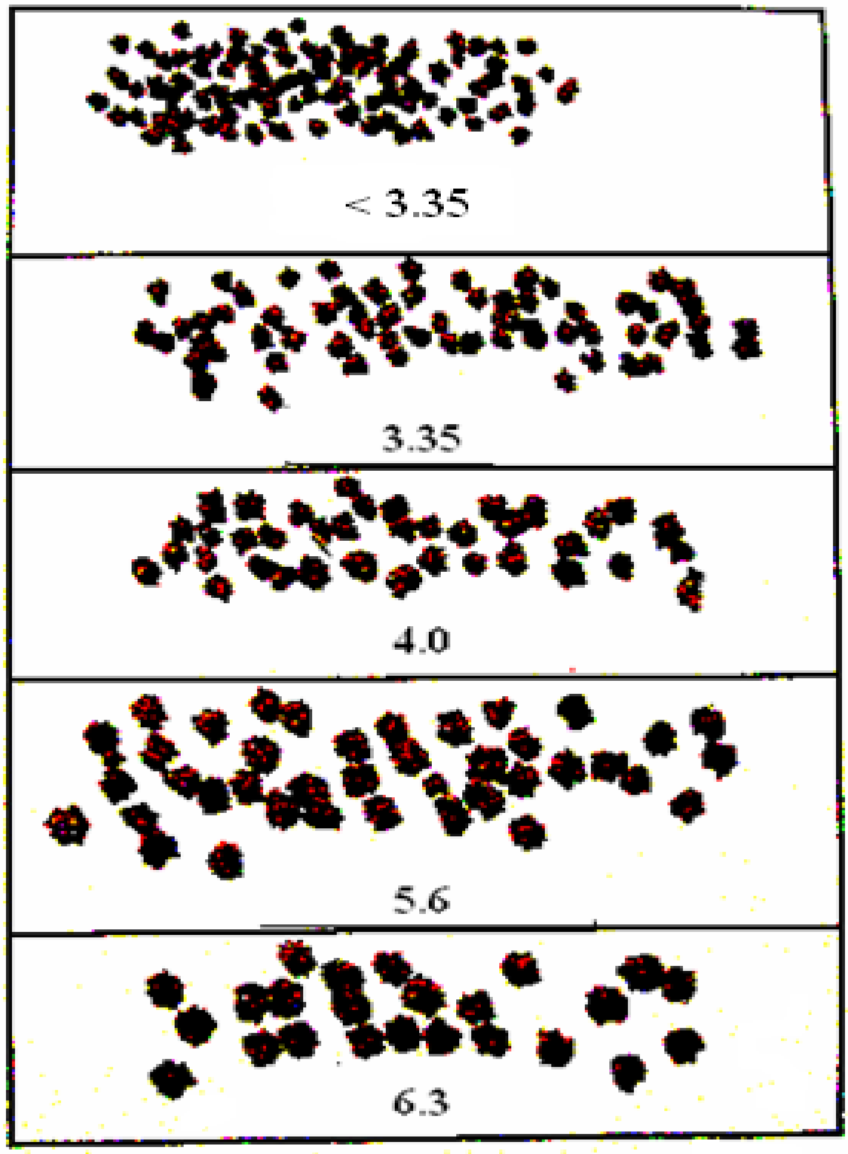

Fig. 1: Different sizes of sugar beet seeds.

Fig.(2): Seed germination (a) in Petri dishes, (b) in germination trays and (c) seedling weight.

2.3. Germination trays experiment:

Seeds of the three examined sugar beet materials were planted in germination trays to study germination percentage and monogermity at the field conditions. Sugar beet seeds were allowed to germinate at open weather. Germinated seeds were counted and germination percentages and monogermity were measured.

2.4. Studied characters:

a. Seed characters

- Size average in bulk %.
- 100- seed Weight.
- Unit seed Weight.
- Ability to absorb water.

b. Germination characters:

- Germination percentage.
- Germination speed.
- Monogermity percentage.
- Seedling vigor.

The unit seed mass, 100- seed weight and seedling weight were measured with a digital electronic balance with an accuracy of 0.0001 g (Carman, 1996 and Sacilik *et al*., 2003).

2.5. Statistical analysis

The experimental design was performed in Randomized Complete Block Design (RCPD) with three replicates, and the data were analyzed according to (Snedecor and Cochran, 1990).

RESULTS AND DISCUSSION

1. Seed characters:

Seed samples of the three examined genotypes were divided into five fractions according to their size (<3.35, 3.35, 4.0, 5.6 and 6.3 mm). Each size was measured and the average was calculated, Table 1 shows average of each size in the sample. The data showed that "Size 3" = 4.0 mm" was found the most abundant size in all studied samples with an average of (70.0, 71.1 and 58.5%) in (Eg. 6, Eg. 26 and Eg. 27), respectively.

Hundred seed Weight data in Table 1 proved that "Size 3" had values of (2.86, 2.90 and 2.54 g), while unit seed Weight values were (0.028, 0.029 and 0.027 g) for (Eg. 6, Eg. 26 and Eg. 27), respectively. The method of selecting viable sugar beet seed from a mixture of viable and non-viable seeds, viable seeds absorb much water when immersed in water and expand appreciably, while non-viable seeds expand only slightly because less water is absorbed. Table 1 represents imbibed 100 seed Weight /g; the data indicated that all five sugar beet seed Egyptian size absorbed water twice their weight, indicating that all studied sizes were viable.

Table 2 represents seed size and weight of four commercial varieties (Glorius, Toro, Farida and Despreze) the data cleared that seed size of (Glorius and Toro) was 4.0 mm, while for (Farida and Despreze) it was 5.6 mm. Hundred seed Weight was found (1.54, 1.62, 2.17 and 2.82 g), while unit seed mass was (0.015, 0.016, 0.024 and 0.029 g) for (Glorius, Toro, Farida and Despreze), respectively. Comparison with sugar beet commercial varieties based on hundred seed Weight and unit seed mass of Egyptian sugar beet genotypes was proven to be superior compared with commercial varieties.

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Table 2: Seed size and weight of four sugar beet commercial varieties

Varieties	Size	100- seed mass	Unit seed mass
Glorius	4.0 mm	1.54 gm	0.015 gm
Toro	4.0 mm	1.62 gm	0.016 gm
Farida	5.6 mm	2.17 gm	0.024 gm
Despreze	5.6 mm	2.82 gm	0.029 gm

2. Germination characters:

Germination characters (germination percentage, monogermity and seedling vigor) were studied. Table 3 represents the data germination, monogermity and germination percentage at three periods (speed of germination). The data indicated that percentages of total seed germination were associated with seed size, the lower seed germination percentage was found in small seed size (1 and 2) at all studied genotypes. Best germination percentages were found in the large seed size. There were negative correlation between monogermity and seed size, highest values of monogermity was found in (size 1), while lowest one was found in large seed size.

Table 3: Germination percentage and monogermity in petry diches at three periods (four days per period)

Genotypes	Size	Germination percentage				Monogermity %
		Period I	**Period II**	**Period III**	**Total**	
Eg. 6	1	20.7	8.7	3.3	32.7	97.0
	2	59.3	14.7	3.3	77.3	87.5
	3	83.3	9.3	0	92.6	38.6
	4	94.7	2.7	0	97.4	13.6
	5	89.7	2.3.5	0.2	92.7	10.1
Eg. 26	1	47.3	13.3	1.3	61.9	88.1
	2	80.0	4.7	0.7	85.4	69.0
	3	86.0	4.7	2.7	93.4	41.6
	4	94.7	0.7	0	95.4	16.9
	5	95.3	0.7	0	96.0	6.5
Eg. 27	1	35.3	12.3	0.7	48.3	97.1
	2	73.3	9.3	0	82.6	76.5
	3	88.7	4.7	0.7	94.1	43.0
	4	92.0	5.5	0	97.5	11.9
	5	94.7	1.0	0	95.7	12.0

After first four days germination percentages of large seeds (size 3, 4 and 5) completed most of its germination in period one, while small seed (size 1 and 2) completed its germination after 12 days at third period, which meaning large seed faster in germination.

Table 4 illustrates the data of seed germination percentage and monogermity in germination trays, the data showed the same direction of data whereas larger seeds produced the best germination percentages, faster germination and highest percentages of multigerm seeds.

Table 4: Germination percentage and monogermity in germination trays

Genotypes	Germination percentage %				
	Size 1	**Size 2**	**Size 3**	**Size 4**	**Size 5**
Eg. 6	33.0	77.8	72.2	77.8	93.9
Eg. 26	22.2	27.8	61.1	66.7	87.9
Eg. 27	38.9	77.8	72.2	83.3	78.8
Monogermity %					
Eg. 6	91.4	86.7	23.3	45.0	5.4
Eg. 26	100.0	66.7	45.0	50.0	7.0
Eg. 27	100.0	86.0	44.4	33.3	6.7

To detect seedling vigor in the five studied seed size categories the seedlings were weighted after 20 days from planting and the data are given in Table 5. These data indicated that there were significant differences between the three studied genotypes and between five seed size in seedling weight, these data are in agreement with that reported by Mukasa and Ogata (2001) who studied the relationship between early growth and seed characters in 69 three-way crossed hybrid lines and three cultivars of sugar beet.They found that in all plants examined, total dry weight of the plants in the early growth period tended to be larger with heavier seed weight and shorter average germination period. The effect of germination period on early growth was larger than that of true seed weight on the basis of standard deviation and the true seed weight mainly affected the growth at the very early growth period. Burris *et al.(*1971and 1973) Hopper *et al*.(1979) reported that larger soybean seeds produced larger embryos and exhibited higher respiratory rates, faster germination and greater emergence potential than smaller seeds.

Table 5: Mean of seedling weight after 20 days from planting in germination trays .

Genotypes	Size					
	Size 1	**Size 2**	**Size 3**	**Size 4**	**Size 5**	**Mean**
Eg. 6	0.138 abc	0.123 bcd	0.135 abc	0.155 a	0.147 ab	0.140 a
Eg. 26	0.115 cde	0.112 cde	0.102 def	0.125 bcd	0.122 bcde	0.115 b
Eg. 27	0.065 g	0.081 fg	0.094 ef	0.100 def	0.100 def	0.088 c
Mean	0.1061 b	0.105 b	0.110 ab	0.126 a	0.123 a	

Conclusion:

Good seed quality is the result of successful interaction between seed breeding, seed multiplication and seed processing. Breeding selects the required genes. Multiplication ensures that the raw materials are produced under optimum, controlled conditions, whereas processing includes subsequent cleaning, sorting, pelleting and coating of commercial seeds. In the present work if sugar beet breeding program can be shifted seed size to (5.6 mm) in the future the data well be expellant.

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خصائص البذرة لثلاثة تراكيب وراثية مصرية مبشرة من بنجر السكر

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بدأ برنامج تربية بنجر السكر فى مصر فى العقدين الأخيرين من القرن الماضى بواسطة العديد من الباحثين والمربين المصريين وقد تم الحصول على نتائج مبشرة فى هذا المجال. حيث تم الحصول على ثلاثة طرز وراثية عديدة الأجنة من بنجر السكر ذات مواصفات محصولية جيدة وتتميز بإعطاء وزن جذرمناسب بالإضافة إلى نسبة سكر عالية وهذه الطرز الوراثية الثلاث هى: (مصرى ٦ ، مصرى ٢٦ ، مصرى ٢٧)

أن أى برنامج تربية لبنجر السكر يهدف فى الأساس للحصول على أصناف عالية فى المحصول ونسبة السكر و نسبة النقاوة (نسبة السكر المستخلص) بالإضافة إلى جودة البذور ونسبة إنبات عالية وأيضا نسبة تزهير كاذب قليلة وقدرة عالية على مقاومة الآفات والأمراض.

وفى هذه الدراسة تم دراسة مواصفات البذور للتراكيب الوراثية المصرية الثلاث المبشرة حيث تم أخذ عينة من بذوركل تركيب وراثى من التراكيب الوراثية الثلاث وتم غربلتها بغرابيل قياسية وذلك لتدريج العينة الواحدة من البذور إلى خمسة أحجام قياسية مختلفة وهى (أقل من ٣,٣٥، ٣,٣٥ ، ٤,٠ ، ٥,٦ ، ٦,٣ مم) وقد تم حساب نسبة وجود كل حجم من أحجام البذور بالنسبة للعينة الأصلية وأوضحت البيانات أن أكبر نسبة تواجد كانت (للحجم الثالث = ٤,٠ مم) وذلك فى التراكيب الوراثية الثلاثة وكانت نسبة تواجد هذا الحجم (٧٠,٠ – ٧١,١ – ٥٨,٥ %) للتراكيب الثلاثة (مصرى ٦ ، مصرى ٢٦ ، مصرى ٢٧) على الترتيب. وقد كانت أوزان مئة بذرة (٢,٨٦ ، ٢,٩ جم) بينما كان وزن البذرة الواحدة (٠,٠٢٨، ٠,٠٢٧، ٠,٠٢٩ ، ٢,٥٤جم) للتراكيب الوراثية الثلاثة على الترتيب.

وعند دراسة نسبة الإنبات وجد أن نسبة الإنبات كانت أفضل بالنسبة للأحجام الكبيرة مقارنة بالأحجام الصغيرة وكذلك أيضا سرعة الإنبات و نسبة البذور التى أعطت أكثر من بادرة كانت أفضل فى الأحجام الكبيرة للبذرة مقارنة بالأحجام الصعيرة, وذلك فى كل من تجارب أطباق بترى أو صوانى الإنبات.

قام بتحكيم البحث

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Table 1: Seed size and weight of three Egyptian sugar beet genotypes

Genotypes	Eg. 6					Eg. 26					Eg. 27				
Size	**Size 1**	**Size 2**	**Size 3**	**Size 4**	**Size 5**	**Size 1**	**Size 2**	**Size 3**	**Size 4**	**Size 5**	**Size 1**	**Size 2**	**Size 3**	**Size 4**	**Size 5**
Code	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315
Size by mm	< 3.35	3.35	4.0	5.6	6.3	< 3.35	3.35	4.0	5.6	6.3	< 3.35	3.35	4.0	5.6	6.3
Average in bulk %	1.5	4.5	70.0	20.1	3.9	4.7	8.1	71.1	13.4	2.7	13.3	20.0	58.5	7.1	1.1
100- seed mass g	0.85	1.53	2.86	4.59	5.81	0.86	1.44	2.90	4.33	5.76	0.93	1.65	2.54	4.97	6.13
Imbibed 100 - seed mass g	2.18	3.48	4.57	8.76	12.1	2.11	3.14	4.66	8.73	12.3	2.10	3.24	4.68	8.61	12.7
Unit seed mass g	0.009	0.015	0.028	0.045	0.059	0.009	0.015	0.029	0.041	0.061	0.009	0.017	0.027	0.050	0.062