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SEED QUALITY IN RELATION TO GERMINATION, GROWTH AND YIELD OF BEAN I- GERMINATION

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ABSTRACT :*The primary objective of this study was to determine the effect of seed quality on some of the processes associated with bean seed germination and seedling growth of several seed weight classes in a laboratory study during two seasons (2005 and 2006). The seed lot of bean (cv. Giza 3) was manually separated into three classes according seed weight as follows: ungraded class; as a control (37.70-42.85 g 100^{-1} seeds; in 2005 season) and (40.02-49.81 g 100^{-1}seeds; in 2006 season), light class (33.79-38.02 g 100^{-1} seeds; in 2005 season) and (34.39-37.13 g 100^{-1}seeds; in 2006 season), and heavy class (47.20-57.60 g 100^{-1} seeds; in 2005 season) and (48.75-57.13 g 100^{-1}seeds; in 2006 season). Germination%, quality index (QI), vigor index (VI), radical length, hypocotyl length, fresh and dry weights of embryonic axes were recorded. Also, water uptake%, electrical conductivity of leaked materials (EC), quality and quantity of materials leaked from each seed class; Na, K, P_i, free amino acids, sugars and A°260 and A°280 absorbing materials were measured as indicators of seed quality and seedling vigor potential. The obtained results indicated that: High-weight class of bean seeds usually exhibited faster and more uniform rates of radicle emergence (as an indicator of germination) than low-weight and control ones. Seedling produced from heavier seeds had greater rates of QI, VI, length of radical hypocotyl and accumulation of fresh and dry weights than those from light seeds. The water uptake%, EC and the quantity of materials leached from the seed (Na, K, P_i, sugars, free amino acids and A°260 and A°280 absorbing materials) during imbibition were inversely related to seed weight. It is suggesting that interferences existed during seed development or deterioration had occurred in the low weight seed.*
Hence, the results obtained suggest that the weight-seed separation of *bean may enable for significantly improved germination and seedling growth. Also, may be used in breeding and seed-increase programs to select high quality planting seed for performance evaluations of bean.*

Keywords: *Bean, Seed quality, germination, vigor*

INTRODUCTION

Seed quality is one of the most important factors affecting the performance and productivity of most agricultural crops (Abdul-Baki and Anderson, 1973; Brakke and Gardner, 1987 and Gadallah, 2000). Seeds of many horticultural crops have been separated by size, weight, density and colour (Smittle *et al.*, 1976 and Smittle, 1982). Separation by seed weight offer a mean of improving germination, seedling growth and/or yield for many crops. (Smith and Camper, 1975 and Smittle, 1982). Most research has indicated that the larger the seed, the better germination and subsequent rate of growth (Maranville and Clegg, 1977 and Qiu and Mosjidis, 1993). Although not all the responses are the same between crops, the balance of the evidence supports the use of the larger (heavier) seed within a given genotype (Burris *et al.*, 1973).

Therefore, one of the basic problems confronting the seed industry is being able to separate the high quality seed within a given seed lot. Sufficient information is not available to accurately define the relationship of plant seed quality to the resulting bean seedlings. Accordingly, the present study sought to determine whether seed quality (of several seed lots differing in seed weight) could be used to improve germinability of bean.

MATERIALS AND METHODS

A laboratory study was conducted over 2 years in Fac. Agric., Fayoum Univ., Egypt. Seeds of bean (*Phaseolus vulgaris* L. cv. Giza 3) used in this study were produced by Ministry of Agriculture, Egypt. The original seed lot was manually separated into two seed quality (expressed as seed weight) classes identified: light and heavy. A portion of the original seed lot was retained to serve as ungraded class (control). The seed index (g 100^{-1} seeds) was determined for each seed class as a follows:

1-control (37.70-42.85 g; in 2005 season) and (40.02- 49.81 g; in 2006 season).

2-Light class (33.79-38.02 g; in 2005 season) and (34.39-37.13 g; in 2006 season).

3- Heavy class (47.20-57.60 g; in 2005 season) and (48.75-57.13 g; in 2006 season).

On 28 February of each season; control, light and heavy seeds were used in this study to determine the relationship between seed quality and germinability of bean. The seeds of each class with visibly damaged and immature seeds were removed.

1. Seed quality measurements.

1.1. Germination%.

The suitable seeds (uniform and free from visible damage) were surface-disinfected for 30 seconds in 0.3% Rizolex-T50 (0-2,6-dichloro-4-methyl phenyl 0,0-dimethyl phosphorothioate) solution (w/v), then washed thoroughly with distilled water. Four hundred seeds in eight replicates for each weight class were allowed to germinate using paper rolls method as described by the International Rules for Seed Testing (ISTA, 1966) in a darkened incubator at a constant temperature of 20°C. The replicates from each class, were arranged in a complete randomized design. Germination% was monitored at 24h interval for 144h after sowing. Visible radicle protrusion was considered as a criterion for germination.

1.2. Quality index (QI).

QI was carried out according the rules of ISTA (1966). This index provides information about the distribution of germination events over time.

1.3. Vigor index (VI).

VI for each class was established by multiplying germination% by length of the hypocotyl plus radicle at the end of germination period (144h) as mentioned by Abdul-Baki and Anderson (1973). This index was used as an indicator for providing information about the strength of seedling growth.

2. Seedling growth measurements.

Seedling growth measurements were recorded after 48, 72, 96, 120 and 144h from sowing. Ten seedlings replicate^{-1} were used for each class. At each time of the sampling, seedlings were separated into embryonic axes and cotyledons. The following measurements were carried out.

2.1. Length of seedling.

Ten embryonic axes were taken from each replicate for each class to determine their mean length after 48, 72, 96, 120 and 144h of germination. The length of both radicle and hypocotyl was also individually recorded for the 144 old seedlings.

2.2. Fresh and dry weights.

Fresh and dry weights of thirty embryonic axes of germinated seeds were recorded (immediately after sampling) from each replicate for each class. Fresh weights were determined immediately after sampling. These materials were dried at 70°C till constant weights were attained, then dry weight was obtained. The fresh and dry weights of both radicle and hypocotyl were also individually recorded for the seedlings after 144h. The dry material was ground in a mill for chemical analysis.

3. Water uptake and solute leakage measurements.

One hundred of uniform seeds and free from visible damage from each class were selected. The seeds were soaked in 100 ml of distilled water in a 250 ml beaker and allowed to leak for 8h at constant temperature of 20°C. Temperature was maintained during imbibitional period by immersing beakers with seeds into a thermo-regulated water bath. The experimental layout was complete randomized design with five replicates. Samples for water uptake and leakage analysis were taken at 1h interval up to 8h to quantity the rate of both water entry and solute efflux from seeds during imbibition. At each time of sampling (1h), the steep water was decanted from the seeds for analysis and the seeds were quickly blotted dry on filter paper and weighed to determine water uptake (as a percentage increase in initial fresh weight).

Also, electrical conductivity (EC) of the leakage was estimated ($dSm^{-1}100^{-1}$ seeds) using a conductometer model LF-91 (Eijkelkamp Co., The Netherlands). Sodium and potassium (mg 100^{-1} seeds) were quantified with flame photometer (Gallenkamp Co., England). Inorganic phosphate (mg 100^{-1} seeds) was determined according to Chen *et al.*, (1956). Total nitrogen (mg 100^{-1}seeds) was measured by micro-kjeldahl procedure (AOAC, 1990). Free amino acids (mg 100^{-1} seeds) were quantified with ninhydrin method (Rosein, 1957), using glycine as a standard. Total sugars (mg 100^{-1} seeds) were estimated according to phenol-sulphoric technique (Dubois *et al.*, 1956), using glucose as a standard. Measurements of leakage absorbing UV light at A°260 and A°280 due to protein and nucleic acids were estimated (Duke *et al.*, 1983).

Statistical analysis.

All obtained data were statistically analyzed according to the design used; a complete randomized design (Snedecor and Cochran, 1980). The least significant difference test (LSD) at 0.05 level was used to verify the difference between treatments mean.

RESULTS AND DISCUSSION:

1. Seed index.

Seed index was significantly varied among the seed classes of bean (Table 1). The heavy class seeds were the best whereas the light class seeds were the worst. Thus, a manual separation of bean seeds has strong effect on seed index.

2. Germination%.

Data in Table (1) show that germination% increased gradually as germination proceeded for different seed classes of bean. Germination% significantly differed among seed classes. It is also clear that during germination period, the highest percentage of germination was recorded by the heavy seeds class as compared to that of control and light classes. Thus, the heavy seeds showed an increase in the germination% by 27.59%, 15.66%, 9.62%, 8.64% and 9.41% above that of control seeds class and by 76.19%, 77.78%, 47.41%, 12.82% and 17.72% above that of light seeds class after 48, 72, 96, 120 and 144h of germination in the first season, respectively. In the second season, the increases were: 21.31%, 27.78%, 5.06%, 5.41% and 13.20% above that of control seeds class and by 117.65%, 168.83%, 35.51%, 25.36% and 22.93% above that of light seeds class after 48, 72, 96, 120 and 144h of germination, respectively. These data strongly suggest that separation of bean seed by weight is desirable for maximizing germination. This result may be due to that nutrient reserves are greater for the heaviest seed and would support germination to better extent. In this respect, heavy seed showed a high germination% and early vigorous seedling growth as compared with light seeds (Gray and Steckel, 1986; Naylor, 1993 and Bredemeier *et al.* 2001). The obtained results are in agreement with those of King and Lamkin (1979); Qiu and Mosjidis (1993) and Gadallah (2000).

3. Quality and Vigor indices.

Quality index (QI) and vigor index (VI) were higher for heavy seeds class than the others (Table 1). At the end of germination period 144h, the QI of heavy seeds increased over the control and light ones by 11.20% and 38.13 % respectively, in the first season while in the second one, the increases were : 12.74% and 52.43%, respectively. Data in Table (1) also indicate that, heavy seeds recorded significant increases in VI as compared to that of control and light ones. The increases reached: 93.16% and 216.46% in the first season, respectively, while in the second one, the increases were: 78.60% and 197.83%, respectively. This means that the heavy seeds of bean are considered the best quality seed lot, while the light seeds are considered the worst one. Thus, the reduction of vigor in light seeds (as expressed by quality and vigor indices) may be associated with decline in respiration and synthesis of proteins and carbohydrates (Abdul-Baki and Anderson, 1973).

Table (1): Seed index, germination%, quality index (QI) and vigor index (VI) of bean seeds as affected by seed quality class in both seasons.

Seed class	Seed index	Germination time (h)						
		Germination %					QI	VI
		48	72	96	120	144	144	
1st season								
Control	37.70 – 42.85	14.50	41.50	78.00	81.00	85.00	71.45	450.12
Light	33.79- 38.02	10.50	27.00	58.00	78.00	79.00	57.52	274.75
Heavy	47.20 – 57.60	18.50	48.00	85.50	88.00	93.00	79.45	869.47
$LSD_{(0.05)}$		3.11	5.02	5.71	2.92	4.07	6.44	68.14
2nd season								
Control	40.02 – 49.81	15.25	40.50	79.00	83.25	85.25	71.74	462.40
Light	34.39 – 37.13	8.50	19.25	61.25	70.00	78.50	53.06	277.29
Heavy	48.75 – 57.13	18.50	51.75	83.00	87.75	96.50	80.88	825.84
$LSD_{(0.05)}$		2.72	4.32	2.81	3.09	5.31	7.19	58.42

4. Radicle length, hypocotyl length and fresh and dry weights of embryonic axes.

The effects of different seed weight classes on a radicle length, hypocotyl length as well as fresh and dry weights of embryonic axes of bean seedlings were significant (Table 2). At any seed class, increasing the germination period from 72 to 144h, were associated with progressive increases in the length of radicle. It is obvious that, decreasing the seed weight class was accompanied with reductions in length of radicle and hypocotyl as well (after

144h of germination) fresh and dry weight. These unsatisfactory results of light seed class may be related to loss of vigor and perhaps undesirable metabolic changes in their axes, which was considered the site of vigor, had occurred (Abdul-Baki and Anderson, 1973). A similar result had been found by Sayed *et al.* (1990) and Gadallah (2000).

Table (2): Radical length (cm), hypocotyl length (cm) and embryonic axes fresh and dry weights ($g10^{-1}$ axes) of bean seedling as affected by seed quality class in both seasons.

Seed class	Germination time (h)						
	Radical length (cm)				Hypocotyl length (cm)	Embryonic axes Fresh weight (g)	Embryonic axes Dry weight (g)
	72	96	120	144	144	144	
1st season							
Control	1.30	4.88	6.28	10.28	5.28	9.51	2.44
Light	1.10	3.40	5.42	8.88	3.50	7.92	0.75
Heavy	1.88	5.75	8.68	14.57	9.01	10.39	3.15
$LSD_{(0.05)}$	0.11	0.60	0.61	1.08	1.12	0.80	0.62
2nd season							
Control	1.45	4.94	6.68	10.56	5.44	11.88	3.05
Light	1.31	2.80	4.83	7.68	3.51	9.90	1.00
Heavy	1.94	6.08	8.18	13.29	8.88	12.99	3.89
$LSD_{(0.05)}$	0.39	0.69	1.19	1.83	0.94	0.59	0.47

4. Water uptake and solute leakage.

4.1.Water uptake.

Table (3) clearly shows that, an increase in water uptake was observed during all the time of imbibition (up 8h) for the seeds of the different seed weight classes, although differential rates of water uptake had developed in response to the seed weight class. It is evident that decrease in seed weight caused a significant decrease in water uptake of seeds. These results can be explained on the basis that deteriorative changes in membrane systems of the low seed weight class may have occurred. In this respect, Krieg and Bartee (1974) mentioned that, low seed weight class absorbed relatively less water than those of high ones.

Table (3): Water uptake% of the initial bean seed fresh weight as affected by seed quality class in both seasons.

Seed class	Imbibition time (h)							
	1	2	3	4	5	6	7	8
				1st season				
Control	29.00	43.30	67.14	81.65	89.32	90.20	108.37	121.34
Light	21.72	39.87	56.58	72.27	84.95	87.04	92.82	105.87
Heavy	38.95	50.20	77.49	83.32	97.20	108.54	127.88	147.48
$LSD_{(0.05)}$	5.17	3.03	7.89	1.72	3.37	1.31	13.01	11.10
				2nd season				
Control	29.78	46.11	67.10	78.77	89.61	90.19	108.27	134.41
Light	20.95	37.57	58.09	72.18	83.90	86.00	93.88	104.82
Heavy	36.11	50.49	78.77	81.65	95.13	114.81	131.01	150.57
$LSD_{(0.05)}$	5.13	3.37	6.18	4.01	3.10	2.71	8.19	13.17

4.2. Conductivity of electrolyte leakage.

Data in Table (4) exhibited that conductivity of electrolytes leakage was significantly and inversely correlated with the seed weight class. In addition, loss of electrolytes from all seed weight classes increased with increasing imbibition time up to 8h. Increasing leakage of light seed weight class may be attributed to enhancement of permeability of cell membrane. It is interesting to note that, the electrical conductivity of electrolyte leakage from seeds was negatively correlated with their vigor, since, the seeds which gave high conductivity were low in vigor and vice versa. Similar results were documented by Bartee and Krieg (1974) and Gadallah (2000).

Table (4): Conductivity of electrolytes leakage (EC, dSm^{-1} 100^{-1} seeds) from imbibition bean seeds as affected by seed quality class in both seasons.

Seed class	Imbibition time (h) EC (dsm^{-1} 100^{-1} seeds)							
	1	2	3	4	5	6	7	8
				1st season				
Control	0.275	0.363	0.575	0.775	1.050	1.125	1.300	1.361
Light	0.328	0.560	0.640	0.830	1.125	1.263	1.331	1.392
Heavy	0.205	0.330	0.405	0.675	0.830	0.940	1.000	1.050
$LSD_{(0.05)}$	0.061	0.021	0.127	0.087	0.189	0.108	0.022	0.020
				2nd season				
Control	0.275	0.540	0.645	0.872	1.063	1.103	1.200	1.300
Light	0.322	0.575	0.675	0.900	1.111	1.200	1.275	1.370
Heavy	0.210	0.384	0.452	0.753	0.813	0.908	0.985	1.022
$LSD_{(0.05)}$	0.038	0.027	0.029	0.022	0.039	0.078	0.061	0.053

5. Compositional changes of leaked solutes.

5.1. Leakage of inorganic solutes.

The influence of seed weight class on inorganic leaked solutes of sodium (Na), potassium (K) and inorganic phosphorus (P_i) was significant during all times of imbibition period of the three tested seed classes; control, light and heavy (Table 5). Light seed weight class, gave the greatest amounts of inorganic solutes; Na, K and P_i while, the heavy seed class attained the least one. Moreover, progressive increases in inorganic leaked solutes of Na, K and P_i were recorded as the imbibition increased up to 8h. The increased leakage of inorganic solutes with decreasing seed weight class suggests a cellular degradation or increased membrane permeability allowing for rapid efflux the soluble Na, K and P_i salts.

5.2. Leakage of organic solutes.

Relative leakage of organic solutes; free amino acids, sugar, and A°260 and A°280 absorbing materials (*esp.* proteins and nucleic acids) from the different seed classes is shown in Tables (6&7). The results indicate that the leakage of organic solutes was significantly influenced with seed weight class during all times of imbibition for the tested seed classes (control, light and heavy). It was obvious that leakage of amino acids and sugars was inversely proportional to seed weight class indicating that the lower the seed weight class, the higher the leakage of the free amino acids and sugars. This result may be as a result of membrane dysfunction with decreasing in seed density class (Krieg and Bratee, 1974). Measurements of A°260 and A°280 absorbing materials (*esp.* proteins nucleic acids) in the imbibiting medium (Table 7), show that there was a linear rate of loss occurred throughout the period of imbibition for all seed classes. The light seeds showing much greater rate of leakage than the other two classes, heavy and control. These results are in accordance with those of Gadallah (2000).

Collectively, these results indicate that the quantity of material available for leaching from the seed was significantly influenced by seed weight. Seed coat and cellular integrity are apparently much less in the low weight (light) seed compared with the higher weight seed (heavy). Thus, the high quantity of soluble compounds leaked from the low weight seeds should provide an ideal media for a rapid growth microorganism.

Finally, based on the consistent results in this study, it is our opinion that weight-grading (separation) of bean seed can be used to improve low quality commercial seed. In addition, it is likely that farmers will obtain a good germination and seedling growth by sowing bean seeds high weight (heavy).

Table (5): Time course of leaked inorganic solutes of sodium (Na), potassium (K), and inorganic phosphorus (Pi) (mg100^{-1} seeds) as affected by bean seed quality class in both seasons.

Seed class	Imbibition time (h)																							
	1			2			3			4			5			6			7			8		
	Na	K	P_i	Na	K	P_i	Na	K	P_i	Na	K	P_i	Na	K	P_i	Na	K	P_i	Na	K	P_i	Na	K	P_i
1st season																								
Control	3.18	11.27	0.245	3.93	12.21	0.295	4.07	14.04	0.320	4.42	22.58	0.363	4.74	23.08	0.485	5.02	24.82	0.548	7.27	26.00	0.678	9.50	27.93	0.770
Light	4.06	12.98	0.331	4.76	15.47	0.394	4.85	22.66	0.489	4.99	25.73	0.575	5.86	26.18	0.697	5.92	27.93	0.756	8.42	28.09	0.833	12.63	30.13	0.923
Heavy	3.00	8.54	0.139	3.60	10.45	0.159	3.73	13.00	0.254	3.94	21.67	0.303	4.09	22.45	0.361	4.34	23.11	0.426	6.70	24.51	0.472	8.11	25.13	0.561
$LSD_{(0.05)}$	0.11	1.61	0.083	0.23	1.12	0.092	0.17	1.01	0.055	0.37	0.51	0.076	0.22	0.42	0.035	0.43	0.81	0.093	0.31	0.91	0.080	1.01	1.11	0.090
2nd season																								
Control	3.97	14.08	0.215	4.91	15.26	0.266	5.08	17.55	0.288	5.52	28.22	0.309	5.93	29.85	0.394	6.28	31.02	0.404	9.08	32.50	0.566	11.87	34.91	0.688
Light	4.29	16.22	0.303	5.95	19.33	0.381	6.06	28.32	0.444	6.23	31.94	0.515	7.33	32.73	0.556	7.40	34.91	0.611	10.52	35.11	0.788	15.78	37.66	0.867
Heavy	3.50	10.67	0.116	4.42	13.06	0.131	4.66	16.25	0.187	4.92	20.07	0.268	5.11	24.06	0.331	5.43	27.88	0.381	8.37	30.63	0.419	9.13	31.40	0.509
$LSD_{(0.05)}$	0.21	2.07	0.062	0.20	2.04	0.071	0.072	0.17	0.093	0.081	0.43	0.031	0.041	0.42	0.071	0.05	0.40	0.012	0.02	0.061	0.011	1.03	1.12	0.062

Table (6): Time course of leaked organic solutes of free amino acids (FAA) and sugars (mg 100^{-1}seeds) as affected by bean seed quality class in both seasons.

Seed class	Imbibition time (h)															
	1		2		3		4		5		6		7		8	
	FAA	Sugars	FAA	Sugars	FAA	Sugars	FAA	Sugars	FAA	Sugars	FAA	Sugars	FAA	Sugars	FAA	Sugars
	mg 100^{-1}seeds															
1st season																
Control	46.71	9.26	50.40	21.74	59.06	32.21	66.13	40.74	83.80	44.44	106.63	50.03	115.09	59.13	126.06	68.18
Light	53.60	14.07	57.49	26.11	66.76	37.03	70.83	46.29	91.89	51.84	120.13	60.11	125.65	78.09	135.06	91.31
Heavy	40.88	6.67	45.99	11.85	53.41	20.74	58.67	33.33	75.52	38.88	88.11	43.21	92.52	52.17	103.56	59.15
$LSD_{(0.05)}$	4.11	1.45	3.73	3.15	4.38	4.92	3.82	4.13	5.59	5.48	11.89	6.21	8.39	4.17	7.70	5.19
2nd season																
Control	38.93	7.04	42.00	15.63	49.22	21.76	55.11	38.11	69.83	43.51	88.86	52.17	95.91	61.02	105.05	70.37
Light	44.66	13.33	47.91	21.48	55.63	33.33	59.03	44.43	76.58	53.69	100.11	64.05	104.71	76.47	112.55	96.22
Heavy	34.07	5.11	38.23	8.01	44.08	17.77	47.89	29.99	61.93	38.88	73.42	46.00	77.10	51.84	86.30	62.41
$LSD_{(0.05)}$	2.37	1.13	2.71	5.01	3.92	2.81	3.57	5.11	4.27	3.62	9.13	5.17	4.19	4.02	6.15	5.02

Table (7): Time course of leaked A°260 and A°280 absorbing materials (mg 100^{-1} seeds) as affected by quality class in both seasons.

Seed class	Imbibition time (h)															
	1		2		3		4		5		6		7		8	
	A°260	A°280	A°260	A°280	A°260	A°280	A°260	A°280	A°260	A°280	A°260	A°280	A°260	A°280	A°260	A°280
1st season																
Control	0.150	0.134	0.247	0.151	0.320	0.226	0.395	0.291	0.471	0.316	0.585	0.481	0.675	0.551	0.754	0.635
Light	0.247	0.191	0.395	o.241	0.440	0.306	0.505	0.371	0.610	0.539	0.745	0.661	0.870	0.747	0.940	0.851
Heavy	0.110	0.071	0.140	0.109	0.225	0.161	0.365	0.190	0.401	0.261	0.452	0.391	0.525	0.471	0.623	0.501
$LSD_{(0.05)}$	0.031	0.053	0.111	0.035	0.076	0.063	0.011	0.086	0.053	0.042	0.115	0.065	0.0.133	0.062	0.120	0.113
2nd season																
Control	0.190	0.119	0.260	0.143	0.340	0.241	0.415	0.241	0.558	0.295	0.611	0.371	0.715	0.476	0.825	0.551
Light	0.303	0.183	0.410	0.226	0.558	0.289	0.628	0.323	0.765	0.403	0.805	0.501	0.900	0.661	0.953	0.750
Heavy	0.131	0.077	0.205	0.115	0.247	0.150	0.375	0.150	0.409	0.189	0.525	0.241	0.623	0.390	0.675	0.460
$LSD_{(0.05)}$	0.051	0.032	0.037	0.019	0.087	0.079	0.038	0.073	0.103	0.092	0.077	0.129	0.083	0.075	0.132	0.085

REFERENCES:

AOAC (1990). Association of Official Analytical Chemists. Official Methods of Analysis. 15th ed. Washington, D.C.

Abdul-Baki, A. A. and J. D. Anderson (1973). Vigor determination in soybean by multiple criteria. Crop Sci., 13: 630-633.

Bartee, S. N. and D. R. Krieg (1974). Cotton and density: Associated physical and chemical properties of 10 cultivars. Agron. J., 66: 433-435.

Brakke, M. P. and F. P. Gardner (1987). Juvenile growth in pigeon pea, soybean and cowpea in relation to seed and seedling characteristics. Crop Sci., 27: 311-316.

Bredemeier, C.; C.M. Mundstock and D. Buttenbender (2001). Effects of seed size on initial plant growth and grain yield of wheat. Pesoquisa, Agropecuaria, Brasileira, 36(8): 1016-1068.

Burris, J. S.; O. T. Edje and A. H. Wahab (1973). Effects of seed size on seedling performance in soybeans: II. Seedling growth, photosynthesis and field performance. Crop Sci., 13(3-4): 207-212.

Chen, P. S.; T. Y. Toribara and H. Warner (1956). Assay of inorganic phosphate, total phosphate and phosphatases. Anal. Chem., 28: 1756-1769.

Dubois, M. F.; K. A. Gilles; J. Hamilton; P. A. Roberts and F. Smith (1956). Colorimetric method for determination of sugars and related substances. Anal. Chem., 28: 350-356.

Duke, S. H.; G. Kakefuda and T. M. Harvey (1983). Differential leakage of intracellular substances from imbibing soybean seeds. Plant Physiol., 72: 919-924.

Gadallah, F. M. (2000). Seed density in relation to germination and seedling quality in cotton (*Gossypium barbadense* L.). Alex. J. Agric. Res., 45(2): 119-137.

Gray, D. and J.R.A. Steckel (1986). The effects of seed-crop plant density, transplant size, harvest date and seed grading on leek (*Allium porrum* L.) seed quality. J. Hort. Sci., 61(3): 315-323.

ISTA (1966). The International Seed Testing Association. International Rules for Seed Testing. Proc. Int. Seed. Test. Assoc., 31: 1-152.

King, E.E. and G.E. Lamkin (1979). Uniform quality cotton seed for laboratory and field use. p.32. In Proc. Beltwide Cotton Prod. Conf. Phoenix, Ariz., 7-11 January. National Cotton Council, Memphis, Tenn.

Krieg, D. R. and S. N. Bartee (1974). Cotton and density: associated germination and seedling emergence properties. Agron. J., 67: 343-347.

Maranville, J. W. and M. D. Clegg (1977). Influence of seed size and density on germination, seedling emergence and yield of grain sorghum. Agron. J., 69(3-4): 329-330.

Naylor, R.E.L. (1993). The effect of parent plant nutrition on seed size, viablitiy and vigour on germination of wheat and tritical at different temperatures. Ann. Appl. Biol., 123(2): 379-390.

Qiu, J. and J. A. Mosjidis (1993). Influence of seed weight and planting depth on common vetch establishment and growth. Field Crop Research, 33: 353-366.

Rosein, H. (1957). A modified ninhydrin colorimetric analysis for amino acids. Arch. Biochem. Biophys., 67: 10-15.

Sayed, G.; D. A. Smittle; H. A. Mills and G. I. Banna (1990). Onion seed size, weight and elemental content affect germination and bulb yield. HortSci., 25(5): 522-523.

Smith, T. J. and H. M. Camper (1975). Effects of seed size on soybean performance. Agron. J., 67: 681-684.

Smittle, D. A. (1982). Radish (*Raphanus sativus*) growth and yield responses to seed grading by size and aspiration. Seed Sci.& Technol., 10: 199-205.

Smittle, D. A.; R. E. Williamson and J. R. Stansell (1976). Response of snap beans to seed separation by acrodynamic properties. HortSci., 11: 469-471.

Snedecor, W. C. and W. G. Cochran (1980). Statistical Methods. 7th ed. The Iowa State Univ. Press, Ames, Iowa, USA.

جودة البذور وعلاقتها بالإنبات والنمو والمحصول فى الفاصوليا.

١- الإنبات

نيفين على السواح

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لقد أجريت هذه الدراسة خلال موسمين متتاليين هما: ٢٠٠٥ و٢٠٠٦ بهدف معرفة العلاقة ما بين جودة بذور الفاصوليا والقدرة الإنباتية لها. ولإنجاز ذلك فقد تم استخدام بذور فاصوليا من صنف جيزة٣ تم فصلها وتدريجها إلى مجموعتين (فئتين) بالفرز اليدوى طبقا لوزن البذور هما:

- الفئة الأولى (الخفيفة): ويتراوح وزن ١٠٠ بذرة منها (٣٣,٧٩-٣٨,٠٢ جم فى الموسم الأول و ٣٤,٣٩-٣٧,١٣ جم فى الموسم الثانى) والفئة الثانية (الثقيلة): ويتراوح وزن ١٠٠ بذرة منها (٤٧,٢٠-٥٧,٦٠ جم فى الموسم الأول و ٤٨,٧٥-٥٧,١٣ جم فى الموسم الثانى).
- أما بذور الصنف جيزة ٣ بدون فرز (الصورة التجارية) ويتراوح وزن ١٠٠ بذرة منها (٣٧,٧٠-٤٢,٨٥ جم فى الموسم الأول و ٤٠,٠٢-٤٩,٨١ جم فى الموسم الثانى) فقد استخدمت كبذور غير مدرجة (كنترول).

واستخدمت الفئات الثلاث السابقة لدراسة هذه العلاقة تحت ظروف المعمل. سُجلت العديد من القياسات المرتبطة بالقدرة الإنباتية للبذور وكانت النتائج على النحو التالى:

١- لوحظ وجود علاقة وطيدة بدرجة كبيرة ما بين النسبة المئوية لإنبات البذور وظهور البادرات من ناحية وبين جودة البذور من ناحية أخرى، حيث أظهرت البذور ذات الوزن العالى (الثقيلة) معدلات أسرع من حيث إنبثاق الجذير وتماثل خروجه مقارنة بالبذور المنخفضة الوزن (الخفيفة) والكنترول.

٢- أظهرت البادرات الناتجة من البذور عالية الوزن معدلات عالية بالنسبة لطول الجذير والسويقة الجنينية السفلى ووزن المحاور الجنينية الطازجة والجافة مقارنة بمثيلتها

الناتجة من البذور الخفيفة الوزن الكنترول ويدل ذلك على أن بذور الفاصوليا ذات الوزن العالى (الثقيلة) تنتج بادرات ذات قدرة عالية على النمو.

٣- أظهرت معدلات التشرب بالماء ودرجة التوصيل الكهربى وأيضا كمية الذائبات غير العضوية (الصوديوم- البوتاسيوم- الفوسفور) والعضوية (الأحماض الأمينية الحرة – السكريات – وبعض المواد الممتصة على طول موجة ٢٦٠و٢٨٠ نانوميتر) المتسربة من البذور عند تشربها بالماء علاقة عكسية مع وزن البذور مفسراً ذلك بحدوث تأثير ضار للبذور ذات الوزن المنخفض أثناء النضج أو حدوث تدهور بها بعد الحصاد .

نستخلص من النتائج السابقة:

أن عملية فصل (تدريج) بذور الفاصوليا إلى الفئات السابقة يساعد على تنقيتها بالقدر الذى يسمح بإنتاج بذور ذات قدرة عالية على الإنبات وإعطاء بادرات متماثلة ، كما تفيد أيضا فى برامج التربية وإنتاج البذور من حيث تسهيل زراعة بذور ذات درجة جودة عالية من الفاصوليا.