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SEED QUALITY IN RELATION TO GERMINATION, GROWTH AND YIELD OF BEAN. 2- GROWTH AND YIELD

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ABSTRACT: *This work aimed to investigate the influence of different levels of bean seed quality on growth, yield and its components (green pod and dry seed yield) and chemical composition under field conditions. To achieve this study, three seed quality classes of Giza 3 cultivar of been i.e. control, light and heavy were grown during two summer successive seasons of 2005 and 2006 at the Experimental Station, Faculty of Agriculture, Fayoum University, Egypt.*

The obtained results were as follows:

- *It can be noticed that seed quality of bean significantly affected field performance of bean plants and resulted in an increase of the studied plant growth traits (plant height, No. of leaves, No. of branches, leaf area leaf^{-1}, leaf area plant^{-1}, fresh and dry weights of leaves plant^{-1}, fresh and dry weights of branches plant^{-1}, and total fresh and dry weights of shoot plant^{-1}) with increasing the level of seed quality class.*
- *It can be seen that there was a close relation between seed quality of bean and green pods yield and its components. In this respect, No. of green pods plant^{-1}, weight of green pod, green pod yield plant^{-1} and feddan^{-1} were increased as seed quality class was increased.*
- *It was found that bean dry seed yield and its components; empty and seeded pods plant^{-1}, total No. of pods plant^{-1}, grades of dry seeded pods, No. of seeds plant^{-1}, seed yield plant^{-1} and feddan^{-1} and seed index (100-seed weight) were positively correlated with the class of sown seeds, the seeds which gave plants with high yield of dry seeds and its components were high in their quality and vice versa.*
- *It was shown that seed quality class markedly affected chemical constituents concentration of the different organs of bean plants produced from the different seed classes. In this respect, the high seed quality class significantly increased total sugars (total soluble carbohydrates in dry seeds), protein, N, P, K, Fe, Mn and Zn contents in leaves, green pods and dry seeds over that of control and light seed classes.*

Finally, in the light of the preceding results, it may be concluded that high quality bean seeds to exhibit higher percent field performance and resulted in uniformity and well establishment which reflected in high green pods and dry seed yield of bean either plant or feddan^{-1}. Thus, it concluded that it is likely that farmers will obtain yield increases of bean by sowing seeds of high seed quality.

Key words: *bean, seed quality, growth, yield, chemical composition*

INTRODUCTION

Of the variables affecting stand establishment and plant performance; seed quality is one trait that can be easily manipulated and may be of economic importance. High seed quality has been positively correlated with plant performance in the field (Burris *et al.*, 1973). Production of a crop depends upon obtaining a timely stand of uniform, healthy, vigorous plants, seed quality is important in obtaining such stand (Maranville and Clegg, 1977). Research has emphasized the relationship of laboratory germination and seedling growth to seed quality (Brakke and Gardner, 1987 and Gadallah, 2000), but information about seed quality and its relation to plant performance under field conditions is less available. However, because there is less information relating seed quality to other aspects of crop performance, possible direct effects of seed quality on plant development and yield are still difficult to discern. Undoubtedly, if seed quality affects yield, its influence should be discernible through some effects on plant growth processes. Thus, the aim of this study to determine whether the differences in seed quality of bean relate to plant growth, yield and chemical composition under field conditions.

MATERIALS AND METHODS

A 2-year field study was conducted at the experimental station, Fac. Agric., Fayoum, Univ., Egypt in 2005 and 2006 seasons. Seeds of bean (*Phaseolus vulgaris* L. cv. Giza 3) used in this study were brought from Ministry of Agriculture, Egypt. The original seed lot was manually separated into two seed quality classes (expressed as seed weight) identified: light and heavy. A portion of the ungraded original seed lot was retained to serve as control class. The seed index (g 100^{-1} seeds) were determined for each seed class as a follows:

1- Control class (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).

Before sowing, soil samples (0-30 cm/depth) were taken each year and analyzed according to published procedure (Black, 1965). Soil analysis results in 2005 and 2006 are shown in Table (1).

Table (1): Physical and chemical properties of the selected soil before sowing in both seasons

Property	Season	
	2005	2006
Physical:		
Clay%	42.6	40.4
Silt%	31.4	32.3
Sand%	26.0	27.3
Texture	Clay	Clay
Chemical:		
pH	7.30	7.34
ECe (dS m^{-1})	4.40	5.02
Total N%	0.10	0.07
Organic matter%	2.11	2.12
$CaCO_3$%	7.17	7.30
Soluble cations (meq $100g^{-1}$):		
Ca^{++}	0.75	0.68
Mg^{++}	0.67	0.75
Na^{+}	1.98	2.47
K^{+}	0.03	0.02
Soluble anions (meq $100g^{-1}$):		
HCO_3^{-}	0.29	0.28
Cl^{-}	1.55	1.83
SO_4^{--}	1.59	2.22
Available microelements (ppm):		
Fe	35.27	38.16
Zn	2.06	2.16
Mn	20.95	21.34
Cu	0.09	0.11

Plots were arranged in a randomized complete block design, replicated 3 times. Each plot consisted of 6 rows; 5 m long and 70 cm apart, within row spacing was 10 cm. Seeds of each class (the seeds with visibly damaged and immature were removed) were hand sown in the field on the 28th February in both 2005 and 2006 seasons. Plots were seeded in excess and after emergence; plants were thinned to the desired stand. All other cultural practices for growing bean were applied according to those recommended by the Ministry of Agriculture, Egypt.

Plant Sampling.

At flowering stage, 10 plants were randomly chosen (at 45 days from sowing) from the first and second rows in each plot from each treatment in each replicate for each class were carefully cut off at the ground level and the following parameters were recorded: plant height (cm), No. of leaves and branches plant^{-1}, fresh and dry weights of leaves and branches plant^{-1} (g), total fresh and dry weights plant^{-1} (without root), leaf area leaf^{-1} (cm^2, using a digital leaf meter, Planimeter Lincolin, L1-3000 portable area Meter produced by L1-COR, Nebraska, USA) and leaf area plant^{-1} (cm^2). At 60 days from sowing (maturity of green pods); yield and its components were recorded from the whole two middle rows (green pods were harvested throughout 21 days at 7 days interval) and the following measurements were recorded: No. of green pods plant^{-1}, fresh and dry weights pod^{-1}, fresh and dry weights of pods plant^{-1} (g) and green pods yield feddan^{-1} (ton). In each plot, plants of the 5 and 6 rows were left growing till pods approached the dry stage (appr. 90 days from sowing). The dry pods of twenty plants of each row picked and divided into two batches, empty and seeded pods. Total number and weight of empty and seeded pods were recorded. Seeded pods were sorted into 5 various grades: grade (A)-pods containing 1 seed pod^{-1}, grade (B)-pods containing 2 seeds pod^{-1}, grade (C)-pods containing 3 seeds pod^{-1}, grade (D)-pods containing 4 seeds pod^{-1} and grade (E)-pods containing 5 seeds pod^{-1}. Number and weight of pods in each of the previous grades was counted and the seeds were handy obtained. Dry seeds weight plant^{-1} (g), seed yield feddan^{-1} (ton), seed index (100-seed weight, g) were determined from air-dried seeds which contained approximately 10% moisture.

Chemical analysis.

In both seasons; randomly samples of fresh leaves (at flowering stage), fresh green pods (at maturity stage) dry seeds (at harvesting time) were used for chemical analysis. The samples were dried in an electric oven at 70°C till constant weight, then well ground for chemical analysis. In fresh leaves: leaf pigments; chlorophyll a, b and total and carotenoids (mg g^{-1} fresh weight of leaf) were estimated. They extracted by acetone 80% then determined using colorimetric method as described by Arnon (1949). In dried leaves: the following parameters were determined: N% was colorimetrically determined by using orange G dye according to the method of Hafez and Mikkelsen (1981). For P, K, Fe, Mn and Zn determination, the wet digestion of 0.1 g of ground dry material of leaves of each class was done with sulphoric and perchloric acids reagent as described by Piper (1947). P (mg 100^{-1} g dry matter) was colorimetrically estimated by using chlorostannous molybdophosphoric blue colour method in sulphoric acid system as described by Jackson (1967). K (mg 100^{-1} g dry matter) was determined using a Perkin-Elmer, Flame-photometer (Page *et al.*, 1982). Fe, Mn and Zn concentrations (mg 100^{-1}g dry matter) were determined using a Perkin-Elmer, Model 3300, Atomic Absorption spectrophotometer according to the method described by Champman and Pratt (1961). In green pods and dried seeds, N, P, K, Fe, Mn and Zn concentrations were determined using the same analytical methods as mentioned before. In addition, total sugars in leaves and green pods (in 80% ethanolic extract) and total soluble carbohydrates% (in digestive dry matter with sulphoric acid; 0.1 N of dry seeds) were colorimetrically determined using phenol-sulphoric acid reagent method as outlined by Dubois *et al.* (1956) as well as protein% were estimated by multiplying seed or green pod N% by a factor of 6.25 for conversion of N% to protein% (Kelley and Bliss, 1975).

Statistical analysis.

According to the experimental design used (a randomized complete blocks design), appropriate analysis of variance on the obtained results were achieved (Snedecor and Cochran, 1980). The least significant difference test (LSD) at 0.05 level was used to verity the difference between treatments mean.

RESULTS AND DISCUSION

1. Vegetative growth

Data represented in Table (2) indicate that, all growth characters, i.e., plant height, No. of leaves plant^{-1}, leaf area leaf^{-1}, leaf area plant^{-1} and No. of branches plant^{-1} recorded a gradual increase as a result of seed weight increase in both seasons. This increase in these characters from all seed weight classes significantly differed. In this respect, values of plant growth (plant height, No. of leaves plant^{-1}, leaf area leaf^{-1}, leaf area plant^{-1} and No. of branches plant^{-1}) produced from heavy seed class were significantly higher than those of the other two seed weight classes (control and light) in both seasons. In the first season, the increases which recorded by heavy seed as compared to those of control and light ones reached: 27.26% and 48.60%, 13.77% and 22.43%, 18.63% and 34.65%, 34.97% and 64.85% as well as 24.14% and 50.00%, respectively. In the second one, the increases were: 15.94% and 30.81%, 2.83% and 17.16%, 8.80% and 27.04%, 20.89% and 51.46% as well as 27.59% and 35.04% for plant height, No. of leaves plant^{-1}, leaf area leaf^{-1}, leaf area plant $^{-1}$ and No. of branches plant^{-1} , respectively. Data shown in Table (3) represented the response of fresh and dry weights of leaves plant^{-1}, fresh and dry weights of branches plant^{-1} as well as fresh and dry weight of shoot plant^{-1} of plants produced from the three different seed weight classes used. It could be observed that the previous characters were significantly influenced by seed quality, in both seasons representing their highest values with heavy class of seed. By other means, plant grown from heavy seeds recorded an increase in the first season: 18.65% and 43.59%, 12.02% and 75.31%, 22.98% and 58.2%, 23.13% and 56.03%, 19.89% and 47.64% as well as 15.59% and 69.43% when compared with the control and light class, respectively. In the second one, the increases reached: 12.33% and 39.87%, 27.61% and 69.03%, 17.59% and 39.85%, 8.50% and 39.86% as well as 21.66% and 59.11%. For fresh and dry weights of leaves plant^{-1}, fresh and dry weights of branches plant^{-1} and fresh and dry weights shoot plant^{-1}, respectively. It means that the best plant growth of leaves was associated with sowing heaviest seeds class. On the contrary, the poorest growth was recorded for light seed. These findings were true in both seasons. Thus, the differences in initial seed weights among the density classes created a differential degree of growth among the classes of seed weight. However, these findings confirm that seed quality may affect plant fresh and dry weights during the first stages of development. Most plant tissues involved in the production of dry matter are formed after seedling emergence and it seems unlikely that seed quality would influence their ability to carry out physiological processes and accumulate dry matter during the whole vegetative of development. These informations confirmed the findings of Tekrony and Egli (1991); Perin *et al.* (2002) and Rodo and Marcos (2003).

Table (2): Plant height, No. of leaves plant^{-1}, leaf area leaf^{-1}, leaf area plant^{-1} and No. of branches plant^{-1} of bean as affected by seed quality in both seasons.

Seed class	Plant height (cm)	No. of leaves plant^{-1}	leaf area leaf^{-1} (cm^2)	leaf area plant^{-1} (cm^2)	No. of branches plant^{-1}
1st season					
Control	29.60	15.83	100.90	1597.25	7.25
Light	25.35	14.71	88.90	1307.72	6.00
High	37.67	18.01	119.70	2155.80	9.00
$LSD_{(0.05)}$	3.71	0.82	8.37	113.15	0.96
2nd season					
Control	27.17	16.02	104.50	1674.09	7.25
Light	24.08	14.93	89.50	1336.24	6.85
High	31.50	17.80	113.70	2023.86	9.25
$LSD_{(0.05)}$	2.82	0.79	7.82	121.09	0.33

Table (3): Fresh and dry weights of leaves plant^{-1}, branches plant^{-1} and shoot Plant^{-1} of bean as affected by seed quality of bean in both seasons.

Seed class	Leaves weight plant^{-1} (g)		Branches weight plant^{-1} (g)		Shoot weight plant^{-1} (Leaves&branches, g)	
	Fresh	Dry	Fresh	Dry	Fresh	Dry
1st season						
Control	18.02	3.66	7.31	1.47	25.33	5.13
Light	14.89	2.34	5.68	1.16	20.57	3.50
High	21.38	4.10	8.99	1.81	30.37	5.91
$LSD_{(0.05)}$	2.02	0.87	090	026	3.92	065
2nd season						
Control	19.30	3.55	7.73	1.76	27.03	5.31
Light	15.50	2.68	6.50	1.38	22.00	4.06
High	21.68	4.53	9.09	1.93	30.77	6.46
$LSD_{(0.05)}$	0.97	0.78	0.93	0.14	2.88	0.93

2. Green pod yield and its components.

It could be noticed that produced plants from heavy seeds showed the highest values of the as compared to control and light classes in both seasons Table (4). On the other hand, the lowest values in this respect were associated with light seed class. However, the variation within the three classes of seed quality was significant for all characters showed in Table (4). In this respect, it was also found that heavy seed produced plants had higher values of control and light ones in the first season by: 14.85% and 29.83%, 11.68% and 26.06%, 8.83% and 34.55%, 28.26% and 63.66%, and 28.39% and 63.59%. In the second one the increases reached: 8.93% and 34.07%, 9.85% and 16.89%, 18.84% and 64.00%, 19.66% and 56.71% and 19.66% and 56.66% for No. of total green pods plant^{-1}, fresh and dry weights pod^{-1}, total green pods yield plant^{-1} and feddan^{-1}, respectively. The superiority of plants produced from heavy seeds in all green yield characters (Table 4) was mainly due to the increase its vegetative growth than other classes, which means that heavy seed class resulted in a pronounced increase in the number of leaves, fresh and dry weight plant^{-1}, ...etc, consequently green pod yield and its components is expected to be higher for heavy seed class plants than others. However, green pod yield compensation in plots planted with heavy seed class may have been affected through the increased branching and pod set plant^{-1} and it has also been reported that plants grown from heavy seed class may have greater yielding capacity at uniform stands (Stivers and Sweeringin, 1978). Also, The number of green pods plant^{-1} increased with increasing seed weight of faba bean (Salih, 1983).

Table (4): No. of green pods plant^{-1}, fresh and dry weights green pod^{-1} and green pods plant^{-1} of bean as affected by seed quality in both seasons.

Seed class	No. of green pods plant^{-1}	Weight green pod^{-1} (g)		Weight of green pods plant^{-1} (g)		Green pods yield feddan^{-1} (ton)
		Fresh	Dry	Fresh	Dry	
1st season						
Control	13.0	7.45	0.68	96.85	8.84	5.53
Light	11.5	6.60	0.46	75.90	5.29	4.34
High	14.93	8.32	0.74	124.22	11.05	7.10
$LSD_{(0.05)}$	1.61	070	0.04	6.13	2.25	1.09
2nd season						
Control	16.0	7.31	0.69	116.96	11.04	6.68
Light	13.0	6.87	0.50	89.31	6.50	5.10
High	17.43	8.03	0.82	139.96	14.29	7.99
$LSD_{(0.05)}$	1.07	0.41	0.17	19.08	3.72	1.01

3. Dry seed yield and its components.

The influence of seed quality on dry seed yield of bean and its components expressed as No. of seeded pods plant^{-1}, No. of empty pods plant^{-1}, No. of seeded dry pod grades; A (1 seed pod^{-1}), B (2 seeds pod^{-1}), C (3 seeds pod^{-1}), D (4 seeds pod^{-1}), E (5 seeds pod^{-1}), total number of dry seeds plant^{-1}, total dry seed yield plant^{-1} and feddan^{-1} and 100-seed weight (seed index) are presented in Table (5).

3.1. Number of empty, seeded and total dry pods.

Data in Table (5) show that No. of empty, seeded and total dry bean pods significantly responded to the seed quality in both seasons. The comparison among the three investigated seed weight classes of bean within each aforementioned trait showed that the heavy seed class significantly resulted in less number of empty dry pods and more number of seeded and total dry pods than those achieved with other seed quality classes. In this respect, the decrease in No. of empty dry bean pods recorded by the heavy seeds as compared to the control and light ones were: 15.91% and 39.34%, respectively in the first season, while reached: 15.58% and 42.02%, respectively in the second season. The increases in No. of seeded and total dry bean pods recorded by the heavy seed class as compared to the control and light ones reached: 21.69% and 50.19%, respectively in the first season while in the second one were: 30.05% and 64.96%, respectively.

3.2. Number of seeded dry bean pod grades.

The results presented in Table (5) indicate that the heavy seeds gave plants with significantly higher number of seeded dry bean pod grades (A-E) as compared to the other classes; control and light ones (Table 5). The corresponding increments in No. of seeded dry bean pods grades (A-E) by the heavy seed over the control and light ones were: 16.26% and 52.13%, 10.33% and 20.36%, 16.96% and 68.07%, 10.84% and 35.47%, as well as 29.06% and 36.04% in the first season and 18.67% and 99.25%, 11.99% and 32.93%, 17.23% and 32.29%, 15.68% and 50.00% and 21.05% and 49.07%, in the second season for grades of A, B, C, D and E respectively.

3.3. No. of seeds plant^{-1}, dry seed yield plant^{-1} and feddan^{-1} and seed index.

The influence of seed quality class; control and light and heavy on No. of seeds plant^{-1}, seed yield plant^{-1} and feddan^{-1} and seed index in both seasons are shown in Table (5). The differences between the previous mentioned characters were significant according to seed weight used and the heavy seed class was superior to the others in this regards. Differences between the heavy seed, control and light classes were: 14.24% and 41.73% and 16.22% and 43.78%, respectively for No. of seeds plant^{-1}, 30.95% and 86.16% and 31.13% and 88.39%, for dry seed yield plant^{-1} as well as 30.79% and 86.86%, 31.05% and 88.19% for seed yield feddan^{-1} as well as 12.86% and 29.12% and 12.77% and 31.23% for seed index in the first and second seasons for control and light classes, respectively. Thus, seed yield and its components was significantly correlated with planted seed quality. The advantage of graded seed might be explained by the theory of Fontes and

Ohlrogge (1972) that ungraded soybeans may produce lower yields than graded seed because plants from large seed suppress plants from small seeds. Generally, crop yield is the product of the interaction of a large number of genetically controlled physiological processes and morphological components that evolved in sequential developmental patterns (Al-Mukhtar and Coyne, 1981). It is well known that high seed quality results in improved field emergence which often leads to increased yield (Johnson and Mulvaney, 1980). Fernandez and Miller (1985) and Westermann and Crothers (1977) mentioned that seed yield in legumes was determined by 3 major yield components, i.e. pods plant^{-1}, seeds pod^{-1} and seed weight. The highest seed yield was obtained when all were maximized. In addition, the increasing seed weight led to increase in seed yield and 1000-seed weight of pea (Ondrej, 1984), seed yield plant^{-1}, weight and No. of seeds pod^{-1} of cowpea (Yadava, 1990), seed yield of bean (Das and Chatterjee, 1992) and seed yield of soybean (Zaimoglu *et al*., 2004). Thus, the current results confirm the above mentioned findings. These findings, generally, indicated that the heavy seed class was favourable and resulted in the best performance in this regards.

Table (5): Number of empty and seeded dry bean pods plant^{-1}, number of seed dry pod grades, seed weight plant^{-1}, seed yield feddan^{-1} and seed index (100-seed weight, g) as affected by seed quality of bean in both seasons.

Seed class	No. of empty pod plant^{-1}	No. of seeded dry pods plant^{-1}	Total No. of dry pods plant^{-1}	No. of seeded dry pod grades					Seeds wt. plant^{-1} (g)	Seed wt. feddan^{-1} (kg)	Seed index (wt. 100^{-1} seed) (g)
				A (1 seed pod^{-1})	B (2 seeds pod^{-1})	C (3 seeds pod^{-1})	D (4 seeds pod^{-1})	E (5 seeds pod^{-1})			
1st season											
Control	2.20	12.91	15.11	2.46	3.00	3.42	2.86	1.17	15.12	864	41.99
Light	1.83	10.46	12.29	1.88	2.75	2.38	2.34	1.11	10.62	607	36.70
High	2.55	14.85	17.40	2.86	3.31	4.00	3.17	1.51	19.77	1130	47.39
$LSD_{(0.05)}$	0.23	1.13	1.27	0.30	0.17	0.51	0.17	0.04	2.71	89	3.21
2nd season											
Control	2.31	12.38	14.69	2.25	2.92	3.25	2.63	1.33	15.10	863	43.15
Light	1.88	9.76	11.64	1.34	2.46	2.88	2.00	1.08	10.51	601	37.08
High	2.67	14.36	17.03	2.67	3.27	3.81	3.00	1.61	19.80	1131	48.66
$LSD_{(0.05)}$	0.18	1.01	1.19	0.32	0.13	0.34	0.21	0.16	3.03	94	4.67

4. Chemical constituents.

4.1. In leaves.

Under different seed quality classes, increasing seed weight resulted in a gradual increase in the values of chemical constituents: leaf pigments (chlorophyll a, b and total as well as carotenoids), total sugars (TS), protein, macro-nutrients (N, P and K) and micro-nutrients (Fe, Mn and Zn) in leaves of plants produced from the different seed quality classes The highest values of those constituents were recorded with the plants produced from heavy seed class. Whereas, the lowest values resulted from plants of light seed class.

The differences between all studied chemical constituents in plants resulted from sowing seeds with different weight were significant (Tables 6&7). In this regard, the increases which recorded by the heavy seed class over the control and light ones reached: 35.88% and 142.73%, 29.41% and 132.25%, 15.17% and 98.03% and 21.79% and 77.60% in the first season for chlorophyll a, b, total and carotenoids, respectively while, in the second one the increases were: 23.68% and 134.32%, 11.29% and 108.11%, 17.61% and 116.93% and 24.44% and 75.00%, for the above mentioned parameters as stated before. Similarly, the highest values of TS, protein, N, P, K, Fe, Mn and Zn concentrations in leaves of bean were detected in plants produced from the heavy seed class in both seasons (Table 7). In this respect, the differences between the three seed classes were statistically significant in both seasons. The corresponding increase in the above mentioned chemical constituents by the heavy seed over the control and light ones were: 21.09% and 34.34% in TS, 11.82% and 35.66% in protein, 11.58% and 35.68% in N, 13.56% and 39.58% in P, 30.53% and 42.51% in K, 7.14% and 17.40% in Fe, 9.11% and 30.54% in Mn and 7.10% and 13.82% in Zn concentration in the first season. Whereas, in the second one the increases reached: 18.75% and 39.71% in TS , 16.36% and 32.49% in protein, 16.41% and 33.77% in N, 13.70% and 40.68% in P, 23.90% and 31.70% in K, 10.27% and 24.26% in Fe, 13.99% and 29.67% in Mn and 5.83% and 11.26% in Zn concentration.

Table (6): Leaf pigments; chlorophyll a, b, total and carotenoids (mg g^{-1} fresh weight of bean leaves) as affected by seed quality of bean in both seasons.

Seed class	Leaf pigments (mg g^{-1} fresh wt. of leaves)			
	a	b	T	carotenoids
		1st season		
Control	1.438	1.163	2.710	0.280
Light	0.805	0.648	1.576	0.192
High	1.954	1.505	3.121	0.341
$LSD_{(0.05)}$	0.413	0.287	0.377	0.051
		2nd season		
Control	1.347	1.107	2.549	0.315
Light	0.711	0.592	1.382	0.224
High	1.666	1.232	2.998	0.392
$LSD_{(0.05)}$	0.248	0.111	0.369	0.061

Table (7): Chemical constituents concentration; N, P, K, Fe, Mn and Zn, protein and total sugars (TS) in bean leaves as affected by seed quality of bean in both seasons

Seed class	N (%)	P	K	Fe	Mn	Zn	Protein	TS
		(mg 100⁻¹g dry matter of leaves)					(%)	
1st season								
Control	2.59	29.5	226.0	19.33	6.15	9.15	16.16	2.94
Light	2.13	24.0	207.0	17.64	5.14	8.61	13.32	2.65
High	2.89	33.5	295.0	20.71	6.71	9.80	18.07	3.56
$LSD_{(0.05)}$	0.21	4.01	11.17	1.17	0.32	0.35	1.72	0.46
2nd season								
Control	2.62	36.5	228.0	18.21	6.29	10.64	16.38	3.20
Light	2.28	29.5	214.5	16.16	5.53	10.12	14.25	2.72
High	3.05	41.5	282.5	20.08	7.17	11.26	19.06	3.80
$LSD_{(0.05)}$	0.43	3.91	10.70	1.03	0.69	0.41	1.09	0.49

4.2. In green pods.

Regarding the changes of chemical constituents in green pods of bean, data presented in Table (8), show that there are significant differences between the different produced plants from seed classes in both seasons for TS, protein, N, P, K, Fe, Mn and Zn concentrations. It is clear that the heavy class of seed resulted in a marked increase in the levels of those chemical constituents over that of control and light classes. This finding seems to indicate that chemical constituents of green pods affected by seed quality class. However, the increases recorded by the heavy seed over control and light classes were 22.05% and 37.76% in TS, 3.76% and 28.91% in protein, 3.74% and 28.48% in N, 13.21% and 23.71% in P, 5.62% and 16.12% in K, 11.04% and 13.84% in Fe, 18.02% and 27.18% in Mn and 37.91% in Zn concentration in the first season. Meanwhile, in the second one increases reached: 22.86% and 39.84% in TS, 10.75% and 32.12% in protein, 10.75% and 32.11% in N, 11.88% and 22.83% in P, 8.26% and 23.38% in K, 5.88% and 19.21% in Fe, 17.36% and 31.48% in Mn and 21.91% and 40.74% in Zn concentration.

Table (8): Chemical constituents concentration; N, P, K, Fe, Mn and Zn, protein and total sugars (TS) in dry matter of bean green pods as affected by seed quality of bean in both seasons.

Seed class	N (%)	P	K	Fe	Mn	Zn	protein	TS
		(mg 100⁻¹g dry matter of green pods)					(%)	
1st season								
Control	1.87	106	320.5	0.815	1.11	17.71	11.66	2.72
Light	1.51	97	291.5	0.795	1.03	14.64	9.41	2.41
High	1.94	120	338.5	0.905	1.31	20.19	12.13	3.32
$LSD_{(0.05)}$	0.04	6.13	11.17	0.67	0.14	1.31	0.40	0.25
2nd season								
Control	1.86	101	348.5	0.850	1.21	16.89	11.63	2.80
Light	1.56	92	305.8	0.755	1.08	14.63	9.75	2.46
High	2.06	113	377.3	0.900	1.42	20.59	12.88	3.44
$LSD_{(0.05)}$	0.15	7.01	15.01	0.031	0.16	2.13	0.32	0.18

4.3. In dry seed.

Data presented in Table (9) show that sowing heavy seeds produced plants that had high contents of the chemical constituents in dry seeds; Total soluble carbohydrates (TSC), protein, N, P, K, Fe, Mn and Zn. The increase affect was more pronounced in the dry seeds of heavy seed class which had been a significant increase as compared to both of control and light seed classes in both seasons. This increase, in the first season, reached: 5.49% and 12.15% in TSC, 10.89% and 27.30% in protein, 10.86% and 27.16% in N, 16.18% and 43.64% in P, 23.08% and 48.84% in K, 11.59% and 22.22% in Fe, 5.59% and 16.44% in Mn and 10.00% and 27.91% in Zn concentration. Whereas, the increases in the second season, were; 9.18% and 18.69% in TSC, 8.92% and 25.17% in protein, 9.21% and 25.17% in N, 23.08% and 53.85% in P, 23.61 % and 53.45% in K, 8.57% and 19.16% in Fe, 4.29% and 12.42% in Mn and 23.53% and 21.88% in Zn concentration. In this respect, larger seed weight positively correlated with seed N, P and K in cowpea (Kang and Ofeimu, 1993).

Table (9): Chemical constituents concentration; N, P, K, Fe, Mn and Zn, protein and total soluble carbohydrates (TSC) in dry seeds of bean as affected by seed quality of bean in both seasons

Seed class	N (%)	P	K	Fe	Mn	Zn	protein	TSC
		(mg 100^{-1}g of dry seeds)					(%)	
1st season								
Control	3.59	68	208	138.0	80.5	50.0	22.41	59.60
Light	3.13	55	172	126.0	73.0	43.0	19.54	56.06
High	3.98	79	256	154.0	85.0	55.0	24.85	62.87
$LSD_{(0.05)}$	0.30	8.12	33.15	11.01	3.07	3.67	1.92	2.03
2nd season								
Control	3.69	65	216	157.5	81.5	52.5	23.10	56.64
Light	3.22	52	174	143.5	76.5	48.0	20.10	52.10
High	4.03	80	267	171.0	86.0	62.0	25.16	61.84
$LSD_{(0.05)}$	0.24	10.02	37.11	10.31	3.77	6.09	1.12	3.13

Thus, it is concluded that the use of high quality seeds of bean are required to obtain adequate plant number $unit^{-1}$ for optimum yield. It is recommended that high quality seeds must be used to reduced the risk of stand establishment failure and ensure full yield of bean (green pods and dry seeds).

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جودة البذور وعلاقتها بالإنبات والنمو والمحصول فى الفاصوليا.

٢- النمو والمحصول

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يهدف هذا البحث لدراسة تأثير المستويات المختلفة لجودة بذور الفاصوليا علــى النمــو والمحصول ومكوناتة (محصول القرون الخضراء ومحصول البذور الجافة) والتركيب الكيماوى تحت الظروف الحقلية. لتحقيق هذا الهدف فقد أستخدمت بعض الفئات البذرية المختلفة الوزن من صنف جيزة ٣ وهى: الفئة الثقيلة: يتراوح وزن ١٠٠بذرة منها ٤٧,٢٠-٥٧,٦٠ جم فى الموسم الأول و ٤٨,٧٥-٥٧,١٣ جم فى الموسم الثانى. – الفئة الخفيفــة: ويتــراوح وزن ١٠٠ بذرة منها ٣٣,٧٩-٣٨,٠٢ جم فى الموسم الأول و ٣٤,٣٩-٣٧,١٣ جم فى الموســم الثانى – والفئة غير المدرجة (كنترول): ويتراوح وزن ١٠٠ بذرة منها ٣٧,٧٠-٤٢,٨٥ جم فى الموسم الأول و ٤٠,٠٢-٤٩,٨١ جم فى الموسم الثانى. تم زراعتة الفئات البذرية الثلاث السابقة خلال الموسم الصيفى لعامى ٢٠٠٥/٢٠٠٦ فى مزرعة كلية الزراعة – جامعة الفيوم – مصر.

ويمكن تلخيص النتائج المتحصل عليها فيما يلى:

١. لوحظ أن زيادة درجة جودة بذور الفاصوليا (الفئة الوزنية للبذور) أثرت بدرجة معنوية على الكفاءة الحقلية لنباتات الفاصوليا مؤدية بدورها إلى زيادة صفات النمو التى تــم دراســتها (إرتفاع النبات – عدد الأوراق للنبات–مساحة الورقة–المساحة الورقيــة للنبــات–الــوزن الطازج والجاف لأوراق النبات–الوزن الطازج والجاف لفروع النبــات–والــوزن الطــازج والجاف الكلى للنبات).

٢. لوحظ وجود علاقة وطيدة بين جودة البذور للفاصوليا ومحصول القرون الخضراء ومكوناتة: عدد القرون الخضراء للنبات–وزن القرن–محصول القرون الخضراء للنبات والفدان. حيــث زادت هذه الصفات بزيادة درجة جودة البذور.

٣.وجد أن محصول البذور الجافة ومكوناته سواء للنبات أو الفدان قد أظهر علاقة إيجابية مع درجة جودة البذور المنزرعة حيث وجد أن النباتات التى أعطت محصول عالى من البذور الجافة كانت ذات درجة جودة عالية والعكس بالعكس.

٤.لقد تبين أن جودة البذور قد أثرت على تركيز المكونات الكيماوية لأعضاء النباتات المختلفة والناتجة من زراعة البذور ذات درجة الجودة المختلفة وفى هذا الصدد، وجد أن البذور ذات درجة الجودة العالية أدت (مقارنة بدرجات الجودة المنخفضة والكنترول) إلى حدوث زيادة معنوية فى تركيز كل من: السكريات الكلية (الأوراق، القرون الخضراء)–الكربوهيدرات الذائبة الكلية (البذور الجافة)–البروتين – النيتروجين–الفوسفور–البوتاسيوم–الحديد–المنجنيز–الزنك فى الأوراق والقرون الخضراء والبذور الجافة.

أخيرا، وفى ضوء النتائج السابقة، فإنة يمكن استنتاج أن الجودة العالية لبذور الفاصوليا قد أدت إلى زيادة نسبة الكفاءة الحقلية لنباتات الفاصوليا والتى تؤدى بدورها لزيادة نسبة التماثل والنمو للنباتات النامية فى الحقل وما تبع ذلك من زيادة فى محصول القرون الخضراء والبذور الجافة سواء للنبات أو الفدان. وهكذا فإنه يوصى بقيام المزارعين بزراعة البذور ذات الجودة العالية للحصول على زيادة فى محصول الفاصوليا (القرون الخضراء والبذور الجافة).