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Effect of Seed Source on Seed Vigour and Field Performance of the Sorghum [*Sorghum bicolor.* (L.) Moench] Cultivar Tabat

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Abstract: A set of laboratory tests and field experiments were conducted for two consecutive seasons (2009/10 and 2010/11) to investigate the effect of seed source on seed quality attributes of the sorghum cultivar Tabat. Simple correlation coefficients were calculated to determine the degree of association between the different vigour tests and seedling emergence under field conditions. Seeds were obtained from four locations: two rainfed (Damazin and Habeela) and two irrigated (Khashm El Girba and El Gezira). Data were collected on initial seed moisture content, 1000-seed weight, germination percentage, rate of germination, seedling shoot length, seedling root length, seedling shoot to root length ratio, seedling fresh weight, seedling dry weight, plant height, number of leaves per plant, leaf area per plant and plant fresh and dry weight. The results indicated that, under laboratory conditions, seed source had significant effect on seedling root length and fresh weight in the first season, on germination percentage and rate of germination in the second season and on seed moisture content and 1000 seed weight in both seasons. Significant differences were found in seedling shoot length and plant height under field conditions. Seeds from Habeela and Damazin performed well with regard to germination percentage, rate of germination and field seedling emergence. Also, seeds from the rainfed areas produced taller plants than those from irrigated areas (Khashm El Girba and El Gezira). The results also showed that field seedling emergence was positively correlated with the estimate, under laboratory

Key words: Sorghum; variety Tabat; seed source; seed vigour

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conditions, of germination percentage (r = 0.66), rate of germination (r = 0.85), seedling shoot length (r = 0.81) and shoot/root length ratio (r = 0.51) and negatively correlated with seedling dry weight (r = -0.99) during the first season. In the second season, field seedling emergence was positively correlated with the estimate, under laboratory conditions, of germination percentage (r =0.80), rate of germination (r = 0.65), seedling root length (r = 0.81) and seedling fresh weight (r = 0.93).

INTRODUCTION

In Sudan, like in many other semi- arid tropical African countries, sorghum is the main food for millions of people and it is produced in all states of the country. However, the bulk of the crop is grown in the central clay plain (the states of Gedarif, Kassalla, Gezira, Blue Nile, White Nile and South Kordofan). Over 90% of the total sorghum acreage is rainfed and most of that is mechanized (Ejeta 1983).

The average sorghum yield is about 574 kg/ha, which is only 41% of the world average yield of 1386 kg/ha. This low productivity is due to many constraints; among them is sub-optimum plant population. Furthermore, replanting increases the cost of production. High seed germinability and seedling vigour are crucial factors in resolving field establishment problem (Bahar Elddin 2006).

It is well known that germination and seedling emergence result from complex interactions of seed quality and seedbed environment (Perry 1983). However, poor crop establishment is often attributed to poor seed quality. Seed of high quality results in rapid germination and emergence and rapid root and shoot growth during the early stages of development. Hence, a prerequisite for successful crop establishment is a seed of high quality, because such seed will determine the ability to cope with suboptimal conditions (Halmer and Bewley 1984; Harris *et al*. 1992). In arid environments, crop varieties with high seedling vigour and good stand establishment tend to maximize use of available soil moisture, resulting in increased dry matter accumulation and improved grain yield (Keim and Gardner 1984).

In spite of its importance as a principal factor in determining crop establishment and performance, little information is available on the effect of seed source on the performance of sorghum. There have been conflicting reports on the effect of seed source and size on growth and grain yield in various crops (Stelling *et al*. 1994; Tapscott and Cowling 1995; Burnett *et al*. 1997; Perin *et al*. 2002; Ahmed 2009). Ahmed (2009) reported that seed source of sorghum has a significant effect on mean plant height, number of leaves/plant, number of tillers/plant, peduncle length, number of heads per plant, number of seeds per head and grain yield, while there were no significant differences due to seed source on mean leaf area per plant. Stelling *et al*. (1994) showed that the seed yield of faba bean, but not field pea, was significantly affected by seed source. Tapscott and Cowling (1995), working on lupine, showed that seed source significantly affected seed yield.

The objectives of this study were to investigate the influence of seed source on seed quality attributes of the sorghum cultivar "Tabat" and to examine the correlation between the laboratory seed vigour tests and seedling performance under field conditions.

MATERIALS AND METHODS

Four seed lots of the sorghum cultivar Tabat, of 2007/08 harvest, were obtained from the propagation plots of the Arab Sudanese Seed Company. They represent four locations; namely, El Gezira and Khashm El Girba from irrigated areas, and El Damazin and Habeela from rainfed areas.

A set of laboratory tests and field experiments were carried out. The laboratory tests were conducted at the Seed Research Laboratory, Department of Agronomy, Faculty of Agriculture, University of Khartoum. The field experiments were carried out at the Demonstration Farm of the Faculty of Agriculture at Shambat (Latitude 15^0 40N, Longitude 32^0 32 E and 380 m above sea level).

Laboratory tests

The initial moisture content of each of the four lots was determined by drying 20 g samples, replicated four times, in an oven set at 80± 1^0C for 24 hours (Anon 1985). The weight of 1000 seeds was taken randomly from each lot with four replications. Working samples from each lot were drawn to perform the following tests:

(i) Germination test: From each lot, 200 seeds in four replications of 50 seeds each were germinated in double moist filtre paper. The seeds were placed two centimetres apart to avoid the contact of seedlings during germination. At the end of the incubation period, the number of normal seedlings was recorded, and the germination percentage was calculated.

(ii) Rate of germination: Daily count of normal seedlings was recorded, and the rate of germination was calculated (Maguire 1962).

(iii) Seedling fresh and dry weight: The fresh weight of the seedlings was determined after the final count. The fresh seedlings were weighed to the nearest milligramme to obtain the average seedling fresh weight. The seedling dry weight was determined after the final count. The seedlings were cut free from their remnants and dried in an oven set at 80± 1^0C for 24 hours (Fiala 1987). The dried seedlings were weighed to the nearest milligramme and the average seedling dry weight was calculated.

Seedling shoots and root length: Seeds from the different lots were germinated as per standard germination test. At the end of the incubation period, shoot and root length of normal seedlings were measured. Shoot length was measured from the point of attachment to the seed to the tip of the seedling, and the average shoot length was calculated by dividing the total shoot length by the number of normal seedlings measured. Similarly, the root length was measured from the point of attachment to the seed to the tip of the root, and the average root length was computed by dividing the total root length by the total number of the normal seedlings (Fiala 1987).

Field experiment

Seed sub-samples similar to those described in the laboratory tests were tested under field conditions. The experiment was conducted in a randomized complete block design with four replications. The experimental plot consisted of 5 rows of 3 metres length, with a spacing of 60 cm between rows and 25 cm between planting holes. Two seeds were sown in each hole in the first and second weeks of April in both seasons. The plots were irrigated every week. Weeding was practiced two and four weeks after emergence. Upon seedling emergence, data were collected on the following:

(i) **Seedling field emergence:** Emerged seedlings were counted regularly up to maximum emergence. The emergence percentage for each plot was calculated.

(ii) **Rate of seedling emergence:** This was carried out by daily count of the seedlings until no more seedlings emerged, and the rate of emergence was calculated as described earlier.

(iii) **Seedling fresh and dry weight:** Random samples of three plants from each plot were used for determination of seedling fresh and dry weight as described before.

(iv) **Plant height and number of leaves/plant:** Plant height was measured from the surface of the soil to the tip of the main panicle of three random plants in each plot and the average number of their leaves was determined.

(v) **Leaf area/plant:** Leaf area was determined using the following formula: Leaf area (cm^2) = the maximum leaf length x the maximum leaf width x 0.75, according to Stickler *et al*. (1961).

Statistical analysis

The collected data were subjected to the analysis of variance appropriate for the design used (Gomez and Gomez 1984). Mean separation was done, according to Duncan's Multiple Range Test. Simple correlation coefficients were calculated to test the association among the laboratory test results and between the laboratory tests and field emergence parameters.

RESULTS

Laboratory tests and field experiments

1. Initial seed moisture content: There were highly significant differences ($P \leq 0.01$) among the different seed sources for this character, in both seasons (Table 1). In the first season, Damazin and El Gezira had significantly higher initial moisture content than El Girba and Habeela. In the second season, El Girba and El Gezira had significantly higher initial moisture content than Habeela and Damazin.

2. **1000- Seed weight:** There were highly significant differences ($P \leq 0.01$) in 1000-seed weight between seed sources, in the two seasons (Table 1). The overall 1000-seed weight was 22.9 g in the first season and 24.0 g in the second season. Habeela had significantly lower 1000-seed weight than the other seed sources, in both seasons (Table 1).

3. **Seed viability:** The overall mean seed viability is represented by the germination percentage in the laboratory and seedling emergence in the field. In both seasons, the overall mean seed viability was relatively higher under laboratory conditions than under field conditions (Table 1). The germination percentage was significantly affected by the seed source in the second season only (Table 1). The field emergence percentage was not significantly different in both seasons.

4. **Rate of Seed germination and seedling field emergence:** The effect of seed source on the rate of germination and field emergence followed a similar pattern to that described for germination percentage and field emergence percentage, respectively. The rate of seed germination was significantly affected by seed source under laboratory conditions in the second season only (Table 2).

5. **Seedling shoot and root length:** Highly significant differences ($P \leq 0.01$) were detected among seed sources in seedling shoot length, under field conditions in the first season only, and no significant differences were found under laboratory conditions in both seasons (Table 2). Seedling root length was significantly affected by seed source under laboratory conditions in the first season only, and there were no significant differences among seed lots under field conditions in both seasons (Table 3)

6. **Seedling shoot to root length ratio:** The data presented in Table 3 show that there were no significant differences among seed sources in the ratio of seedling shoot to root length under both laboratory and field conditions, in both seasons.

7. **Seedling fresh and dry weight:** Seedling fresh weight was significantly affected by seed source under laboratory conditions in the first season only, but there were no significant differences among the seed sources under field conditions in both seasons (Table 4). The dry weight of seedlings was not significantly affected by seed source under both laboratory and field conditions, in both seasons (Table 4).

8. **Plant height:** Significant differences ($P \leq 0.05$) were found in plant height among the different seed lots at 40 and 60 days after emergence in the first season (Tables 5 and 6), but there were no differences at 50 days after emergence (Table 5). In both seasons, Habeela had the highest plant height at all harvesting times.

9. **Number of leaves and leaf area per plant:** No significant differences were detected among the four seed sources in the number of leaves and leaf area per plant, in both seasons (Tables 5 and 6) at all harvesting times.

10. **Plant fresh and dry weight:** No significant differences were obtained among seed sources in fresh and dry weight, in both seasons (Tables 5 and 6) at all harvesting times.

Correlation analysis in the first season, seedling emergence in the field was positively correlated with estimates, under laboratory conditions, of germination percentage, rate of germination, seedling shoot length and shoot/root length ratio and negatively correlated with dry weight during the first season. In the second season, it was positively correlated with germination percentage, rate of germination; seedling root length and seedling fresh weight (Table 7).

Table1. Effect of seed source on initial seed moisture content, 1000-seed weight, seed germination (%) and field emergence (%) of the sorghum cultivar Tabat

Seed source	Moisture content (%)		1000 seed weight (g)		Germination (%)		Field emergence (%)	
	I	II	I	II	I	II	I	II
Damazin	8.4a	6.00c	23.7a	25.9a	84.0a	94.5a	29.0a (34)	39.0a (41.3)
El Gezira	8.3a	7.00a	24.1a	24.9a	84.5a	90.5b	33.5a (39)	30.5a (33.7)
El Girba	7.1b	7.70a	23.7a	23.3b	82.5a	85.5c	33.0a (40)	25.5a (29.8)
Habeela	5.5c	6.13b	20.3b	21.9c	90.0a	92.0ab	36.0a (40)	27.5a (29.9)
Mean	7.3	6.70	22.9	24.0	85.0	90.6	33.0	30.6
SE±	0.08	0.06	0.41	0.42	3.7	1.53	4.1	13.3
C.V%	0.6	0.45	2.5	2.5	3.7	2.39	17.8	61.6

I = first season (2009/2010); II = second season (2010/2011). Means in a column followed by the same letter (s) are not significantly different at P ≥0.05, according to Duncan's Multiple Range Test. Figure between brackets is the field emergence expressed over the germination percentage.

Table 2. Effect of seed source on the rate of germination in the laboratory, rate of field emergence and seedling shoot length of the sorghum cultivar Tabat under laboratory and field conditions

Seed source	Rate of germination		Rate of field emergence		Seedling shoot length (cm)			
					Laboratory		Field	
	I	II	I	II	I	II	I	II
Damazin	66.6a	70.1a	9.9a (14.8)	15.2a (21.7)	2.2a	6.7a	9.3a	15.5a
El Gezira	69.4a	67.9a	11.0a (15.8)	11.5a(16.9)	3.3a	8.1a	8.4bc	15.7a
El Girba	66.9a	58.4b	11.4a (17.0)	8.7a(14.9)	3.5a	6.3a	9.2ab	11.0a
Habeela	70.8a	69.3a	13.0a (18.3)	11.5a(16.6)	3.3a	6.6a	7.6c	15.5a
Mean	68.4	66.4	11.3	11.7	3.1	6.9	8.6	14.4
SE±	2.8	1.8	1.7	6.0	0.8	1.1	0.4	2.2
C.V%	5.9	3.8	21.7	72.8	37.9	22.0	6.8	21.8

I = first season (2009/2010); II = second season (2010/2011). Means in a column followed by the same letter (s) are not significantly different at P ≥ 0.05; according to Duncan's Multiple Range Test. Figure between brackets is the rate of field emergence expressed over the rate of germination.

Table 3. Effect of seed source on seedling root length and shoot to root length ratio of the sorghum cultivar Tabat under laboratory and field conditions

Seed source	Seedling root length (cm)				Seedling shoot to root length ratio			
	Laboratory		Field		Laboratory		Field	
	I	II	I	II	I	II	I	II
Damazin	2.77b	6.7a	4.20a	8.4a	79.79a	98.28a	241.98a	191.24a
El Gezira	3.52b	6.2a	4.07a	8.3a	95.84a	133.25a	221.88a	206.83a
El Girba	4.57a	5.9a	3.69a	6.5a	77.10a	105.63a	280.85a	179.01a
Habeela	3.58b	5.3a	4.44a	8.5a	88.95a	127.68a	196.75a	194.27a
Mean	3.60	6.0	4.10	7.9	85.42	116.21	235.36	192.84
SE±	0.35	0.48	0.88	1.8	20.15	19.06	52.90	31.65
C.V%	13.6	11.4	30	31.9	33.4	23.20	31.80	23.21

I = first season (2009/2010); II = second season (2010/2011). Means in a column followed by the same letter are not significantly different at P ≥0.05, according to Duncan's Multiple Range Test.

Table 4. Effect of seed source on the sorghum cultivar Tabat seedling fresh and dry weight under laboratory and field conditions

Seed source	Seedling fresh weight (mg)				Seedling dry weight (mg)			
	Laboratory		Field		Laboratory		Field	
	I	II	I	II	I	II	I	II
Damazin	100.0a	117.5a	1945.0a	566.5a	17.50a	13.0a	255.00	141.8a
El Gezira	85.0a	102.5a	2023.0a	774.8a	12.50a	17.0a	342.50a	189.5a
El Girba	65.0b	102.5a	1923.0a	249.8a	12.50a	11.0a	302.50a	67.3a
Habeela	88.0a	102.5a	1515.0a	649.8a	10.00a	10.0a	237.50a	148.6a
Mean	84.4	106.3	1851.3	560.2	13.13	12.8	284.38	136.8
SE±	9.9	18.0	265.6	280.7	2.43	2.8	93.4	54.4
C.V%	16.6	33.9	20.3	70.99	26.2	30.5	46.4	56.2

I = first season (2009/2010); II = second season (2010/2011). Means in a column followed by the same letter are not significantly different at P ≥0.05, according to Duncan's Multiple Range Test.

Table 5. Effect of seed source on the sorghum cultivar Tabat growth parameters 30 and 40 days after emergence in the the field in the 1st and 2nd seasons

Seed source	Plant ht (cm)		No. of leaves		Leaf area (cm^2)		Fresh wt (g)		Dry wt (g)	
	I	II	I	II	I	II	I	II	I	II
30 days after emergence										
Damazin	-	39.8a	6.66a	7.9a	128.13a	238.5a	14.58a	59.3a	9.38a	11.0a
El Gezira	-	39.7a	7.00a	7.8a	79.52a	224.2a	13.33a	64.7a	8.48a	13.3a
El Girba	-	40.0a	6.66a	7.8a	103.28a	233.7a	16.66a	73.0a	7.88a	13.0a
Habeela	-	44.2a	8.00a	7.3a	78.53a	202.5a	13.33a	52.0a	8.70a	10.7a
Mean	-	40.9	7.08	7.7	97.36	224.8	13.23	62.3	8.60	12.0
SE±	-	3.0	0.90	0.39	31.60	39.2	1.78	16.0	1.20	3.1
C.V%	-	10.4	17.6	7.2	45.9	24.6	19.04	31.6	19.8	31.6

Table 5. Cont.

Seed source	Plant ht. (cm)		No. of leaves		Leaf area (cm^2)		Fresh wt (g)		Dry wt (g)	
	I	II	I	II	I	II	I	II	I	II
30 days after emergence										
Damazin	35.14b	49.4a	8.50a	9.3a	165.69a	253.3a	87.50a	80.7a	14.08a	23.7a
El Gezira	34.97b	52.8a	8.25a	8.7a	203.69a	299.9a	97.08a	30.7a	14.42a	8.7a
El Girba	35.90b	50.4a	8.75a	9.0a	234.54a	270.5a	95.83a	64.7a	15.83a	18.7a
Habeela	45.17a	57.8a	9.25a	8.8a	242.23a	262.1a	81.50a	96.0a	13.33a	25.7a
Mean	37.79	52.6	8.68	8.9	211.54	271.4	90.48	68.0	14.41	19.2
SE±	3.21	4.5	0.35	0.35	28.15	46.2	13.70	29.8	3.69	8.7
C.V%	12	12.1	5.7	5.6	18.8	24.1	21.4	53.7	36.2	55.5

I = first season (2009/2010); II = second season (2010/2011). Within columns, means followed by the same letter are not significantly different at P≤0.05 according to Duncan's Multiple Range Test.

Table 6. Effect of seed source on the sorghum cultivar Tabat growth parameters 50 and 60 days after emergence in the field in the 1st and 2nd seasons

Seed source	Plant height (cm)		No. of leaves		Leaf area (cm^2)		Fresh wt(g)		Dry wt (g)	
	I	II	I	II	I	II	I	II	I	II
					50 days after emergence					
Damazin	53.41a	53.58a	10.25a	10.58a	288.20a	433.28a	325.40a	-	68.83a	-
El Gezira	53.92a	53.88a	11.08a	10.43a	286.95a	467.75a	249.25a	-	51.25a	-
El Girba	54.08a	51.9a	10.91a	10.68a	349.42a	443.58a	309.00a	-	49.25a	-
Habeela	58.66a	59.14a	10.25a	11.55a	281.38a	377.65a	394.20a	-	67.66a	-
mean	55.02	54.62	10.62	10.81	301.48	430.56	319.46	-	59.25	-
SE±	6.37	4.66	0.48	0.49	29.28	37.6	90.18	-	14.30	-
C.V%	16.4	12.1	6.4	6.4	13.7	12.4	0.87	-	34.1	-

Table 6. Cont.

Seed source	Plant height (cm)		No. of leaves		Leaf area (cm^2)		Fresh wt(g)		Dry wt (g)	
	I	II	I	II	I	II	I	II	I	II
60 days after emergence										
Damazin	56.09b	66.88a	9.00a	11.92a	321.50a	440.65a	337.90a	-	82.58a	-
El Gezira	54.92b	67.96a	9.91a	12.21a	324.25a	481.78a	409.60a	-	90.00a	-
El Girba	55.65b	59.08a	10.25a	12.46a	327.60a	383.72a	452.90a	-	120.25a	-
Habeela	63.75a	73.13a	8.67a	12.5a	344.90a	464.77a	506.25a	-	129.33a	-
mean	57.60	66.76	9.46	12.27	329.57	442.73	426.66	-	105.54	-
SE±	2.87	6.26	0.55	0.63	38.49	59.89	103.37	-	18.81	-
C.V%	7.06	13.3	8.2	7.3	16.5	19.13	34.3	-	25.2	-

= first season (2009/2010); II = second season (2010/2011). Within columns, means followed by the same letter are not significantly different at P≤0.05 according to Duncan's Multiple Range Test.

Table 7. Correlation coefficients between the various vigour tests and between the vigour tests and field emergence in 2009 and 2010

	1	2	3	4	5	6	7
			2009				
1- Standard germination	-						
2- Rate of germination	0.85	-					
3- Seedling shoot length	0.10	0.45	-				
4- Seedling root length	-0.23	-0.02	0.86	-			
5- Shoot/root ratio	0.46	0.79	0.28	-0.23	-		
6- Fresh weight	0.34	0.09	-0.83	-0.99	0.24	-	
7- Dry weight	-0.58	-0.01	-0.86	-0.59	-0.45	0.51	-
8- Field emergence	0.66	0.85	0.81	0.49	0.51	-0.42	-0.99

Table 7. Cont.

	1	2	3	4	5	6	7
			2009				
1- Standard germination	-						
2- Rate of germination	0.95	-					
3- Seedling shoot length	0.19	0.38	-				
4- Seedling root length	0.31	0.14	0.22	-			
5- Shoot/root ratio	-0.08	0.28	0.67	-0.57	-		
6- Fresh weight	0.68	0.45	-0.19	0.77	-0.71	-	
7- Dry weight	0.16	0.26	0.92	0.55	0.35	0.05	-
8- Field emergence	0.80	0.65	0.15	0.81	-0.44	0.93	0.35

DISCUSSION

The influence of seed source on seed quality attributes, such as germination percentage, rate of germination, seedling root length and seedling fresh weight, was significant under laboratory conditions. The lack of a significant difference under field conditions may be attributed to the fact that the conditions are seldom optimal in the field.

Field emergence was not significantly different among the seed lots, being low, although the germination percentage was high for all four lots under laboratory conditions. This might be explained by the fact that the germination test in the laboratory was conducted under optimal conditions, whereas field conditions are seldom optimum and cannot be controlled. Field emergence expressed over the germination percentage was very low for the four seed sources ranging between 34% and 40% in the first season and 29.8% and 41.3% in the second season. This indicates that for the cultivar Tabat, laboratory germination test can estimate less than 50% of seedling emergence. However, the optimum germination conditions in the laboratory are rarely encountered in the field, and field emergence may be overestimated by standard germination and vigour tests. Also, the low seedling emergence might be due to the fact that Tabat has relatively low α-amylase specific activity in the seedling, which also might be further affected by the heterogeneous conditions in the field (Ahmed 2006).

Generally, the highest germination percentage (90%) and the highest seedling emergence (36%) in the field were recorded for the seed lot from Habeela (rainfed), in the first season, while Damazin and Habeela seeds had the highest germination percentages (94.5% and 92%, respectively) in the second season. This may be attributed to the lowest initial seed moisture content of the seed lots from rainfed areas. On the other hand, Bahar Elddin (2006) reported that seeds with medium moisture content (7.5%) consistently resulted in better vigour attributes than either high (10%) or low (5%) moisture content. In this study, the seed lot from El Girba with moisture content comparable to that reported by Bahar Elddin (2006), did not show the highest germination percentage and field emergence.

As for the germination percentage and seedling field emergence, the latter was generally low as compared with the high germination rates in the laboratory. The germination rate is considered a measure of seed vigour. Its suitability for predicting field emergence of soybean was discussed by Egli and Tekrony (1995). In the present study, the data showed that germination rate was a poor indicator of field emergence as was shown by the low values of the field emergence expressed over germination rate. Slow rate of emergence subjects the growing seedling to attack by the microorganisms in the soil. This is of particular importance for small farmers in rainfed areas who seldom apply fungicides or bactericides as seed dressing.

Differences among the four seed sources were found in seedling shoot length, particularly under field conditions in the first season, while they were more or less similar in the laboratory in both seasons. These results disagree partially with the findings of Bahar Elddin (2006) who stated that there were significant differences in seedling shoot length under field and laboratory conditions. Seedling root length was similar under both laboratory and field conditions. Generally, the seed lot from El Girba (irrigated area) recorded higher root length under laboratory conditions than the other sources in the first season.

Shoot to root ratio was generally high under field conditions than under laboratory conditions. This high ratio could be explained by the rapid development of the shoot than the root under field conditions. Vigour attributes, such as seedling fresh and dry weight, were generally lower in the laboratory than in the field. The highest seedling fresh and dry weights were recorded for the seed lot from El Gezira (irrigated area), in both seasons. Differences in plant height were very small except for the seed lot from Habeela (rainfed) which showed taller plants than the other seed lots.

Number of leaves per plant was not significantly affected by seed source at the different harvesting times, in both seasons, but generally the two irrigated seed lots produced greater number of leaves than the rain-fed areas. These results agree with the findings of Ahmed (2009). Leaf area (cm^2) per plant was similar for all seed lots, during all harvesting times, in both seasons. Plant fresh and dry weights followed a similar pattern, and there were no significant differences among seed lots, in both seasons. These results disagree with the findings of Ahmed (2009) who stated that seeds obtained from rainfed areas resulted in plants with greater dry weights than those obtained from irrigated areas.

Field emergence and other growth parameters followed the same pattern as laboratory tests for the various vigour attributes, i.e. the attribute with high values in the laboratory followed the same trend in the field, but the laboratory tests were poor indicators of the field emergence and rate of seedling emergence. Nevertheless, positive significant correlation was found between standard germination test and field seedling emergence. Rate of germination, shoot length and shoot to root ratio were positively correlated with field emergence and negatively correlated with seedling dry weight. Similar results were obtained by Bahar Elddin (2006), except for the correlation between field seedling emergence and seedling dry weight. The results reported by Eagli and TeKrony (1995) showed that the relationship between laboratory tests and field emergence is complex, and the ability of laboratory tests to predict field emergence is variable and strongly dependent on the field environment.

CONCLUSIONS

1- For Tabat cultivar of sorghum, laboratory germination test can estimate less than 50% of seedling emergence.
2- Further studies with special emphasis on using different cultivars with different maturity (early, medium, late) and enzymology under different meteorological conditions are needed to determine the appropriate seed treatments that lead to better vigour attributes.

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تأثير مصدر البذرة علي قوة الإنبات والأداء الحقلي للذرة الرفيعة صنف طابت*

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المستخلص: أجريت مجموعة من الاختبارات المعملية وتجارب حقلية لموسمين متتالين (10/2009 و 11/2010) لدراسة تأثير مصدر بذور الذرة الرفيعة (صنف طابت) علي خصائصها. أجرى حساب معدل الارتباط البسيط بين الاختبارات المعملية لقوة الإنبات والإنبات الحقلي. جمعت البذور من أربع مناطق هى منطقتين للزراعة المطرية (الدمازين وهبيلة) ومنطقتين للزراعة المروية (خشم القربة و الجزيرة). جمعت بيانات عن المحتوي الرطوبى للبذرة، وزن 1000بذرة، نسبة الإنبات، معدل الإنبات، طول ساق وجذر البادرة، نسبة الساق الى جذر البادرة، الوزن الجاف والرطب للبادرة، طول النبات، عدد الأوراق فى النبات الواحد، مساحة سطح الأوراق، الوزن الرطب و الجاف للنبات. أوضحت النتائج أن لمصدر البذور تأثيراً معنوياً علي طول جذر البادرة و الوزن الرطب للبادرة فى الموسم الاول وعلى نسبة الإنبات و معدل الإنبات فى الموسم الثانى وعلى المحتوي الرطوبى للبذرة و وزن 1000بذرة فى الموسمين تحت ظروف المعمل، بينما اظهر طول ساق البادرة وطول النبات فروقاً معنوية تحت ظروف الحقل. كان أداء البذور المنتجة فى هبيلة والدمازين عموما جيدا في ما يختص بنسبة الإنبات و معدل الإنبات وبزوغ البادرات في الحقل مقارنة بالمنتجة بالرى. كذلك أعطت هذه البذور نباتات تفوق في طولها نباتات البذور المنتجة تحت ظروف الري. كذلك دلت النتائج علي أن بزوغ البادرات في الحقل له علاقة ارتباط موجبة مع نتائج المعمل فيما يتعلق بنسبة الإنبات (r = 0.66) و معدل الإنبات (r = 0.85) و طول ساق البادرة (0.81)

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و نسبة طول الساق الى الجذر (r = 0.51) ، بينما له علاقة ارتباط سالبة مع الوزن الجاف للبادرة (r = -0.99) وذلك في الموسم الأول . في الموسم الثاني، كانت له علاقة ارتباط موجبة مع نتائج المعمل فيما يتعلق بنسبة الإنبات (r = 0.80) معدل الإنبات (r = 0.65) ، و طول جذر البادرة (r = 0.81) و الوزن الرطب للبادرة(r = 0.93) .