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Genotypic and Environmental Interaction Effects on Forage Yield and its Related Traits of some Summer Forage Crops

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ABSTRACT

Two field experiments were conducted at Sakha and Sids Agriculture Research Station, ARC, during the two successive summer seasons of 2015 and 2016. Six summer forage crops; sorghum cv. Giza 1, Sudan grass cv. piper black, sorghum cv. SX-17, millet cv. Shandaweel 1, teosinte cv. Sakha and maize Drawa were evaluated in two locations for forage yield and some related traits. Three cuts were taken from the five forage crops and two cuts from Drawa at the same period. Combined analysis of variance revealed significant and highly significant differences for seasons, locations, summer forage crops and most of their interactions on fresh and dry forage yield, plant height, stem diameter, fresh and dry leaf/stem ratio at the two cuts and three cuts and total yield.The interaction effect between forage crops and seasons were more pronounced than between forage crops with the location on some traits, and the opposite for the other traits. Sudangrass (piper black) followed by Sorgo (Giza 1) were the best summer forage crops for fresh and dry forage yield under the study, over environments. While maize (Drawa) was the lowest one. Millet (Shandaweel 1) gave more fresh and dry yield than SX-17 at Sids location, but SX-17 exceeded millet at Sakha location, over the two seasons. Plant height and stem diameter had the same trend of fresh and dry forage yield. Fresh leaf/stem ratio had higher values in the two seasons and their combined at Sakha than at Sids. Teosinte was the best one. Concerning dry leaf/stem ratio values, season 2016 had higher values at Sakha than season 2015 at Sids and teosinte was the best one. It is economically viable to cultivate teosinte at Kafr El-Sheikh Governorate and surrounding areas since it has high palatability and good quality. On the other hand, maize as Drawa not preferable as summer forage crop since it had the lowest fresh and dry forage yield and dry leaf/stem ratio.

INTRODUCTION

One of the limitations of efficient livestock production in Egypt is the lack of adequate amounts of high-quality forage, especially during the summer. Therefore, great efforts have been directed towards the improvement and introduction of new sources of summer forage crops. In Egypt, the production of green forage is less than the demand, which affects either meat or milk production. Moreover, the acute shortage of feed is during summer season (Hathout, 1987).The farmers in Egypt are in very bad need to fresh forage to feed their livestock because it is essential especially during summer. The area devoted to the summer forage crops is very limited due to the big competition with the economic crops such as; rice, maize, cotton, and grain sorghum. Meawed (1997) studied the differences among four fodder crops i.e., Sudan grass cv. piper, pearl millet, teosinte, and local sorghum Sudan grass hybrid. He reported that the differences in fresh and dry forage yield potentialities among the four crops were the highest in the first cut and declined in the second cut and the lowest in the third cut. He indicated that total fresh and dry forage yield productivity at the first cut in the two seasons for the four fodder summer grasses ranked as follows in a descending order: sorghum Sudangrass hybrid > Sudan grass> pearl millet >teosinte. Similar trends were obtained for plant height and stem diameter. Kumar Srivas and Singh (2004) in a similar study found that dry forage yield to be significantly and positively associated with fodder yield, plant height, and stem diameter. Moreover, Carpici and Celik (2010)concluded that the relationship between dry forage yield and each of the yield components except leaf/stem ratio were positive and significant.

The objectives of this study were to evaluate some summer forage crops in two locations over two seasons for total fresh and dry forage yield and to study the interaction effects of the crops and environment on forage yield and its components.

MATERIALS AND METHODS

The present study was carried out at two different locations which represent Sakha Agric. Res. Stn. (Northern Delta) and Sids Agric. Res. Stn. (Northern Upper Egypt), A.R.C., Egypt, during 2015 and 2016 summer seasons, to evaluate the productivity of some summer forage crops over locations and seasons.

The materials used in this investigation are presented in Table (1).

Table 1.The name and source of summer forage crops used in this investigation.

Crop	Sci.name	cultivar	Source
Sorghum	*Sorghum bicolor* L.	S. Giza 1	Variety of Sorghum saccharatum, Forage Crops Res. Dept., ARC, Egypt
Sorghum	*Sorghum bicolor* L.	S.S.piper black	Selected through breeding program of Sudan grass, Forage Crops Res. Dept., ARC, Egypt
Sorghum	*Sorghum bicolor* L.	S. SX-17	Commercial hybrid sorghum, SX -17
Millet	Pennisetum glucum L.	Shandaweel-1	Local variety, selected through breeding program of millet.
Teosinte	*Zea mexicana* (Shrad.)	Local	Sakha variety, Forage Crops Res. Dept.
Maize	*Zea mays* L.	Maize (SC10)	Commercial hybrid maize , Maize Crops, Res. Dept.

The six summer forage crops were grown in a randomized complete blocks design (R.C.B.D.) with four replications. The plot size for each crop was 12 m^2 (five ridges, 60 cm 3m width, four meters long).

The seeding rates were 20 kg/fed. for sorghum and millet, 30 kg/fed. For teosinte, while 40 kg/fed. For maize(drawa). Also, drawa was sown twice, with growth period of about 125 days (two times early and late season).

The seeds hand drilled in the top ridges and covered. The sowing dates were on May 11th and 15th at Sakha location and May 8th and 13th at Sids location in the two seasons, respectively. The fertilizer rates were 150 kg/fed. superphosphate (15.5% P_2O_5) added during land preparation. The nitrogen fertilizer rates were added at three equal doses (30 Kg/fed.). The first dose was added after about 21 days from sowing, the second and the third doses were added after the first and the second cuts, respectively, while for drawa we added 30 kg/nitrogen/fed for every cut. Eighteen kg N/fad. after about 21 days from sowing and 12 kg N/fad. after 10-15 days from the first dose.

Appropriate agricultural practices were followed during both growing seasons at each location. Three cuts were taken in each season and locations for the five forage crops, while drawa only two cuts were taken for the two times, respectively., But the growth periods for all forage crops were ranged from 115 to 120 days.

The studied traits were:

1. Fresh forage yield (kg/plot) for every cut and total fresh yield.
2. Dry forage yield (kg/plot) for every cut and total dry yield.
3. Plant height (cm)
4. Stem diameter (cm)
5. Fresh leaf/stem ratio.
6. Dry leaf/stem ratio.

Statistical analysis:

Data were subjected to proper statistical analysis of RCBD design as outlined by Snedecor and Cochran (1967). Combined analysis for each studied trait was calculated over the four environments to study the interaction effects of the forage crops with environments. Before carrying out the combined analysis, the homogeneity test of variances was computed by Bartlett (1937) The test was significant for all traits thus the data of both years were combined. Means were compared at 0.05 and 0.01 levels of significant by the least significant differences (LSD) test using MSTAT computer program (1986).

RESULTS AND DISCUSSION

Analysis of variance:

Mean squares of fresh and dry forage yield of some summer forage crops at the two cuts and total yield overall environments are presented in Table (2).

Table 2. Combined analysis of variance for fresh and dry forage yield (kg/plot) at the two cuts and total yield over two seasons, two locations and their interaction.

S.O.V.	d.f	Fresh yield (kg/plot)			Dry yield (kg/plot)		
		Cut 1	Cut 2	Total	Cut 1	Cut 2	Total
Season (S)	1	14065.0**	1093.500**	32120.167**	263.5**	65.41**	276.8**
Location (L)	1	165.37**	2242.667**	5280.667**	10.30**	226.57**	199.6**
S x L	1	5430.00**	104.167**	204.167*	115.5**	2.32**	41.36**
R (L x S)	12	1.45	1.500	9.618	0.022	0.032	0.14
Genotypes (G)	5	2073.6**	436.567**	8335.767**	40.85**	22.09**	241.75**
S x G	5	322.40**	84.350**	1124.217**	9.55**	5.79**	22.06**
L x G	5	306.80**	430.867**	2040.667**	6.00**	3.56**	11.80**
S x L x G	5	443.4**	571.617**	429.017**	11.47**	1.27**	3.35**
Error	60	6.89	11.300	43.835	0.10	0.09	0.72

***,** significant and highly significant at the 0.05 and 0. 01, respectively.**

Data of analysis of variance revealed highly significant differences over seasons (S), locations (L) and seasons x locations (SXL) interaction effects for the two cuts and total fresh and dry forage yield, except the total fresh yield of the interaction (seasons x locations) of fresh forage yield, had significant differences. Results indicated that season had more effects on yield than the location in the first and total fresh and dry forage yield, while at the second cut location had more effects (Table 2).

Highly significant differences were detected among genotypes (G) seasons x genotypes (SXG), location, and genotypes and seasons x locations x genotypes (SXLXG) interaction effects for the two cuts and total fresh and dry forage yield.

Data also revealed that seasons x genotypes had higher effects than location x genotypes and seasons x locations x genotypes in the two cuts and total fresh and dry forage yield, except at the first cut of fresh and dry forage yield had higher effects than season x genotype and location x genotype .

The results indicated that unpredicted environment variability were more effective than predictable environment. Also, the yield of these genotypes was affected by the environment, and all genotypes don't similarly respond to environmental changes.

Similar results were reported by Abd El-Maksoud *et al*. (1998), Abd El-Twab and Rashed (1985).

Mean squares of plant height, stem diameter, fresh and dry leaf/stem ratio traits of some summer forage crops at the two cuts overall environments are presented in Table (3). Data revealed that seasons had highly significant effects for plant height, stem diameter and fresh leaf/stem ratio traits at the first and second cut. Also, locations showed highly significant effects for plant height, stem diameter, fresh leaf/stem ratio and dry leaf/stem ratio traits at the two cuttings. Season x location interactions revealed a highly significant effect for plant height at the two cuts, stem diameter at the second cut and fresh and dry leaf/stem ratio at the first cut. Results in Table (3) revealed that seasons were more effective than locations for plant height at the two cuts and stem diameter at the second cut, while locations were more effective for stem diameter trait at the first cut, fresh and dry leaf/stem ratio traits at the two cuts. Similar results were reported by (Allard and Bradshaw, 1964).

Table 3. Combined analysis of variance for plant height (cm), stem diameter (cm), fresh and dry leaf stem ratio at the two cuts and two seasons and two locations and their combined data.

S.O.V.	d.f	Plant height		Stem diameter		Fresh leaf stem ratio		Dry leaf stem ratio	
		Cut 1	Cut 2	Cut 1	Cut 2	Cut 1	Cut 2	Cut 1	Cut 2
Season	1	30709.2**	16328.1**	0.193**	3.263**	100.0**	541.5**	0.042	0.375
Location	1	10647.1**	150.0**	0.271**	0.940**	3725.0**	6048.4**	1926.00**	7884.3**
S x L	1	2762.7**	8362.6**	0.013	1.964**	145.0**	13.5	40.0**	2.04
R (L x S)	12	5.4	2.6	0.007	0.002	2.25	3.4	3.85	3.93
Genotypes (G)	5	19761.7**	9857.8**	1.390**	0.387**	2827.4**	575.9**	3174.0**	114.9**
S x G	5	1243.7**	1420.8**	0.010	0.035	56.8**	155.9**	171.2**	106.8**
L x G	5	1930.3**	1376.5**	0.086*	0.080*	433.0**	411.5**	1598.0**	445.6**
S x L x G	5	1715.1**	533.6**	0.022	0.015	64.2**	167.1**	97.0**	110.1**
Error	60	12.1	16.3	0.017	0.014	10.27	8.90	12.5	11.90

***,** significant and highly significant at the 0. 05 and 0.01, respectively.**

Combined analysis of variance of summer forage crops under the study revealed highly significant differences for plant height, stem diameter, fresh and dry leaf/stem ratio traits at the two cuttings. Seasons x genotypes interaction showed highly significant effects on plant height, fresh and dry leaf/stem ratio at the two cuts. Also, locations x genotypes interaction (Table 3) revealed highly significant effects on plant height, fresh and dry leaf/stem ratio at the two cuts, while stem diameter had significant effects at the two cuts. The interaction between seasons, locations and genotypes showed highly significant effects for plant height, fresh and dry leaf/stem ratio of the two cuts. Data in Table (3) also revealed that locations x genotypes interaction had higher effects than year x genotypes and seasons x locations x genotypes had for plant height, stem diameter and fresh and dry leaf/stem ratio at the two cuts, except plant height at the second cut, whereas, seasons x genotypes interaction effect was higher than the other two interactions. Combined analysis of variance revealed that year x genotypes interaction effect occurred because there was a large variance in the environmental conditions between the two locations (Sakha and Sids), also indicated that genotypes don't similarly respond to environmental changes.

Combined analysis of variance for all traits studied at the third cut (summer forage crops studied except drawa) over two seasons and two locations and their interactions are presented in Table (4). Data revealed that seasons, locations and their interaction effects were highly significantly different for all traits studied at the third cut except fresh leaf/stem ratio trait was significant. Also, seasons x location interaction were more effective than seasons or location for fresh yield, dry yield and plant height at the third cut (Table 4). While seasons were more effective for stem diameter and locations were more effective for fresh and dry leaf/stem ratio traits at the third cut.

Data revealed that genotypes had highly significant differences among the six traits studied over the two locations and two seasons.

Seasons x genotypes interaction effects were highly significantly different for fresh yield, dry yield, and plant height, while fresh and dry leaf /stem ratio were significantly different (Table 4). Location x genotypes – showed highly significant differences for fresh yield, dry yield, plant height, fresh leaf/stem ratio, and dry leaf/stem ratio traits at the third cut, while stem diameter had significant differences. Season x location x genotypes interaction effects were highly significantly different for fresh, dry yield, plant height, and fresh leaf/stem ratio (Table 4). Data also revealed that location x genotypes interaction had more effects than other interactions studied for fresh yield, plant height, stem diameter and dry leaf/stem ratio traits at the third cut, while season x location x genotype interaction were more effective for dry yield and fresh leaf/stem ratio traits. This may be due to predictable environmental variation (Sakha and Sids) locations which were more discriminating than unpredictable environment variations (Allard and Bradshaw, 1964). Also, genotypes don't similarly respond to environmental changes.

Table 4. Combined analysis of variance for the six characters, fresh and dry yield, plant height, stem diameter and fresh and dry leaf/stem ratio at the third cut for five genotypes at the two seasons, two locations and their interaction.

S.O.V.	d.f	Fresh yield	Dry yield	Plant height	Stem diameter	fresh leaf/stem ratio	Dry leaf/stem ratio
Season	1	911.25**	34.90**	952.20**	0.392**	897.80**	480.2**
Location	1	1748.45**	6.85**	3753.80**	0.288**	11809.80**	10672.2**
S x L	1	2904.05**	39.48**	29032.20**	0.072**	20.00*	696.20**
R (L x S)	12	1.91	0.05	4.30	0.002	2.87	4.0
Genotypes (G)	4	518.80**	13.27**	17478.0**	0.190**	1892.38**	3686.7**
S x G	4	55.50**	1.79**	771.20**	0.022	31.93*	36.7*
L x G	4	250.70**	4.83**	2418.80**	0.068*	179.93**	1211.7**
S x L x G	4	171.80**	5.51**	1769.20**	0.032	319.38**	25.7
Error	60	4.47	0.12	9.785	0.010	10.41	12.29

***,** significant and highly significant at the 0. 05 and 0.01, respectively.**

Similar results were reported by Obilana and El-Rouby (1980).

Total fresh forage yield of some summer forage crops as affected by two locations and two seasons and their combined data are presented in Table (5). Data revealed that summer season 2016 had the highest total fresh forage yield over two locations (146.7 kg/plot), while summer season 2015 had (106.7 kg/plot). Sakha location had the highest total fresh yield over the two seasons (130.0 kg/plot), while Sids had123.3 kg/plot.

Combined data overall environments (Table 5) showed that Sudan grass piper black was the first one for fresh forage yield (162.5 kg/plot), followed by S. Giza 1 (149.8 kg/plot), while the lowest one was Drawa which had (86.9 kg/plot). Data also revealed that millet had high fresh forage yield (140.0 kg/plot) compared to S.SX-17 (119.5 kg/plot) at Sids location, while at Sakha location S.Sx-17 had higher fresh forage yield (147 kg/plot) compared with millet (123 kg/plot) over the two seasons. The results indicated that Sudan grass piper black and S.Giza 1 are useful summer forage crops at Sakha and Sids locations. The same results were obtained by El-Gaafary *et al*. (2016) and Reddy *et al*. (2004).

Table 5.Total fresh forage yield (kg/plot) of some summer forage crops as affected by two locations and two seasons and their combined data.

Forage crops	2015 season			2016 season			Combined over two seasons		Combined overall location
	Sakha	Sids	Mean	Sakha	Sids	Mean	Sakha	Sids	
S. Giza1	134	127	130.5	177	161	169.0	155.5	144	149.8
S. Piper B	146	137	141.5	187	180	183.5	166.5	158.5	162.5
S. SX-17	128	91	109.5	166	148	157.0	147	119.5	133.3
Millet	98	104	101	148	176	162.0	123	140.0	131.5-
Teosinte	88	77	82.5	112	111	111.5	100	94.0	97.0
Drawa	78.0	72.0	75.0	98.0	96.0	97.0	88.0	84.0	86.0
G. mean	112.0	101.3	106.7	148	145.3	146.7	130	123.3	126.7
LSD 0.05	9.2	10.2	-	10.3	10.4	-	7.6	6. 2	4.9

Results in Table (5) show that evaluated summer forage crops could be put in descending order from economical viability and yield potentiality as follows; Sudan grass (piper black), Sorgo (Giza 1), H.S. (SX 17), millet (Shandaweel 1) and teosinte (Sakha), but don't sow maize (drawa).

Mean performance of total dry forage yield trait of some summer forage crops as affected by two locations and two seasons and their combined data are presented in Table (6). Data illustrate that summer season 2016 had high dry forage yield (18.6 kg/plot) than that of 2015 (13.6 kg/plot), also Sakha location was high dry forage yield (16.5 kg/plot) than that on Sids location (15.7 kg/plot). The highest summer forage crop was Sudan grass (piper black), (21 kg/plot) overall environments, followed by Sorgo (Giza 1) (19.2 kg/plot). The lowest one was maize (Drawa) (11.3 kg/plot). Data also revealed that SX-17 exceeded millet at Sakha while millet exceeded SX-17 at Sids location over the two seasons.

Table 6. Total dry forage yield (kg/plot) of some summer forage crops as affected by two locations and two seasons and their combined data.

Forage crops	2015 season			2016 season			Combined over two seasons		Combined overall location
	Sakha	Sids	Mean	Sakha	Sids	Mean	Sakha	Sids	
S. Giza1	16.8	16.4	16.6	22.3	21.2	21.8	19.6	18.8	19.2
S. Piper B	18.5	18	18.3	24.3	23.1	23.8	21.4	20.6	21.0
S. SX-17	16.8	11.7	14.3	21.6	20.4	21.0	19.2	16.1	17.7
Millet	11.7	12.9	12.3	18.7	20.3	19.5	15.2	16.6	15.9
Teosinte	10.6	9.1	9.8	13.6	13.5	13.4	12.1	11.2	11.7
Drawa	10.5	9.5	10.0	12.8	12	12.4	11.7	10.8	11.3
G. mean	14.1	12.9	13.6	18.9	18.4	18.6	16.5	15.7	16.1
LSD 0.05	1.37	1.1	-	1.4	1.23	-	0.94	5.79	5.62

Mean performance of plant height of some forage crops at two locations, two seasons and their combined data are presented in Table (7). Data illustrated that summer season 2016 had the tallest plant (167.4 cm) compared to summer season 2015 (142.9 cm). Combined data over the two seasons revealed a highly significant difference between both locations (Table 4) (159.8 and 150.4 cm). Sudangrass (piper black) had the tallest plant (182.1 cm) overall the environments, followed by Sorgo (Giza 1) (171.9 cm), but the shortest one was teosinte (102.1 cm).

Mean performance of stem diameter (cm) of some summer forage crops at two locations, two seasons and their combined data are presented in Table (8). The results revealed that summer season 2016 had a thicker stem (1.16 cm) than the other season (2015) which had (0.98 cm). Combined data over the two seasons revealed insignificant differences between both locations of stem diameter (Table 4) with the average (1.07 and 1.07 cm). Data overall environments revealed that Sudan grass (piper black) had the thicker stem (1.19 cm), followed by Sorgo (Giza 1), (1.12 cm).

Plant height (cm) and stem diameter (cm) as a yield components revealed that fresh forage and dry forage yield overall environments (Tables 5 and 6) were related with plant height and stem diameter (Tables 7 and 8), whereas Sudan grass (piper black) which had the highest fresh and dry forage yield, where it had the tallest and thicker plants Elshahawy and Gheit (1999).

Table 7. Mean performance for plant height(cm) of some summer forage crops as affected by two locations and two seasons and their combined data.

Forage crops	2015 season			2016 season			Combined over two seasons		Combined overall location
	Sakha	Sids	Mean	Sakha	Sids	Mean	Sakha	Sids	
S. Giza1	171.7	150.3	161.0	198.7	166.7	182.7	185.2	158.5	171.9
S. Piper B	179.4	153.0	166.2	203.3	192.3	197.8	191.4	172.7	182.1
S. SX-17	156.0	146.0	151.0	179.7	161.3	170.5	167.9	153.7	160.6
Millet	109.0	146.3	127.7	162.3	179.3	170.8	135.7	162.8	149.3
Teosinte	101.3	98.0	99.7	118.0	90.7	104.4	109.7	94.4	102.1
Drawa	156.0	147.9	152.0	183.0	173.5	178.3	169.5	160.7	164.9
G. mean	145	140.5	142.9	174.2	160.6	167.4	159.8	150.4	155.1
LSD 0.05	5.4	6.1		4.7	4.8		5.3	5.1	5.2

Table 8. Mean performance for stem diameter of some summer forage crops as affected by two locations and two seasons and their combined data.

Forage crops	2015 season			2016 season			Combined over two seasons		Combined overall location
	Sakha	Sids	Mean	Sakha	Sids	Mean	Sakha	Sids	
S. Giza1	1.03	1.03	1.03	1.23	1.20	1.22	1.13	1.12	1.12
S. Piper B	1.07	1.10	1.08	1.23	1.37	1.30	1.15	1.23	1.19
S. SX-17	1.13	0.83	0.98	1.17	1.13	1.15	1.15	0.98	1.07
Millet	0.90	0.90	0.90	1.03	1.28	1.15	0.97	1.09	1.03
Teosinte	0.87	0.83	0.85	1.00	1.17	1.08	0.93	1.00	0.97
Drawa	1.04	0.93	0.99	1.10	1.07	1.08	1.04	1.00	1.02
G. mean	1.01	0.94	0.98	1.13	1.20	1.16	1.07	1.07	1.07
LSD 0.05	0.11	0.10		0.12	0.13		0.10	0.11	0.10

Mean performances for fresh leaf/stem ratio of some summer forage crops at two locations, two seasons and their combined data are presented in Table (9). Data revealed that summer season 2015 was high for fresh leaf/stem ratio (51.7%), while the other season was (49.1%), it is due to 2016 season had the tallest and thicker plants in comparison with 2015 season. Also, Sakha location had a higher value of fresh leaf/stem ratio (55.1%) more than Sids location had (45.7%) over the two seasons, it is significant differences (Table 4) it had a similar trend that plant height and stem diameter had (Tables 7 and 8). Data revealed also that teosinte had the highest value of fresh leaf/stem ratio (62.7%) followed by millet (Shandaweel 1) which had (56.6%) and the lowest one Sorgo (Giza 1) followed by maize (Drawa) 43.8 and 44.7%, respectively, overall environments.

Mean performance for dry leaf/stem ratio of some summer forage crops at two locations, two seasons and their combined data, are presented in Table (10).

Table 9. Mean performance for fresh leaf/stem ratio of some summer forage crops as affected by two locations and two seasons and their combined data.

Forage crops	2015 season			2016 season			Combined over two seasons		Combined overall location
	Sakha	Sids	Mean	Sakha	Sids	Mean	Sakha	Sids	
S. Giza1	51.0	36.8	43.9	48.6	38.6	43.6	49.8	37.7	43.8
S. Piper B	56.3	39.2	47.8	50.8	40.2	45.5	53.6	39.7	46.7
S. SX-17	55.7	40.6	48.2	53.0	42.4	47.7	54.4	41.5	48.0
Millet	63.9	53.0	58.5	60.6	48.8	54.7	62.3	50.9	56.6
Teosinte	66.7	65.3	66.0	63.8	54.6	59.2	65.3	60.0	62.7
Drawa	48.0	43.4	45.7	42.2	45.0	43.6	45.1	44.2	44.7
G. mean	50.9	46.4	51.7	53.2	44.9	49.1	55.1	45.7	50.4
LSD 0.05	4.42	4.84		5.34	4.92		4.68	4.32	3.84

Table 10. Mean performance for dry leaf/stem ratio of some summer forage crops as affected by two locations and two seasons and their combined data.

Forage crops	2015 season			2016 season			Combined over two seasons		Combined overall location
	Sakha	Sids	Mean	Sakha	Sids	Mean	Sakha	Sids	
S. Giza1	63.3	51.3	57.3	61.7	56.7	59.2	62.5	54.0	58.3
S. Piper B	67.8	54.0	60.9	66.0	58.4	62.2	66.9	56.2	61.6
S. SX-17	70.0	56.4	63.2	70.0	55.6	62.8	70.0	56.0	63.0
Millet	75.3	67.3	71.3	77.3	68.7	73.0	76.3	68.0	72.2
Teosinte	76.4	80.4	78.4	76.0	88.0	82.0	76.2	84.2	80.2
Drawa	60.0	53.5	56.8	50.7	66.5	58.6	55.4	60.0	57.7
G. mean	68.8	60.5	64.7	67.0	65.7	66.3	67.9	63.1	65.5
LSD 0.05	5.1	5.4		5.3	5.6		3.65	3.82	3.76

Results illustrate that summer season 2016 slightly increased than that in 2015 season for dry leaf/stem ratio 66.3 and 64.7%, respectively with significant different (Table 4). Regarding, the combined over the two seasons, Sakha location had a higher dry leaf/stem ratio (67.9%) than Sids location was 63.1% and had a significant effect (Table 4).

Combined data overall environments indicated that teosinte had the highest value of dry leaf/stem ratio (80.2%) followed by millet (Shandaweel 1) (72.2%), while the lowest one was for the maize (Drawa) (57.7%) followed by S. Giza 1 58.3%. Dry leaf/stem ratio for all forage crops is an indicator for good palatability and quality. Teosinte followed by millet had leafy plants, shortest and thin stem compared with the other summer forage crops in this investigation (Meawed, 1997 and Assaeed, 1994).

It can be concluded that fresh and dry forage yield and its components were affected by locations and seasons. The highest one was Sudangrass (piper black) followed by Sorgo (Giza 1) overall environments, while the lowest one was Drawa. While the best summer forage crop under the study was teosinte followed by millet for dry leaf/stem ratio. Therefore, we may recommend sowing teosinte at the large scale at Kafr El-Sheikh Governorate.

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تأثير التفاعل البيئى والتراكيب الوراثية على محصول العلف والصفات المرتبطة به لبعض محاصيل العلف الصيفية

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قسم بحوث محاصيل العلف ، معهد بحوث المحاصيل الحقلية ، مركز البحوث الزراعية الجيزة- مصر

تم تقييم ستة محاصيل علف صيفيه وهى سورجم العلف صنف (جيزة ١) ، حشيشة السودان صنف (بيبر بلاك) ، هجين سورجم تجارى (إس إكس ١٧) ، ودخن العلف صنف(شندويل ١) ، أذرة ريانة صنف (سخا) ، أذرة شامية كدراوة وذلك فى موقعين (سخا وسدس) وفى موسمين (٢٠١٥ ، ٢٠١٦). تم أخذ ثلاث حشات من خمسة محاصيل علف وعروتين فقط من الدراوة لنفس الفترة.أوضح تحليل التباين المشترك اختلافات عالية المعنوية بين السنوات، المواقع ومحاصيل العلف الصيفية تحت الدراسة ومعظم تفاعلاتها لصفات المحصول الأخضر والجاف والطول وسمك الساق ونسبة ورق/سوق أخضر وجاف لحشتين وثلاثة حشات والمحصول الكلى. كان التفاعل بين المحاصيل والسنوات أعلى من تفاعل المحاصيل مع المواقع لبعض الصفات والعكس صحيح للبعض الآخر.حشيشة السودان (بيبر بلاك) يليها الأذرة السكرية جيزة ١ أفضل محاصيل العلف الصيفية إنتاجا للعلف الأخضر والجاف تحت البيئات المختلفة – بينما الأذرة الشامية كدراوة هى الأقل محصولا.دخن شندويل (١) أعلى من هجين سورجم (إس إكس ١٧) فى موقع سدس بينما (إس إكس ١٧) أعلى من دخن شندويل(١) فى موقع سخا، للعلف الأخضر والجاف. وأخذت صفة طول النبات وسمك الساق نفس إتجاه المحصول.نسبة الورق للسوق أخضر وجاف الأعلى قيمة فى موسم ٢٠١٥ والجاف فى ٢٠١٦ وبفرق معنوى والأذرة الريانة الأعلى فى نسبة ورق/سوق أخضر وجاف حيث كانت هذه الصفة المميزة للأذرة الريانة دافعا لزراعة الأذرة الريانة بمحافظة كفرالشيخ ومناطق أخرى بسبب الاستساغة العالية والجودة. ولا يفضل التوسع في زراعة الأذرة الشامية كدراوة كمحصول علف صيفى لإنخفاض المحصول الأخضر والجاف وكذا نسبة ورق/سوق أخضر وجاف مقارنة بمحصول الذرة الريانة.