Assiut J. Agric. Sci., (48) No. (3) 2017 (22-33) *ISSN: 1110-0486*
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Forage Yield Stability of some Egyptian Clover Genotypes (*Trifolium alexandrinum* L.) under Different Sowing Dates

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Received on: 12/2/2017 **Accepted for publication on:** 19/3/2017

Abstract

This investigation was carried out to study the effect of temperature resulting from different planting dates during the stage of vegetative growth and the effect of genotypes x environment interaction on forage yield and its components in some varieties of berseem clover (*Trifolium alexandrinum* L.). A set of six varieties (Serw-1, Gemmeiza-1, Giza-6, Sakha-4, Helally and Local variety) were sown on four planting dates (September 15th, October 15th, November 15th and December 15th) in randomized complete block design with four replicates in experimental farm of Assiut University during 2014/2015 and 2015/2016 seasons. Three cuts were taken after 70, 110, 145 days from sowing. The results showed that the planting dates and varieties had a significant differences for plant height leaf/stem ratio, seasonal fresh and dry forage yields in both seasons and over the two seasons. Also, the tallest plant height was obtained from the plants sown on 15th October in both seasons. Serw-1 variety significantly gave the tallest plant height over planting dates. Moreover, the highest leaf/stem ratio was obtained from the planting date at September 15th in both seasons. Otherwise, leaf/stem ratio decreased gradually and reached to the minimum value at the December 15th in both seasons. Local variety gave the highest leaf/stem ratio.

The seasonal fresh forage yield significant decreased as planting date was delayed. Helally variety produced the highest seasonal fresh forage yield over the two seasons. Meanwhile, the seasonal dry forage yield increased as planting date was delayed. No significant differences were noticed in seasonal dry forage yield among commercial varieties (Serw-1, Gemmeiza-1, Giza-6, Sakha-4 and Helally). In the same the trend, the environments, varieties and their interaction were significant for plant height, leaf/stem ratio and seasonal dry forage yield.

Finally, the stability analysis revealed that the average stability region involved Gemmeiza-1, Giza-6, Local variety and Serw-1 varieties for plant height, Gemmeiza-1, Local variety and Serw-1 varieties for leaf/stem ratio and Gemmeiza-1 and Helally varieties for seasonal dry forage yield.

Keywords: *Egyptian clover, Trifolium alexandrinum L., planting dates, stability, genotype x environment interaction, forage yield.*

Introduction

Egyptian clover or berseem, *Trifolium alexandrinum* L. is the main and oldest cultivated winter forage leguminous crop in Egypt. It is basic for realizing a sustainable cropping system in Egypt. It occupies about one fourth of the cultivated area with average of 1.63 million feddan (B.A.S., 2014/2015). Also, it is well adapted to semi-arid condition and grown in India, Pakistan, Turkey and Mediterranean region. Egyptian clover is high nutritional quality for animal feed also contributes to soil fertility and improved physical and chemical characteristics (Graves *et al*., 1996). Thereby it is called king of forages in Egypt.

Current changes in the climatic conditions towards warming especially in Egypt are expected to prolong the spring and summer seasons and shortens the winter season and extended in temperature during which Egyptian clover in grown. Thus, it was throught desirable to change the planting date of Egyptian clover to avoid the high or low temperature effects at the beginning of the full season, a practice which was studied by some workers.

Forage yield and its components is often influenced by weather condition at the reproductive period. Ramadan *et al*. (1994) reported that the first ten days of October are the best period for sowing all cultivars for forage yield. Usmani-Khalil *et al*. (2001) found sowing berseem clover on the 15th November gaves more fresh forage yield. El-Zanaty (2005) revealed that the highest fresh and dry forage yields were significantly obtained by planting on the first of November. Also, Kandil and Sharief (2016) stated that early planting on Mid-September maximize forage production per unit area and enhancing forage quality.

Variation in weather conditions at various stages of plant development may affect the differential response of genotypes to environments. Identification of weather variables associated with the genotype x environment interaction is thus important in understanding the nature and patterns of these interactions (Saeed and Francis, 1984). It is important to determine how the temperature affects forage yield components and define the nature of their associations with forage yield in Egyptian clover. Such information may be used to plan efficient breeding programs to develop more productive varieties or to improve crop management which might favour forage production as an economically competitive enterprise. Under the changes in climatic conditions, it is important issue to determine the stability of the Egyptian clover varieties. The genotypic stability as estimated by Tai (1971) is a fit analysis to propose the stability of these varieties performance.

The objective of this study was undertaken to determine the influence of temperature conditions resulting from different sowing dates on the forage yield and its components, as well as study the stability of forage yield of berseem varieties when tested under different environments (planting dates x seasons).

Materials and Methods

The present study was carried out at the Agricultural Experimental Farm, Assiut University, Egypt, during two successive growing seasons of 2014/2015 and 2015/2016 to study the effect of temperature conditions resulting from different sowing dates on forage yield and its components of six berseem varieties. The some physical and chemical properties of the experimental soil are sand (26%), silt (24%), clay (50.0%), soil pH (7.8), organic matter (1.6%), total N (0.1%) and $CaCO_3$ (1.2%).

The genetic materials for this study included five varieties obtained from the Forage Crop Department, ARC, Ministry of Agriculture, Giza, Egypt, beside the local variety from Assiut farmers. The names of these varieties are Serw-1, Gemmeiza-1, Giza-6, Sakha-4, Helally and Local variety.

Four sowing dates of 15th September, 15th October, 15th November and 15th December were used for the six berseem varieties in randomized complete block design with four replications for each planting date in both seasons. Plot size was 10.5 m^2. Berseem seed were sown by hand at the rate of 6.0 g/m^2 (25 kg/fed.). Phosphorus was applied at the level of 37.5 g P_2O_5/plot in the form of calcium super phosphate (P_2O_5 15.5%) before seeding. All cultural practices

were maintained at optimum level for maximum berseem productivity. Three cuts were taken from each planting date at 70, 110 and 145 days after sowing at 70, 40 and 35 days intervals, respectively.

Data recorded:

The following traits were recorded at the time of each cut for each planting date.

1- Plant height (cm) determined from soil surface until the upper tip of plant. The average of five measurements for each plot at each cut, then average of three cuts were calculated.

2- Leaves/stems ratio (fresh weight). A sample of fresh forage in each plot (about 200 g) was hand separated to leaves and stems. Each component was weighed immediately to estimate the ratio, then mean of three cuts were taken.

3- Fresh forage yield (kg/plot) determined by hand clipping of each plot and total of three cuts were taken for each planting date.

4- Dry forage yield (kg/plot) estimated by using, green forage yield of each plot x mean dry matter percentage, where dry matter percentage was determined from random samples of 150 g from each plot at each cut, after drying in an oven at 70°C until weight constancy. The total of three cuts were taken.

Climatic data during the study period including maximum and minimum daily temperature measured from planting date to the third cut in each season and planting date are presented in Table 1.

Table 1. Summary of the daily temperature during the period of berseem clover growth in 2014/2015 and 2015/2016 seasons.

Month	Average temperature				Relative humidity				Photoperiod	
	Maximum		Minimum		Maximum		Minimum			
	2014/2015	2015/2016	2014/2015	2015/2016	2014/2015	2015/2016	2014/2015	2015/2016	2014/2015	2015/2016
15-30 September	38.1	39.4	21.5	21.3	54.5	56.4	16.21	16.4	12:09:28 pm	12:09:52 pm
1-15 October	33.9	36.6	18.3	20.6	59.4	73.8	17.4	22.73	11:45:28 am	11:45:52 am
16-31 October	32.2	33.5	15.8	19.0	59.6	77.8	19.12	26.2	11:21:41 am	11:22:11 am
1-15 November	30.1	28.3	14.0	14.5	67.66	84.3	20.6	33.6	10:59:56 am	11:00:16 am
16-30 November	26.0	27.5	11.7	12.0	72.8	84.0	29.6	29.2	10:42:36 am	10:42:52 am
1-15 December	26.0	22.7	10.7	8.3	68.1	86.8	26.0	33.0	10:30:56 am	10:31:00 am
16-31 December	23.1	21.6	8.4	6.9	73.6	90.2	28.7	31.3	10:27:11 am	10:27:08 am
1-15 January	18.3	21.5	4.5	6.2	71.0	84.1	29.0	28.7	10:32:00 am	10:31:52 am
16-31 January	24.5	19.7	7.6	4.6	64.7	85.5	19.2	29.8	10:45:07 am	10:44:56 am
1-15 February	23.5	32.7	7.3	5.9	58.9	85.1	16.5	25.9	11:04:16 am	11:03:52 am
16-28 or 29 February	23.6	27.6	7.9	9.6	66.0	73.0	22.6	17.5	11:24:37 am	11:23:00 am
1-15 March	27.6	29.6	11.6	12.9	62.8	64.0	18.2	17.66	11:46:48 am	11:47:36 am
16-31 March	30.3	28.2	12.8	11.7	55.3	67.3	13.6	18.2	12:11:26 pm	12:12:41 pm
1-15 April	28.1	34.3	12.3	15.3	45.3	63.1	13.4	10.1	12:36:16 pm	12:37:28 pm
16-30 April	34.9	27.6	14.6	16.9	39.7	59.6	7.8	8.4	12:58:00 pm	12:59:05 pm
1-15 May	34.6	38.1	18.1	19.7	49.5	47.4	13.1	9.1	13:20:00 pm	13:21:00 pm
16-31 May	39.8	38.0	22.0	19.7	44.6	55.5	12.3	10.0	13:35:55 pm	13:38:04 pm
1-15 June	37.8	44.1	21.5	24.0	60.3	41.6	16.6	6.6	13:48:24 pm	13:48:44 pm
16-30 June	38.0	41.5	22.4	24.8	63.1	59.6	15.4	12.6	13:46:19 pm	13:46:30 pm
1-15 July	38.1	39.6	23.0	24.1	72.2	58.4	17.4	16.6	13:47:44 pm	13:47:16 pm
16-31 July	41.3	38.7	23.5	23.5	51.4	65.9	9.5	16.0	13:36:04 pm	13:35:08 pm

Source: Meteorological authority, Assiut, Egypt.

The total growing degree days GDD, (base = 7°C) was calculated for each planting date according to Saeed and Francis (1984) as follows:

Total growing degree days (GDD) =

Σ[((Maximum + Minimum temperature)/2)-7] where:

7= Zero growth point from sowing date to third cut continuous to seed maturity, (Table 2).

Table 2. Total growing degree day (GDD) for each planting date and season at Assiut where Egyptian clover trials were conducted.

Planting date	Total growing degree day from planting date until third cut	
	2014/2015	2015/2016
15th September	1930	1960
15th October	1625	1692
15th November	1562	1625
15th December	1767	1860

Statistical analysis:

For forage yield and its components in each planting date over the three cuts. Separate as well as combined analysis of variance were performed for the data over the planting dates in each season and over two seasons according to Gomez and Gomez (1984), whenever the homogeneity of variances between planting dates and over two seasons was detected. Means were compared using L.S.D. test at 5% level of probability.

Stability analysis:

Stability analysis was computed according to Tai (1971), where he suggested partitioning the genotype x environment interaction (GE) effect of the i^{th} variety into two components (α_i and λ_i). These estimates (α_i and λ_i) were computed for each of the six varieties to compare the relative stability of varieties. The parameter α_i measures the linear response to the environmental effects and λ_i parameter measures the deviation from linear response in terms of the magnitude of the error variance. The two components are defined as genotypic stability parameters. The values (α=-1, λ=1) will be referred as perfect stability. However, the values (α= 0, λ=1) will be referred as average stability whereas the values (α>0 and λ=1) as below average stability. The hyperbola graph to test α's statistics and the limits the confidence interval for λ's statistics were superimposed according to Tai (1971).

Results and Discussion

1- Plant height:

The combined analysis in Table 3 indicated that there was highly significant difference among sowing dates and varieties for plant height. The second sowing date (October 15th) gave the highest plant height in first, second and over two seasons, with significant differences among the four sowing dates (Table 4). The 15th September sowing date gave the lowest plant height. This could be due to that the climatological conditions prevailing during this period favoured. These results are in agreement with those reported by Kandil and Shalaby (1985b) and Ramadan *et al*. (1994). Serw-1 variety significantly gave the tallest plant height, while, Local variety gave the shortest plant height in first, second and over two seasons. These results are in opposite with obtained by Ramadan *et al*. (1994) and El-Zanaty (2005).

Table 3. Combined analysis of variance for forage yield traits of six Egyptian clover varieties under different sowing dates over two seasons.

Source of variation	d.f	Mean squares			
		Plant height (cm)	Leaf/stem ratio	Fresh forage yield	Dry forage yield
Years (Y)	1	699.7**	71.19**	583.4	88.3**
Rep./Year	6	31.3	22.54	288.2	1.28
Sowing dates (D)	3	2296.8**	79.62**	32324.4**	914.2**
Y x D	3	340.3**	4.44	5340.3**	115.9**
Error (b)	18	17.2	14.52	98.2	2.24
Varieties (V)	5	74.0**	104.42**	1043.7**	23.1**
V x D	15	18.6*	31.43**	225.8**	9.1**
V x Y	5	8.1	2.91	50.1	17.4**
V x D x Y	15	20.2*	3.93	188.3**	18.8**
Error c	120	9.54	6.25	70.0	2.12

Table 4. Average plant height (cm) of six Egyptian clover varieties as affected by different sowing dates in 2014/2015, 2015/2016 and over two seasons.

Season	Planting date	Variety						
		Serw-1	Gem-meiza-1	Giza-6	Sakha-4	Helally	Local variety	Mean
2014/ 2015	15 Sept.	84.2	82.7	85.7	76.2	81.2	77.2	81.2
	15 Oct.	95.1	92.2	93.1	89.8	95.5	93.3	93.2
	15 Nov.	93.5	85.6	86.6	85.9	86.6	87.0	87.6
	15 Dec.	88.6	86.4	88.1	89.7	86.7	83.3	87.1
	Mean	**90.4**	**86.7**	**88.0**	**85.4**	**87.5**	**85.2**	**87.3**
LSD5% for								
Sowing dates (D)	=							3.01
Variety (V)	=							2.06
D x V	=							4.12
2015/ 2016	15 Sept.	72.7	70.8	74.7	70.7	73.6	72.7	72.5
	15 Oct.	92.9	94.0	91.7	92.1	94.0	90.7	92.6
	15 Nov.	93.6	87.9	88.0	91.0	90.9	85.7	89.5
	15 Dec.	80.2	79.6	81.4	75.0	79.5	79.8	79.2
	Mean	**84.9**	**83.0**	**84.0**	**82.2**	**84.5**	**82.3**	**83.4**
LSD5% for								
Sowing dates (D)	=							2.71
Variety (V)	=							2.14
D x V	=							--
Over two seasons (Combined)	15 Sept.	78.5	76.7	80.2	73.5	77.4	77.3	76.9
	15 Oct.	94.0	93.1	92.4	90.9	94.8	92.0	92.9
	15 Nov.	93.6	86.8	87.3	88.5	88.8	86.4	88.6
	15 Dec.	84.4	82.7	84.7	82.4	83.1	81.5	83.1
	Mean	**87.65**	**84.83**	**86.21**	**83.83**	**86.09**	**83.72**	**85.3**
LSD5% for								
Sowing dates (D)	=							1.78
Variety (V)	=							1.53
D x V	=							3.05
V x Y	=							--
D x Y	=							2.51
D x V x Y	=							4.32

- F value not significant.

2- Leaf/stem ratio:

The results in Table 3 showed that sowing dates and varieties highly significantly affected leaf/stem ratio over two seasons. Comparisons among the four sowing dates showed that sowing date at September 15th resulted in the highest leaf/stem ratio of 44.5, 43.5 and 44% in 2014/2015, 2015/2016 and over the two seasons, respectively (Table 5). Moreover, the results indicated that leaf/stem ratio decreased gradually, reached its lowest value at the fourth planting date (December 15th) in both seasons and over two seasons (Table 5). These

results are in agreement with those obtained by Kandil and Shalaby (1985b). Comparison between the average leaf/stem ratio of the different varieties, it be concluded that Local variety produced the significantly highest leaf/stem ratio as compared with the other varieties in both seasons (Table 5). These results are in line with those obtained by Radwan *et al*. (2014).

3- Seasonal fresh and dry forage yields:

Data presented in Tables 6 and 7 indicate that seasonal fresh and dry forage yields significantly affected by sowing dates and varieties in each season and over seasons. The combined analysis of variance (Table 3) over seasons revealed that seasons had significant effect on seasonal dry forage yield. The results in Table 6 showed the maximum seasonal fresh forage yield/plot of 142.9 and 142.7 kg/plot was obtained from planting sown on November 15th and October 15th in 2014/2015 and 2015/2016 seasons, respectively. But, the maximum seasonal dry forage yield was obtained when sowing was performed at December 15th in 2014/2015 and over both seasons. This may be due to the high temperature consequence the high dry matter percentage in cutting of this late planting date. These results are in contrary with that reported by El-Zanaty (2005) who found sowing on the 1st November significant surpassed sowing on the 1st December on seasonal dry forage yield by 13.6 and 24.5% in the first and second seasons, respectively.

Table 5. Average leaf/stem ratio (%) of six Egyptian clover varieties as affected by different sowing dates in 2014/2015, 2015/2016 and over two seasons.

Season	Planting date	Variety						
		Serw-1	Gemmeiza-1	Giza-6	Sakha-4	Helally	Local variety	Mean
2014/ 2015	15 Sept.	43.34	43.27	42.82	45.84	42.01	49.50	44.46
	15 Oct.	37.22	42.92	42.38	42.98	42.03	44.53	42.01
	15 Nov.	41.02	40.93	42.82	43.50	42.66	43.45	42.39
	15 Dec.	40.05	43.85	39.80	42.70	42.24	43.41	42.00
	Mean	**40.40**	**42.74**	**41.95**	**43.75**	**42.23**	**45.22**	**42.71**
LSD5% for								
Sowing dates (D)	=							1.32
Variety (V)	=							1.15
D x V	=							2.31
2015/ 2016	15 Sept.	42.19	42.99	41.22	45.10	37.67	51.84	43.50
	15 Oct.	37.06	41.84	42.33	42.50	42.14	42.98	41.47
	15 Nov.	39.81	40.76	41.20	40.83	41.23	41.97	40.96
	15 Dec.	38.33	41.95	35.68	40.25	41.13	43.04	40.06
	Mean	**39.34**	**41.88**	**40.10**	**42.17**	**40.54**	**44.95**	**41.49**
LSD5% for								
Sowing dates (D)	=							1.90
Variety (V)	=							2.15
D x V	=							4.30
Over two seasons (Combined)	15 Sept.	42.76	43.13	42.02	45.47	39.84	50.67	43.98
	15 Oct.	37.14	42.38	42.35	42.74	42.08	43.76	41.74
	15 Nov.	40.42	40.84	42.01	42.16	41.95	42.71	41.68
	15 Dec.	39.19	42.90	37.74	41.47	41.68	43.23	41.03
	Mean	**39.88**	**42.32**	**41.03**	**42.97**	**41.39**	**45.09**	**42.11**
LSD5% for								
Sowing dates (D)	=							1.63
Variety (V)	=							1.23
D x V	=							2.46
V x Y	=							--
D x Y	=							--
D x V x Y	=							--

- F value not significant.

The two factors, sowing dates and date of the last cut, play a great role in plant development i.e. plant height leaf/stem ratio and consequently the fresh and dry forage yields. Over two seasons, no significant differences were noticed in seasonal dry forage yield between commercial varieties of berseem clover (Serw-1, Gemmeiza-1, Giza-6, Sakha-4 and Helally). But significant differences were noticed between each of commercial cultivars with Local variety Tables 6 and 7. These results are in line with those reported by Ramadan *et al*. (1994) and El-Zanaty (2005) reported that no different between Helally, Sakha-4, Sakha-3 and Giza 15.

Table 6. Seasonal fresh forage yield/plot (kg) of six Egyptian clover varieties as affected by different sowing dates in 2014/2015, 2015/2016 and over two seasons.

Season	Planting date	Variety						
		Serw-1	Gemmeiza-1	Giza-6	Sakha-4	Helally	Local variety	Mean
2014/ 2015	15 Sept.	77.3	103.2	95.7	92.1	89.7	84.4	90.4
	15 Oct.	126.0	128.5	116.5	129.9	132.6	113.3	124.5
	15 Nov.	157.3	140.7	143.5	143.9	143.2	128.5	142.9
	15 Dec.	114.6	116.6	118.3	124.8	120.0	101.4	116.0
	Mean	**118.7**	**122.3**	**118.5**	**122.7**	**121.4**	**106.9**	**118.4**
LSD5% for								
Sowing dates (D)	=							6.19
Variety (V)	=							4.62
D x V	=							9.24
2015/ 2016	15 Sept.	61.9	71.5	62.1	63.5	75.3	67.5	67.0
	15 Oct.	139.5	138.0	149.3	150.3	155.5	123.8	142.7
	15 Nov.	125.3	135.0	116.5	131.0	127.0	105.0	123.3
	15 Dec.	119.3	130.0	129.3	129.3	127.3	125.8	126.8
	Mean	**111.5**	**118.6**	**114.3**	**118.5**	**121.3**	**132.3**	**115.0**
LSD5% for								
Sowing dates (D)	=							8.78
Variety (V)	=							2.15
D x V	=							4.29
Over two seasons (Combined)	15 Sept.	69.6	87.4	78.9	77.8	82.5	75.9	78.7
	15 Oct.	132.8	133.3	132.9	140.1	144.0	118.5	133.6
	15 Nov.	141.3	137.9	130.0	137.5	135.1	116.8	133.1
	15 Dec.	116.9	123.3	123.8	127.0	123.6	113.6	121.4
	Mean	**115.2**	**120.5**	**116.4**	**120.6**	**121.3**	**106.2**	**116.7**
LSD5% for								
Sowing dates (D)	=							4.25
Variety (V)	=							4.12
D x V	=							8.24
V x Y	=							--
D x Y	=							6.01
D x V x Y	=							11.65

- F value not significant.

Table 7. Seasonal dry forage yield/plot (kg) of six Egyptian clover varieties as affected by different sowing dates in 2014/2015, 2015/2016 and over two seasons.

Season	Planting date	Variety						
		Serw-1	Gem-meiza-1	Giza-6	Sakha-4	Helally	Local variety	Mean
2014/ 2015	**15 Sept.**	11.8	12.0	12.0	10.0	9.3	9.3	10.83
	15 Oct.	14.3	14.8	13.0	13.8	16.0	13.8	14.3
	15 Nov.	18.5	17.0	17.5	17.3	16.8	16.8	17.3
	15 Dec.	26.3	21.0	27.3	26.5	22.0	14.3	22.9
	Mean	**17.7**	**16.2**	**17.5**	**16.9**	**16.0**	**13.6**	**16.3**
LSD5% for								
Sowing dates (D)	=							1.09
Variety (V)	=							1.27
D x V	=							2.53
2015/ 2016	**15 Sept.**	7.9	9.1	8.5	8.6	10.4	8.98	8.9
	15 Oct.	16.6	16.1	18.5	16.98	17.4	15.2	16.8
	15 Nov.	16.6	17.5	15.83	15.7	17.4	14.9	16.3
	15 Dec.	17.2	18.0	18.23	17.2	17.7	18.9	17.9
	Mean	**14.6**	**15.2**	**15.3**	**14.6**	**15.7**	**14.5**	**15.0**
LSD5% for								
Sowing dates (D)	=							0.63
Variety (V)	=							0.71
D x V	=							1.41
Over two seasons (Combined)	**15 Sept.**	9.8	10.5	10.2	9.3	9.8	9.1	9.87
	15 Oct.	15.4	15.4	15.8	15.4	16.7	14.5	15.55
	15 Nov.	17.5	17.2	16.7	16.5	17.1	15.8	15.05
	15 Dec.	21.7	19.5	22.7	21.9	19.9	16.6	20.40
	Mean	**16.13**	**15.67**	**16.35**	**15.74**	**15.90**	**13.98**	**15.63**
LSD5% for								
Sowing dates (D)	=							0.64
Variety (V)	=							0.72
D x V	=							1.43
V x Y	=							1.02
D x Y	=							0.91
D x V x Y	=							2.03

Stability analysis:

1-Stability analysis for forage yield and its components:

Analysis of variance across varieties and environments indicated that the environments, varieties and varieties x environments (GE) interaction were highly significant for plant height, leaf/stem ratio and dry forage yield, except the environments effect for leaf/stem ratio was significant only (Table 8). The environment mean square was significant indicating that the four planting dates in the two seasons provided a sufficient range of environments, and hence the validating of environmental requirements suggested by Tai (1971) were fulfilled. The results are in broad agreement with reported by Bakheit (1985), Khatri *et al*. (1991), Bakheit and El-Hinnawy (1993), and Abdel-Galil *et al*. (2007).

According to Tai's theory, the variety by environment interaction is partitioned into two components: α which measures the linear response to environmental effect and λ which measures the deviation from the linear response. The genotypic stability

parameters were determined ($\overline{X}$, α and λ) for all varieties for plant height, leaf/stem ratio and dry forage yield and presented in Table 9.

According to this method, the values (α= 0-1, λ= 1) refer to perfect stability, while a variety that has only average stability might have an estimate of α= 0.0 and λ= 1. The varieties different in the amount of deviation from the linear response (λ) and to a less extent in the response (α) for dry forage yield. This variation suggested that the relatively unpredictable components of the genotype x environment interaction variance may be more important than the relatively predictable component of variation for those varieties which showed different degree of stability as mentioned by Bakheit (1985). The variety Sakha-4 was significant value for plant height, while Giza-6 variety was significant value for leaf/stem ratio. But the varieties Serw-1, Giza-6, Sakha-4 and local variety were significant values for dry forage yield. Therefore, they were considered to be unstable (Table 9 and Fig. 1).

Also, the average stability region involved Gemmeiza-1, Giza-6, Serw-1 and Helally varieties for plant height, Gemmeiza-1, Serw-1 and Local variety varieties for leaf stem/ratio and Gemmeiza and Helally varieties for dry forage yield.

Table 8. Stability analysis of variance for plant height, leaf/stem ratio % and dry forage yield of six Egyptian clover varieties under different environments.

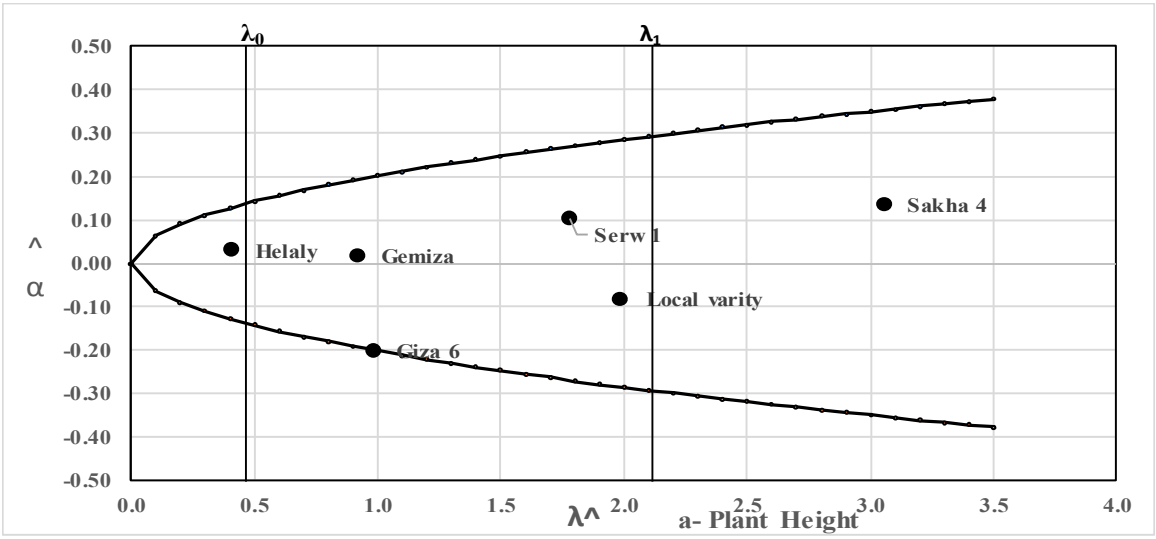
Source of variation	d.f	Mean squares for		
		Plant height (cm)	Leaf/stem ratio (%)	Dry forage yield (kg/plot)
Environment (E)	7	1230.2**	46.20*	454.07**
Rep./Envir.	24	20.70	16.52	2.01
Varieties (V)	5	73.97**	104.42**	23.06**
V x E	35	17.76**	15.57**	14.46**
Error	120	9.54	6.25	2.12

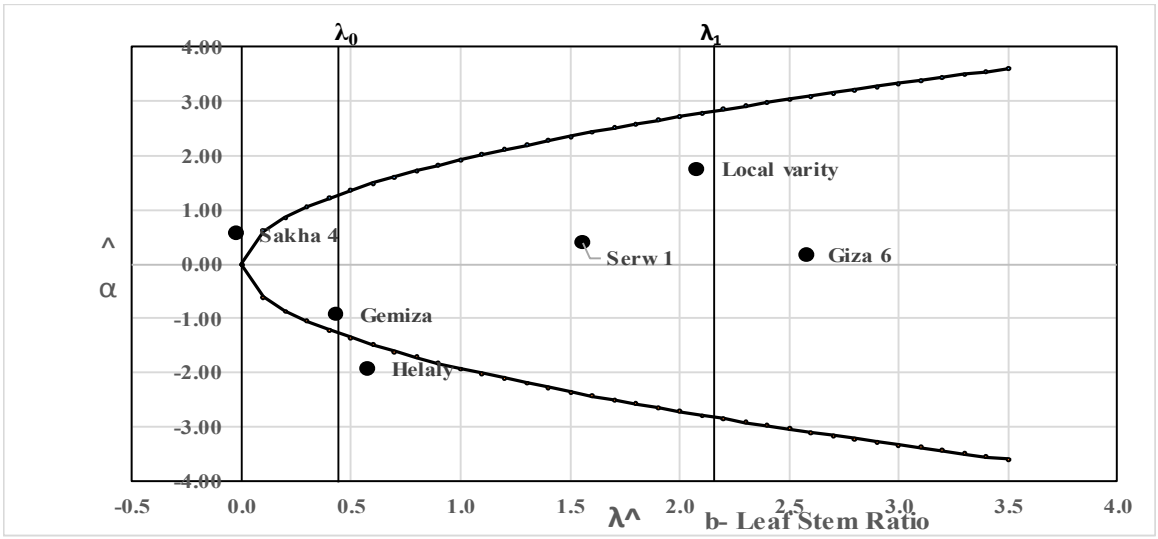
*, ** Significant at 0.05 and 0.01 level of probability, respectively.

Table 9. Mean performance over eight environment ($\overline{X}$) and stability parameter (α, λ) of six Egyptian clover varieties for plant height, leaf/stem ratio and dry forage yield.

Traits / Varieties	Plant height (cm)			Leaf/stem ratio (%)			Dry forage yield (kg/plot)		
	$\overline{X}$	α	λ	$\overline{X}$	α	λ	$\overline{X}$	α	λ
Serw-1	87.7	0.10	1.78	39.88	0.40	1.56	16.13	0.21	2.47*
Gemmeiza-1	84.8	0.02	0.92	42.32	-0.93	0.43	15.67	-0.16	1.18
Giza-6	26.2	-0.20	0.99	41.03	0.16	2.58*	16.35	0.25	4.22*
Sakha-4	83.8	0.14	3.06*	42.97	0.55	-0.02	15.74	0.24	2.40*
Helally	86.1	0.03	0.41	41.39	-1.93	0.58	15.95	-0.11	2.00
Local variety	83.7	-0.08	1.99	45.09	1.75	2.08	13.98	-0.43	12.01*

* Value greater than Fa value derived from F table with n_1= 6, n_2= 120 and a= 0.05





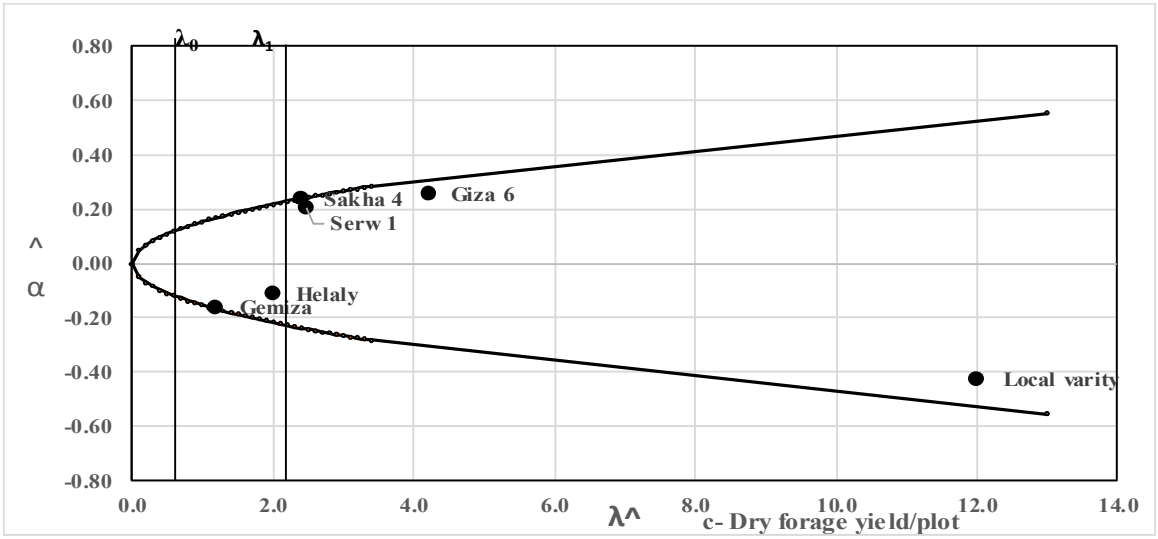


Fig. 1. Distribution of estimates of genotypes stability parameter (α & λ) for plant height, leaf stem ratio and dray forage yield/plot of six Egyptian clover varieties.

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ثبات المحصول العلفي لبعض التراكيب الوراثية تحت اختلاف مواعيد الزراعة

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الملخص

أجري هذا البحث لدراسة تأثير درجات الحرارة الناتجة عن اختلاف مواعيد الزراعة خلال مراحل النمو الخضري وتأثير تفاعل التراكيب الوراثية والبيئات (مواعيد الزراعة × مواسم النمو) علي المحصول العلفي ومكوناته في بعض أصناف البرسيم المصري. تم زراعة ست أصناف (سرو-١، جميزة-١، جيزة-٦، سخا-٤، هلالي ، بالإضافة إلي الصنف المحلي) في أربعة مواعيد زراعة (١٥ سبتمبر ، ١٥ أكتوبر، ١٥ نوفمبر، ١٥ ديسمبر) في تصميم القطاعات الكاملة العشوائية (RCBD) باستخدام أربع مكررات في كل ميعاد زراعة. وتم أخذ ثلاث حشات علي فترات (٧٠ ، ١١٠ ، ١٤٥ يوم من الزراعة) وقد نفذت التجربة خلال موسمي ٢٠١٤/٢٠١٥ ، ٢٠١٥/٢٠١٦ في المزرعة البحثية لكلية الزراعة – جامعة أسيوط.

ويمكن تلخيص أهم النتائج فيما يلي:

١- كان لمواعيد الزراعة والأصناف تأثير معنوي لصفة طول النبات، نسبة الأوراق/السيقان وللمحصول العلفي الطازج والجاف في كلا الموسمين والتحليل المشترك.

٢- أعطي ميعاد الزراعة في ١٥ أكتوبر أطول النباتات. وكان طول النباتات للصنف سرو-١ معنوياً تحت كل مواعيد الزراعة.

٣- تم الحصول علي أعلي نسبة أوراق/السيقان من ميعاد الزراعة في ١٥ سبتمبر في كلا الموسمين ولوحظ أن نسبة الأوراق/السيقان انخفضت تدريجياً ووصلت إلي الحد الأدني في ميعاد الزراعة في ١٥ ديسمبر وأعطي الصنف المحلي أعلي نسبة أوراق/السيقان.

٤- نقص المحصول العلفي الطازج معنوياً عند تأخير ميعاد الزراعة وأعطي الصنف هلالي أعلي محصول علف طازج كمتوسط لمحصول الموسمين بينما ارتفع المحصول العلفي الجاف عند تأخير ميعاد الزراعة. ولا يوجد اختلاف في المحصول العلفي الجاف بين الأصناف التجارية.

٥- أظهرت البيئات ، الأصناف والتفاعل بينهما اختلافاً معنوياً لصفة طول النبات، نسبة الأوراق/ السيقان والمحصول العلفي الجاف وشملت منطقة الثبات الأنصاف جيزة-١، الصنف المحلي، سرو-١، جيزة-٦ لصفة طول النبات بينما كان الصنف جميزة-١، سرو-١ والصنف المحلي لصفة نسبة الأوراق/السيقان وكان الصنف جميزة-١ وهلالي لصفة المحصول العلفي الجاف.