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RESPONSE OF SOME ALFALFA GENOTYPES TO SOWING DATES IN NEWLY LANDS OF EGYPT

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ABSTRACT

A field experiment was carried out at Wadi El-Natroon farm of Fac. Agric., Cairo Univ., Egypt, under drip irrigation system from 2016 to 2018 seasons. Five sowing dates (September 15, October 15 and November 15 in 2016; March 15 and April 15 in 2017) were applied to five alfalfa genotypes, three local genotypes, *i.e.* Laboon population, Rammah 1 and Ismailia 1 and two introduced from USA, *i.e.* SW 9601 and SW 9628. Seeding in October 15 gave the tallest plants at all cuts, except at the 6th and 7th cuts in 2017. Whereas, seeding in March 15 gave the tallest plants at all cuts, except at the 3rd and 7th cuts in 2018**.** Seeding in October 15 gave the highest total dry forage and protein yields of both years. Seeding in October 15 surpassed seeding in September 15, November 15, March 15 and April 15 by 36.38, 5.17, 33.27 and 50.69 % for total dry forage yield of both years, respectively. Seeding in October 15 surpassed seeding in September 15, November 15, March 15 and April 15 by 37.45, 3.79, 33.94 and 51.61 % for total protein yield of both years, respectively. Seeding Ismailia 1 genotype in October 15 gave the highest total dry forage and protein yields of both years.

***Keywords*:** Sowing date, Alfalfa Genotype, dry forage and protein.

Introduction

Alfalfa has good production potential, but lack of agronomic techniques (*i.e*. sowing dates and genotypes) are responsible for reduction of quantity and quality of alfalfa forage yield. The climatic conditions is changing towards warming especially in Egypt that expect to the summer season will extended and shorten the winter or any season during which alfalfa is grown. So, change the alfalfa sowing date is desirable to avoid the high or low temperature effects at the beginning of the fall season, Abdalrady *et al*. (2017).

The proper time of sowing determines forage yield and quality of alfalfa crop that depends upon variety and temperature. Both fall and spring sowing of alfalfa have many advantages and disadvantages, depending upon the area, because of the influence of climatic conditions on stand establishment (Rankin 2001 and McAlavy 2002). Sowing alfalfa in March, April and May gave significantly taller plants and higher dry yield as compared to sown in June to November (El-tomi, 1982; Taylor, 1987 and Coruh and Tan, 2016). Whereas, sown alfalfa from September to December had the tallest plants (Dowdy (1984); Kumar and Petal (2013) and Abdalrady *et al*. (2017) in Egypt).

Delaying alfalfa sowing beyond late July decreased dry yield (Allinson, 1972; Wynn-Williams, 1976; Kunelius and Campbell, 1986; Taylor, 1987; Justes *et al.* 2002; Thiébeau *et al.,* 2011).William *et al.* (2006) in USA mentioned that September sowing date had a lower dry yield than the sowing date for August. However, Malhi *et al.* (2007) in Canada reported that sown alfalfa in spring (May) produced more alfalfa dry yield than sown in fall (October). Meanwhile, Jauregui *et al*. (2019) in New Zealand found that dry yield was 90% higher in the earliest spring sowing date compared with the latest. Coruh and Tan (2016) in Turkey found that sowing in May gave the highest dry yield as compared to sowing in August. Lauriault *et al*. (2020) in USA mentioned that sowing alfalfa in spring can potentially increase dry yield and persistence. Whereas, sowing alfalfa in fall produced 20-30 % higher yield than spring sowing. Teixeiraa *et al.* (2011) reported that sown alfalfa in October 24 yielded 30–40% more than sown in December 27. Moreover, Khumalo (2012) mentioned that sown of alfalfa in October 4 had higher dry yield as compared sown in January 10 and this was in agreement with Sim *et al.* (2015) in New Zealand. Meanwhile Hwang *et al*. (2002) in Canada reported that sowing alfalfa in fall season in October had higher dry yield than spring season in May. Moreover, sowing on mid-November reduced dry yield as compared to October and December (Petal, 2003; Kumar and Petal, 2013 and Kumar and Petal, 2017) in India. However, the highest dry yield was obtained from the plants sown in December 20 in Egypt, Abdalrady *et al*. (2017). In other studies, alfalfa dry yield was not affected by sowing dates in (Byers and Templeton, 1988; William *et al.,* 2006; and Moot *et al.,* 2012; Glunk, 2018).

Crude protein yield of alfalfa was the highest for March or May (Byers and Templeton, 1988) in USA. Meanwhile other researchers found that sown alfalfa in November or December gave the highest protein yield (Abdalrady *et al*., 2017) in Egypt and (Kumar and Petal, 2017) in India.

Successful alfalfa production depends on selection of cultivars that are adapted to site conditions especially in the

newly reclaimed soils of Egypt. Nowadays, the high yielding varieties are most sensitive to time of sowing; hence, optimum time of sowing contributes more towards yield. Alfalfa cultivars had significantly effects on alfalfa dry yield (Wynn-Williams, 1976; Tesar, 1977; El-tomi, 1982 and Glunk, 2018). Abdalrady *et al*. (2017) in Egypt showed that Aswan variety gave the tallest plants and the highest dry and protein yields. Whereas, there was insignificant differences between alfalfa cultivars were found in plant height and dry yield (El-tomi, 1982; Dowdy, 1984 and Taylor, 1987).

So, The objectives of this study were: (i) to determine the best sowing date for alfalfa, (ii) to study the growth, yield and quality performance of alfalfa genotypes and (iii) the suitable sowing date for alfalfa genotypes under drip irrigation system in Wadi El-Natroon soil farm El- Behira Governorate, Egypt.

Materials and Methods

A field experiment was conducted at the Agricultural Experiments and Research Station, Cairo Univ., Wadi El-Natroon, El-Bihera Governorate, Egypt under drip irrigation system from 2016 to 2018 seasons. The soil type was sandy with 7.6 (pH) and 6.22 ds/m (Ec).

Five sowing dates (September 15, October 15 and November 15 in 2016; March 15 and April 15 in 2017) were applied to five alfalfa genotypes, three local genotypes *i.e.* Laboon population, Rammah 1 and Ismailia 1 and two introduced from USA *i.e.* SW 9601 and SW 9628. A spilt plot was arranged in randomized complete blocks design (RCBD) with three replications. Sowing dates were located in main plots. Alfalfa genotypes were distributed in sub-plots. The plot size was 3 m^2 (3×1 m) with 5 rows, 20 cm apart. Alfalfa seeding rate was 15 kg fed^{-1}. Cutting for alfalfa was applied at 10% flowering to record plant height (cm), dry forage yield, crude protein percentage was calculated by multiplying total nitrogen by 6.25, total dry forage and protein yields (t fed^{-1}). Total nitrogen was determined by the micro-Kjeldahl method (A.O.A.C., 1995). Data obtained in each year of the study were statistically analyzed according to procedures outlined by Steel *et al.* (1997) using Mstat-C computer program (Freed, 2007). The differences among treatment means were compared by the least significant difference test (LSD) at 0.05 level of probability.

Table 1 : Means of climatic data in Wadi El-Natroon during the period 2011- 2018*

Month	Temperature (^{0}C)		RH (%)	Wind speed (km day^{-1})	Sunshine (hrs)	Solar radiation (MJ m^{-2} day^{-1})	Rainfall (mm)
	Max.	Min.					
January	19.8	5.2	52	207	7.8	13.9	1.00
February	21.8	6.6	44	242	8.6	17.1	1.00
March	24.8	9.6	39	277	8.9	20.1	1.00
April	30.7	13.8	31	277	9.3	22.8	1.00
May	34.5	17.5	29	268	10.3	25.3	0
June	36.9	20.3	31	277	11.2	26.9	0
July	37.1	21.3	36	225	11.1	26.5	0
August	36.8	21.4	38	207	10.8	25.3	0
September	34.4	19.4	43	216	9.9	22.1	0
October	30.3	16.2	46	216	9.1	18.3	0
November	25.5	10.6	51	181	8.4	14.9	0
December	20.7	6.6	55	199	7.9	13.3	0

*M.A.L.R. (2011-2018)

Results and Discussion

Sowing date

Results in Table (2) showed that the tallest plants were detected in October 15 at all cuts, except at the 6th and 7th cuts in 2017. Kumar and Petal (2013) in India reported that the tallest plants obtained from sowing alfalfa in November 10 as compared to the other sowing dates. However, Abdalrady *et al*. (2017) in Egypt reported that the tallest plants obtained from the plants sown in December 20 as compared to sowing in October 20 and November 20.

Table 2 : Effect of sowing date on alfalfa plant height at each cut in 2017 and 2018

Sowing date	1st cut	2nd cut	3rd cut	4th cut	5th cut	6th cut	7th cut
2017							
Sept.15, 2016	67.7	70.8	73.3	71.4	67.7	49.9	58.4
Oct.15, 2016	75.5	83.9	92.5	95.2	82.0	68.6	57.8
Nov.15, 2016	67.1	79.4	91.3	82.0	59.7	77.2	71.9
Mar. 15, 2017	54.9	53.7	51.9	46.2	-	-	-
Apr. 15, 2017	45.2	50.0	54.2	-	-	-	-
$LSD_{0.05}$	4.8	4.0	4.8	12.5	8.1	7.2	5.2
2018							
Sept.15, 2016	73.5	75.0	76.9	79.8	65.2	50.2	65.1
Oct.15, 2016	81.1	82.2	79.5	76.7	74.1	74.6	75.4
Nov.15, 2016	77.9	73.6	72.4	71.2	73.5	78.0	82.4
Mar. 15, 2017	84.1	82.7	77.1	87.7	75.4	80.1	81.4
Apr. 15, 2017	79.4	73.1	77.2	66.2	70.5	79.7	88.9
$LSD_{0.05}$	1.7	1.7	2.6	4.2	1.7	4.5	6.1

Seeding in March 15 gave the tallest plants at all cuts, except at the 3rd and 7th cuts in 2018 (Table 2). El-tomi (1982) showed that sowing alfalfa dates in March, April, May, and August produced the tallest plants as compared to September and October.

No obvious differences were observed for crude protein % and for crude fiber % at all cuts in both years under sowing dates (Figs.1&2).

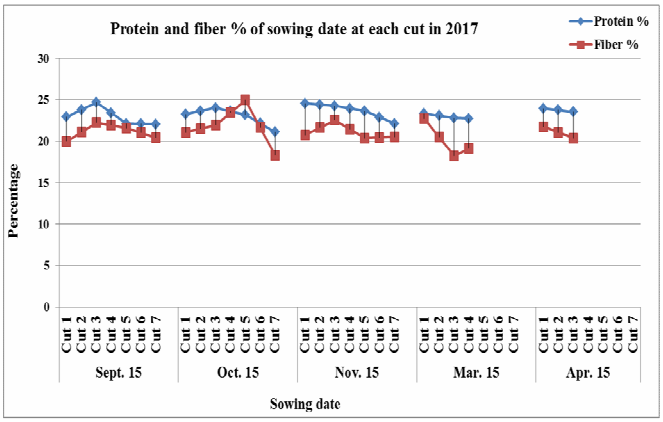

Fig. 1 : Protein and fiber % of alfalfa at each cut under sowing dates in 2017

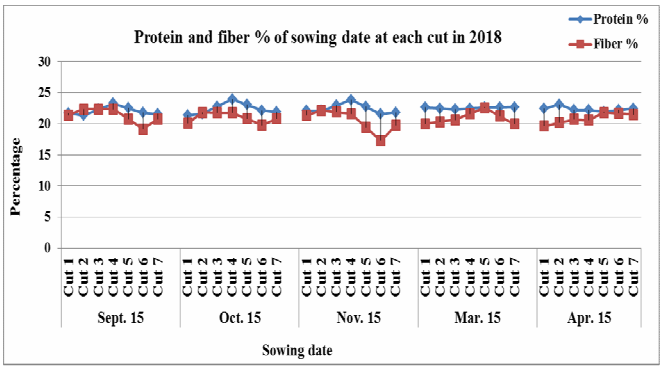

Fig. 2 : Protein and fiber % of alfalfa at each cut under sowing dates in 2018

Seeding in October 15 gave the highest total dry forage and protein yields of both years (Table 3) these may be due to the suitable temperature (30.3°C) for alfalfa seeds germination (Table 1). Seeding in October 15 surpassed seeding in September 15, November 15, March 15 and April by 36.38, 5.17, 33.27 and 50.69 % for total dry forage yield of both years, respectively (Table 3). Seeding in October 15 surpassed seeding in September 15, November 15, March 15 and April by 37.45, 3.79, 33.94 and 51.61 % for total protein yield of both years, respectively (Table 3). Byers and Templeton (1988) in USA found crude protein yield was significantly higher in March of experiment 1 and in May of experiment of the establishment year. Meanwhile, Abdalrady *et al.* (2017) in Egypt reported that the highest protein yield was obtained from the plants sown in December 20 compared to October 20 and November 20. Also, Kumar and Petal (2017) in India indicated that the highest protein yield was obtained by sowing alfalfa in November 10. Whereas, sowing in November 20 gave the highest crude protein content.

Table 3 : Effect of sowing date on total dry forage and protein yields of both years (t fed^{-1})

Sowing date	Total dry forage yield of both years	Total protein yield of both years
Sept. 15	19.83	4.46
Oct. 15	31.17	7.13
Nov. 15	29.56	6.86
Mar. 15	20.80	4.71
Apr. 15	15.37	3.45
$LSD_{0.05}$	1.87	0.43

Genotype

Rammah 1 genotype gave the tallest plants at each cut, except at the 7th cut in 2017 (Table 4). Wynn-Williams (1976) in New Zealand, El-tomi (1982) and Glunk, (2018) found significant effects between alfalfa cultivars growth and yield. Abdalrady *et al.* (2017) in Egypt noted that Aswan variety gave the tallest plants. However, other researchers reported insignificant differences between alfalfa cultivars for growth and yield (Tesar, 1977; El-tomi, 1982; Dowdy, 1984 and Taylor, 1987).

Table 4 : Plant height of alfalfa genotypes at each cut in 2017 and 2018

Genotype	1st cut	2nd cut	3rd cut	4th cut	5th cut	6th cut	7th cut
2017							
Laboon	62.64	67.42	71.88	70.75	68.96	68.19	67.30
Rammah 1	66.09	74.27	81.97	83.14	75.15	66.19	63.93
Ismailia 1	62.33	66.78	70.82	72.08	74.48	69.41	68.89
SW 9601	57.24	64.22	70.81	70.28	64.50	62.48	57.67
SW 9628	62.07	65.09	67.68	72.33	66.04	59.85	55.67
$LSD_{0.05}$	3.70	3.31	4.53	5.53	6.23	N.S	5.81
2018							
Laboon	81.73	79.34	77.07	73.29	71.69	70.12	79.72
Rammah 1	82.15	78.66	74.52	63.00	73.49	70.56	72.46
Ismailia 1	78.13	70.99	71.88	81.38	67.18	69.54	71.46
SW 9601	77.16	83.72	85.52	79.25	75.11	69.71	82.18
SW 9628	76.93	74.02	74.08	84.71	71.31	82.65	87.33
$LSD_{0.05}$	1.55	1.51	1.30	1.19	2.27	2.00	2.07

Ismailia 1 genotype had a higher protein % than the other genotypes at the first four cuts in 2017 (Fig. 3).

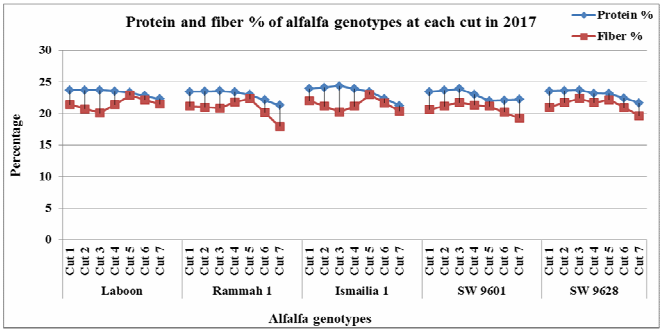

Fig. 3 : Protein and fiber % of alfalfa genotypes at each cut in 2017

All alfalfa genotypes had insignificant differences for total dry and protein yields because the similarity of protein % at all cuts (Table 5). Abdalrady *et al*. (2017) in Egypt reported that Aswan variety gave the highest protein yield.

Ismailia 1 genotype surpassed the other genotypes for total dry and protein yields of both years (Table 5).

Table 5 : Total dry and protein yields of both years of alfalfa genotypes

Genotype	Total dry forage yield of both years	Total protein yield of both years
Laboon	23.34	5.29
Rammah 1	23.63	5.43
Ismailia 1	23.77	5.43
SW 9601	22.70	5.18
SW 9628	23.23	5.26
$LSD_{0.05}$	N.S	N.S

Sowing date × genotypes interaction

Seeding Ismailia 1 genotype in October 15 gave the highest total dry forage and protein yields of both years (Table 6).

Therefore the recommended alfalfa sowing date is in October 15 under drip irrigation system in Wadi El-Natroon farm.

Table 5 : Total dry forage and protein yields (t fed^{-1}) of both years of some alfalfa genotypes under sowing dates

Interaction		Total dry forage yield of both years	Total protein yield of both years
15th Sept.	Laboon	20.68	4.66
	Rammah 1	16.50	3.76
	Ismailia 1	22.40	5.05
	SW 9601	18.95	4.26
	SW 9628	20.51	4.60
15th Oct.	Laboon	29.17	6.71
	Rammah 1	30.78	7.13
	Ismailia 1	34.15	7.72
	SW 9601	31.15	7.18
	SW 9628	30.50	6.91
15th Nov.	Laboon	30.10	6.86
	Rammah 1	32.12	7.46
	Ismailia 1	27.66	6.43
	SW 9601	27.44	6.38
	SW 9628	30.45	7.10
15th Mar.	Laboon	20.46	4.63
	Rammah 1	23.12	5.28
	Ismailia 1	17.94	4.13
	SW 9601	21.80	4.88
	SW 9628	20.68	4.59
15th Apr.	Laboon	16.26	3.61
	Rammah 1	15.64	3.49
	Ismailia 1	16.72	3.82
	SW 9601	14.19	3.19
	SW 9628	14.00	3.12
$LSD_{0.05}$		3.17	0.17

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