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FORAGE PRODUCTIVITY OF SOME ALFALFA (*Medicago sativa* L.) VARIETIES UNDER NORTH SINAI CONDITIONS

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ABSTRACT

This study was carried out at the Experimental Farm of Environmental Agricultural Sciences Faculty, North Sinai Governorate, Arish University during 2020. In order to study the response of four alfalfa varieties productivity (New Valley (NV), Siwa-1, Ismailia-1, Ramah1-1) to different planting distances (25, 50, 75 cm) among hills in sandy soil using growth criteria of alfalfa (*Medicago sativa* L.). Factorial experiment with randomized complete block design with three replicates was used. In the first Cut (1st cut), planting Swia variety by 25 cm among hills recorded the highest plant height (73.05 cm). NV variety recorded the maximum number of branches/plant (20.88). The interaction between varieties and hill planting distances on plant height revealed that the NV variety planted with 75 cm among hills recorded the highest number of branches/plant (23.01) in 1st cut. Varieties showed significant effect on fresh weight. Ramah1 variety recorded the maximum fresh weight (4.17 ton per faddan) in cut1. The interaction between varieties and among hills planting distances on dry yield. Ramah1 variety sown in 25 cm among hills recorded the highest dry weight (2.17 ton per faddan) in 1st cut. The highest plant height was recorded with 25 cm (80.52 cm) in the Fourth cut (4th cut). Ramah1 variety planted in 25 cm among hills recorded the highest plant height (92.22 cm) in 4th Cut. Finally, results concluded that planted Ramah1 variety with on – line distances of 25 cm among hills gave the highest forage productivity in sandy soil.

INTRODUCTION

In Egypt, there is a gap between production and demand of green forages, especially during the summer, where the available forages are limited as a result of the competition with strategic crops on limited arable land. Alfalfa is nominated to be the best crop to overcome this problem as it is the most suitable forage crop to be cultivated in the newly reclaimed land for producing high yields of high-quality forage and longevity of stand **(Diaa, 2015).**

Alfalfa (*Medicago sativa*) is a very important crop commodity in Sinai region of North and West where salinity problems occur in the soil and irrigation water resources. There has been significant research in the area of salt tolerance of alfalfa but there is need for screening current and experimental alfalfa cultivars to assist growers with variety selection. Due to the complexity of salinity tolerance in plants, it is also necessary to screening methodologies and results to field conditions.

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Alfalfa (*Medicago sativa* L., 2n=4x=32) is one of the most important perennial legume crops and a superior source of forage due to its high nutritional quality and herbage yield (**Wang *et al.*, 2013**). Seed yield of alfalfa is important in determining the effective distribution of new cultivars to farmers (**Li and Brummer, 2009**). In 2013, alfalfa was grown in an area around of 79339 fed in Egypt with an annual production of 2,722,749 metric ton with an average of 34.318 ton/fed (**EAS, 2015**). Improving the production of alfalfa seed is possible by creating high yielding varieties and by improved cultural practices. Research on genetics and breeding showed that progress in achieving higher seed yield in alfalfa is limited (**Bolanos-Aguilar *et al.*, 2002**). Soil quality depends not only on its physical and chemical characteristics, but is also closely related to its biological activities **(Ebhin *et al.*, 2006).** The application of nitrogen-fixing and phosphate solubilizing microorganism could decrease the use of chemical fertilizer and the pollution of underground water, renovate the ecological environment of soil and increase the yield and quality of plants (**Lee and Bressan, 2005; Chen *et al.*, 2013)**. On the other hand, the optimal use of mineral nutrition (**Terzić, 2011**), row distances, the amount of seed used for sowing and plant density (**Zhang *et al.*, 2008**) can have a significant impact on yield components and yield formation, and it seems like it could be a better route to achieving higher and more stable seed yields. So, this investigated was conducted to evaluate alfalfa varieties for forage yields under North Sinai conditions and similar regions and find out optimum hills planting distances in rows for higher alfalfa forage yield productivity.

MATERIALS AND METHODS

This study was carried out at the Experimental Farm of Environmental Agricultural Sciences Faculty, North Sinai Governorate, Arish University, (310 08' 40.3` N, 330 49` 37.2` E), during 2020-2021 to evaluate alfalfa varieties for forage yields under optimum North Sinai conditions and distances between hills in the row for higher alfalfa forage yields .

Seeds of alfalfa varieties (New Valley (NV**)**, Siwa-1, Ismailia-1 and Ramah1-1) were obtained from the Forage Crops Research Department, Agricultural Research Centre (ARC), Ministry of Agriculture, Egypt. The origin of these varieties is presented in Table 1.

Experimental Treatments

There were 12 treatment combinations consisting of three- distances among hills in row spacing and four alfalfa varieties as follow:

Main plots: row spacing

1. Among hills planting distances 25 cm
2. Among hills planting distances 50 cm
3. Among hills planting distances 75 cm all spacing among rows 50 cm

Sub plots: Alfalfa Variety

1. New Valley (NV)
2. Siwa-1, (Siwa)
3. Ismailia-1(Ismailia)
4. Ramah1-1

Treatments

The seeds of alfalfa varieties were sown on May 15, 2020. The seeding rate was 12 kg/faddan (25 cm), 8 kg /faddan (50 cm) and 4 kg/faddan (75 cm).

The same physical and chemical properties of the experimental soil site in 2020 and 2021 showed that it contained of sand (76, 74%), silt (13,14%), clay (11, 12%), soil pH (8.10, 8.13), organic matter (0.15, 0.17%), and $CaCO_3$ (22.43, 22.48%) **(Richard, 1954).**

Table 1. Location and source of seed varieties

NUMBER	VARIETY	ORIGIN
1	**New Valley (NV)**	Egypt
2	**Siwa-1**	Egypt
3	**Ismailia-1**	Egypt
4	**Ramah1-1**	Egypt

varieties were used for the randomized complete block design with three replications for each sowing among hills planting distances treatments. Plot area ten meter square (5-meter-long × 2 m apart) was used.

Fertilizer Application

Fertilizers were obtained and purchased from the Budget Fund of the Ministry of Agriculture and in accordance with the recommendations of agriculture in the new lands, where 400 kg of superphosphate and 200 kg of potassium sulphate were added for each faddan. The quantity was taken according to the area of the experiment and was added in the stage of land preparation.

The biofertilizers were mixed with sugar solution then mixed with seeds. Biofertilizer add with the seed before sowing (Phosphorin, Potasomag and Rizobactrera 50 g/kg seeds). The bio fertilizer mixed with sugar solution after that mixed with seeds before sowing time. The treated with mineral fertilizer NPK (20:20:20) was added every cut with 10 kg per faddan in drip irrigation system after every cut.

Irrigation

Since plants were sown in 1/5/2020, drip irrigation system (4 L/hr.) was used. The spacing among rows was 100 cm. The experimental site was irrigated immediately just after seeding and thereafter, irrigation every day for 1.5 hours and stopped for two days. Underground water (4000 ppm) pumped from a well from sowing was applied.

Cuts

Cut green forage was done at 10 present flowering. First cut was taken 60 days after sowing and subsequent cut at an interval of 30 days. The plants were cut 5 cm above the ground level. At the time of each cut yield parameters per plot were recorded in the field immediately after cut for 40 days every one. A sample consisting of ten plants randomly selected from treatment was used for recording biometric observations, including some vegetative growth.

Plant height

At each cut, ten plants were taken from each plot to determine plant height (cm).

Number of branches per plant

The number of branches/plants was counted.

Fresh forage yield

Fresh forage yield (kg/m^2) was determined by hand clipping of each plot every cut were taken for each

Dry forage yield

Estimated by using, green forage yield of each plot × means dry matter percentage, where dry matter percentage was determined from each plot (10 m^2) at each cut, after drying in an oven at 70°C until weight constancy.

Statistical Analysis

The obtained results were computed and subjected to the proper statistical analysis of factorial experiment with randomized complete block design with three replicates was used. The General Linear Models (GLMs) procedures co-stat version 6.400 was used **(Co stat, 2008).** The means followed by the same alphabetical letters were not statistically significant at the 0.05 level of significance according to the (**Duncan, 1955)**.

RESULTS AND DISCUSSION

Growth Parameters

The effect of alfalfa varieties (Var.), among hills planting distances (D) and their interaction (D × Var.) on growth criteria are presented in Tables 2, 3, 4 and 5.

Cut 1

Plant height

Results in Table 2 also indicated that the varietal different showed significant effect on plant height among hills planting distances had significant effect on plant height. The highest plant was recorded with 25 cm among hills (68.30 cm) in cut1.

Siwa variety achieved the superiority (P≤0.05) among all varieties in plant height with mean (69.57 cm) but, New Valley **(NV)** variety gave the lowest mean value in all cuts (60.20 cm).

According to the interaction between varieties and among hills planting distances revealed Siwa variety planting in 25 cm among hills recorded the highest plant height (73.05 cm) in cut1.

Diaa (2015) showed that Ismailia and Giza varieties achieved the superiority (P≤0.05) among all varieties in plant height with mean (64.47 and 64.96 cm respectively) but, WL528 variety gave the lowest mean value in all cuts (52.93 cm).

Hoda *et al.* (2015) found that highly significant differences among the investigated varieties for plant height trait in both seasons. New Valley variety (65.89 and 69.02 cm) ranked first followed by Ismailia-94 (61.62 and 69.29 cm) for plant height in both seasons, respectively.

Number of branches/plant

Results presented in Table 2 revealed that the different among hills planting distances had insignificant effect on number of brunches/plant in among hills planting distances (D) and varieties. On the other hand, the highest number of branches / plant was recorded with 75 cm (19.80) among hills in cut1. NV variety recorded the maximum number of branches/plant (20.88) in cut1.

The interaction between varieties and among hills planting distances on number of branches/plant (23.10 number of brunches/plant) ranked first followed by NV with 75 cm among hills. According to the interaction between varieties and planting distances on number of branches/ plant (450.55 and 614.15) ranked first followed by Ismailia-94 (449.36 and 615.42) for tillers m^2 in both seasons, respectively **(Hoda *et al.*, 2015).**

Fresh weight

Results presented in Table 2 revealed that the different among hills planting distances had insignificant effect on fresh weight. On the other hand, the highest fresh weight ton per faddan were recorded with 25 cm (3.37 ton per faddan) in cut1. Also, results in Table 2 also indicated that the different varieties showed significant effect on fresh weight. Ramah1 variety recorded the maximum fresh weight ton per faddan (4.17 ton per faddan) in cut 1.

According to the interaction between varieties and among hills planting distances on fresh weight. Ramah1 variety planting in 25 cm among hills recorded the highest fresh weight ton per faddan (4.70 ton per faddan) in Cut1. On the contrary, **(Diaa, 2015)** cultivated Siriver variety in soil contained with 100% mineral treatments given the lowest mean in fresh weight (42.19 kg m^{-2}).

Table 2. Effect of among hills planting distances (D) on alfalfa varieties (Var.) and their interaction (D × Var.) on some vegetative parameters in (Cut 1)

Treatments	Plant height (cm)	No. of brunches	Fresh weight (ton per faddan)	dry weight ton per faddan
Planting distances (D)				
25 cm	68.30 a	19.77	3.69	1.39
50 cm	67.45 a	19.58	3.57	1. 16
75 cm	61.99 b	19.80	3.37	1.10
Significance	*	NS	NS	NS
Varieties (var.)				
NV	60.20 b	20.88	1.95 c	0.67 c
Siwa	69.57 a	19.44	3.13 b	1.19 b
Ismailia	67.01 a	19.07	2.26 bc	0.90 bc
Ramah1	66.88 a	19.47	4.17 a	1.88 a
Significance	*	NS	*	*
Interaction				
25 cm + NV	60.05 bc	21.99 ab	2.25 c	0.76 c
25 cm + Siwa	73.05 a	19.99 b	2.59 b	1.36 b
25 cm + Ismailia	72.27 a	18.88 cd	2.93 b	1.26 b
25 cm + Ramah1	64.44 b	18.21 cd	4.70 a	2.17 a
50 cm + NV	56.33 c	17.55 cd	1.57 d	0.56 c
50 cm + Siwa	67.22 ab	21.22 ab	3.33 b	1.29 b
50 cm + Ismailia	60.66 c	18.88 cd	1.82 cd	0.70 c
50 cm + Ramah1	63.77 bc	20.66 ab	3.59 a	1.43 b
75 cm + NV	64.22 bc	23.10 a	2.02 c	0.69 c
75 cm + Siwa	68.44 ab	17.10 d	2.48 b	0.92 c
75 cm + Ismailia	68.10 ab	19.44 c	2.03 c	1.10 b
75 cm + Ramah1	72.44 a	19.55 c	4.22 a	2.05 a
Significance	*	*	*	*

Means of each factor designated by the same letter are not significantly different at 5% level using Duncan's multiple range test.

Table 3. Effect of among hills planting distances (D), alfalfa varieties (Var.) and their interaction (D × Var.) on some vegetative parameters in (Cut 2)

Treatments	Plant height (cm)	No. of brunches	Fresh weight (ton per faddan)	dry weight ton per faddan
Planting distances (D)				
25 cm	78.24 a	16.63 b	3.92 a	1.12 a
50 cm	77.19 ab	16.69 b	2.54 b	0.85 b
75 cm	75.58 b	17.35 a	2.10 b	0.69 b
Significance	*	*	*	*
Varieties (var.)				
NV	70.99 b	16.33 b	2.01 b	0.70 b
Siwa	72.36 b	16.18 b	2.57 b	0.80 b
Ismailia	79.92 a	15.84 b	2.72 b	0.85 b
Ramah1	82.07 a	18.55 a	4.11 a	1.20 a
Significance	*	*	*	*
Interaction				
25 cm + NV	67.33 c	16.33 a	2.90 c	0.75 bc
25 cm + Siwa	75.55 b	17.66 a	3.32 b	0.73 bc
25 cm + Ismailia	79.11 ab	16.33 b	3.79 b	0.84 bc
25 cm + Ramah1	83.00 a	17.22 ab	5.68 a	1.26 a
50 cm + NV	75.66 b	16.99 b	1.85 d	0.56 cd
50 cm + Siwa	67.33 c	16.44 b	2.35 c	0.60 cd
50 cm + Ismailia	79.99 b	16.44 b	2.25 c	0.57 cd
50 cm + Ramah1	79.33 b	16.88 b	3.71 b	0.98 b
75 cm + NV	69.99 c	15.66 bc	1.28 d	0.36 d
75 cm + Siwa	74.22 b	14.44 c	2.04 cd	0.58 cd
75 cm + Ismailia	80.66 a	14.77 c	2.12 c	0.62 cd
75 cm + Ramah1	83.88 a	18.55 a	2.95 c	0.64 cd
Significance	*	*	*	*

Means of each factor designated by the same letter are not significantly different at 5% level using Duncan's Multiple range test.

Table 4. Effect of among hills planting distances (D), alfalfa varieties (Var.) and their interaction (D × Var.) on some vegetative parameters in (Cut 3)

Treatments	Plant height (cm)	No. of brunches	Fresh weight (ton per faddan)	Dry weight ton per faddan
Planting distances (D)				
25 cm	84.07 a	16.99 ab	4.84 a	1.09 a
50 cm	80.82 b	16.52 b	3.71 b	0.91 b
75 cm	79.38 b	17.10 a	3.08 c	0.75 c
Significance	*	*	*	*
Varieties (var.)				
NV	71.25 c	15.58 b	2.93 d	0.71 c
Siwa	81.96 b	17.18 ab	4.14 b	0.93 b
Ismailia	82.07 b	16.51 ab	3.48 c	0.83 bc
Ramah1	90.44 a	18.21 a	4.95 a	1.19 a
Significance	*	*	*	*
Interaction				
25 cm + NV	75.66 c	16.10 b	3.66 c	0.86 bcd
25 cm + Siwa	83.99 b	17.33 a	4.63 b	1.02 bc
25 cm + Ismailia	86.66 b	16.55 b	4.66 b	1.08 bc
25 cm + Ramah1	92.22 a	17.99 a	6.40 a	1.41 a
50 cm + NV	69.32 d	14.77 d	3.06 c	0.74 de
50 cm + Siwa	82.33 b	16.66 b	3.93 bc	0.98 bc
50 cm + Ismailia	82.55 b	16.99 b	3.26 c	0.76 cd
50 cm + Ramah1	89.10 a	17.66 b	4.60 b	1.16 ab
75 cm + NV	68.77 d	15.88 c	2.06 e	0.53 f
75 cm + Siwa	79.55 c	17.55 a	3.86 bc	0.80 cd
75 cm + Ismailia	76.99 c	16.00 bc	2.53 e	0.66 ef
75 cm + Ramah1	89.99 a	18.99 a	3.86 bc	1.01 ab
Significance	**8888***	*	*	*

Means of each factor designated by the same letter are not significantly different at 5% level using Duncan's multiple range test.

Table 5. Effect of among hills planting distances (D), alfalfa varieties (Var.) and their interaction (D × Var.) on some vegetative parameters in (Cut 4)

Treatments	Plant height (cm)	No. of brunches	Fresh weight (ton per faddan)	dry weight (ton per faddan)
Planting distances (D)				
25 cm	80.52 a	14.81 b	4.50 a	0.96 a
50 cm	78.74 b	14.87 ab	4.18 ab	0.94 a
75 cm	76.77 b	15.36 a	4.05 b	0.86 b
Significance	*	*	*	*
Varieties (var.)				
NV	71.07 d	14.84 ab	3.16 c	0.87 bc
Siwa	81.25 b	15.90 a	4.60 b	0.93 b
Ismailia	77.22 c	14.51 b	3.74 c	0.82 c
Ramah1	85.18 a	14.79 b	5.47 a	1.05 a
Significance	*	*	*	*
Interaction				
25 cm + NV	71.99 f	14.99 b	3.10 cd	0.88 cd
25 cm + Siwa	82.66 c	15.10 b	4.43 bc	0.87 cd
25 cm + Ismailia	80.11 d	13.72 c	3.58 c	0.80 de
25 cm + Ramah1	87.33 b	15.66 b	6.91 a	1.20 a
50 cm + NV	70.77 e	15.27 b	3.58 c	0.84 de
50 cm + Siwa	83.66 c	14.60 bc	4.68 b	1.05 ab
50 cm + Ismailia	76.33 e	14.44 bc	3.98 c	0.94 ab
50 cm + Ramah1	76.33 e	14.94 bc	4.50 bc	1.01 ab
75 cm + NV	70.44 f	14.27 bc	2.82 d	0.89 cd
75 cm + Siwa	77.44 e	17.99 a	4.70 b	0.88 cd
75 cm + Ismailia	75.21 e	15.38 b	3.68 cd	0.73 e
75 cm + Ramah1	91.88 a	13.78 c	5.02 b	0.93 ab
Significance	*	*	*	*

Means of each factor designated by the same letter are not significantly different at 5% level using Duncan's multiple range tests.

Results presented in Table 2 revealed that the different among hills planting distances had significant effect on dry weight. The highest fresh weight ton per faddan were recorded with 25 cm (1.39 ton per faddan) in cut1. Also, results in Table 2 also indicated that the different varieties showed significant effect on dry weight. Ramah1 variety recorded the maximum dry weight ton per faddan (1.88 ton per faddan) in cut 1.

According to the interaction between varieties and among hills planting distances on dry weight. Ramah1 variety planting in 25 cm among hills recorded the highest dry weight ton per faddan (2.17 ton per faddan) in cut1.

These results were in agreement with **(Zhang, 2008; Abadouz *et al*., 2010; Diaa, 2015)** indicated that, the highest values of dry weight from Giza and Ismailia varieties that achieved significant superiority ($P \leq 0.05$) between all varieties. However, Siriver variety gave the lowest mean value in all cuts (21.02 kg m^{-2}). Moreover, Ismailia variety had increased dry weight at means over all cuts (22.89 kg m^{-2}). New Valley recorded the highest dry forage yield (20.04 ton fed^{-1}) followed by $Siwa^{-1}$ (19.40 ton fed^{-1}), New Valley ranked also first regarding plant height (67.46 cm), Ismailia-94 (532.39 m 2) ranked first followed by New Valley (532.35 m^2) for tillers m^2 **(Hoda *et al*., 2015)**. The genotypes Zobel and Oscarpoly could be considered as the most stable genotypes with respect to most studied traits **(Okasha and Mubarak, 2018)**.

Cut 2

Plant height

Results presented in Table 3 revealed that the different among hills planting distances had significant effect on plant height. The highest plant height was recorded with 25 cm among hills (78.24 cm) in cut 2.

Results in Tables 3 also indicated that the different varieties showed significant effect on plant height. Ramah1 variety recorded the maximum plant height (82.07 cm) in cut 2.

According to the interaction between varieties and among hills planting distances on plant height. Ramah1 variety planting in 75 cm among hills recorded the highest plant height (83.88 cm) in cut2.

Number of branches/plant

Results presented in Table 3 revealed that the different among hills planting distances had significant effect on numbers of brunches/plant. The highest numbers of brunches/plant were recorded with 75 cm among hills (17.35) in cut2.

Ramah1 variety recorded the maximum number of brunches/plant (18.55) in cut 2.

According to the interaction between varieties and among hills planting distances on number of brunches/plant. Ramah1 variety planting in 75 cm among hills recorded the highest number of brunches/ plant (18.55) in cut 2.

Fresh weight (ton/faddan)

Results presented in Table 3 revealed that the different among hills planting distances had significant effect on fresh weight. The highest fresh weight was recorded with 25 cm among hills (3.92 ton/faddan) in cut2.

Ramah1 variety recorded the maximum fresh weight ton per faddan (4.11) in cut 2.

According to the interaction between varieties and among hills planting distances on fresh weight, Ramah1 variety planting in 25 cm among hills recorded the highest fresh weight ton per faddan (5.68) in cut 2.

Dry weight (ton/faddan)

Results presented in Table 3 revealed that the different among hills planting distances had significant effect on fresh weight. The highest dry weight was recorded with 25 cm (1.12) in cut 2. Ramah1 variety recorded the maximum dry weight ton per faddan (1.20) in cut 2. According the interaction between varieties and among hills planting distances on dry weight. Ramah1 variety planting in 25 cm recorded the highest dry weight ton per faddan (1.26) in cut2.

Cut 3

Plant height

Results presented in Table 4 revealed that the different among hills planting distances had significant effect on plant height. The highest plant height was recorded with 25 cm among hills (84.07 cm) in cut 3.

Ramah1 variety recorded the maximum plant height (90.44 cm) in cut3.

According to the interaction between varieties and among hills planting distances on plant height. Ramah1 variety planting in 25 cm among hills recorded the highest plant height (92.22 cm) in cut3.

Number of branches/plant

Results presented in Table 4 revealed that the different among hills planting distances had significant effect on number of brunches/plant. The highest number of brunches/ plants was recorded with 75 cm (17.10) in cut 3.

Ramah1 variety recorded the maximum number of brunches/plant (18.21) in cut 3.

According to the interaction between varieties and among hills planting distances on number of brunches/plant. Ramah1 variety planting in 25 cm recorded the highest number of brunches / plant (18.99) in cut 3.

Fresh weight (ton/faddan)

Results presented in Table 4 further revealed that the different among hills planting distances had significant effect on fresh weight. The highest fresh weight ton per faddan were recorded with 25 cm (4.84) in cut3.

Results in Table 4 indicated that the different varieties showed significant effect on fresh weight. Ramah1 variety recorded the maximum fresh weight ton per faddan (4.95) in cut 3.

According to the interaction between varieties and among hills planting distances on fresh weight, Ramah1 variety planting in 25 cm recorded the highest fresh weight ton per faddan (6.40) in cut 3.

Dry weight (ton/faddan)

Results presented in Table 4 revealed that the different among hills planting distances had significant effect on dry weight. The highest dry weight ton per faddan was recorded with 25 cm (1.09) in cut 3.

Ramah1 variety recorded the maximum dry weight ton per faddan (1.19) in cut 3.

According to the interaction between varieties and among hills planting distances on dry weight. Ramah1 variety planting in 25 cm among hills, the highest dry weight ton per faddan was recorded (1.41) in cut 3.

Cut 4

Plant height

Results presented in Table 5 revealed that the different among hills planting distances had significant effect on plant height. The highest plant height was recorded with 25 cm among hills (80.52 cm) in Cut 4.

Results in Table 5 also indicated that the different varieties showed significant effect on plant height. Ramah1 variety

recorded the maximum plant height (85.18 cm) in Cut 4.

According to the interaction between varieties and among hills planting distances on plant height. Ramah1 variety planting in 25 cm among hills recorded the highest plant height (92.22 cm) in in cut4.

Number of branches/plant

Results presented in Table 5 revealed that the different among hills planting distances had insignificant effect on number of brunches/plant. The highest number of brunches/plant was recorded with 75 cm among hills (15.36) in Cut4. Swia 1 variety recorded the maximum number of brunches/plant (15.90) in cut3.

According to the interaction between varieties and among hills planting distances on number of brunches/plant, Siwa 1 variety planting in 25 cm among hills recorded the highest number of brunches/ plant (17.99) in cut4.

Fresh weight

Results presented in Table 5 revealed that the different among hills planting distances had insignificant effect on fresh weight. The highest fresh weight ton per faddan was recorded by 25 cm among hills (4.50) in cut 4.

Ramah1 variety recorded the maximum fresh weight (5.47) in cut 4.

According to the interaction between varieties and among hills planting distances on fresh weight, Ramah1 variety planting in 25 cm among hills recorded the highest fresh weight ton per faddan (6.19) in cut4.

Dry weight (ton/faddan)

Results presented in Table 5 revealed that the different among hills planting distances had significant effect on dry weight. The highest dry yield ton per faddan were recorded with 50 cm among hills (0.94 ton per faddan) in cut4.

Ramah1 variety recorded the maximum dry weight (1.05 ton per faddan) in cut4.

According to the interaction between varieties and among hills planting distances had significant effect on dry weight. Ramah1 variety planting in 25 cm among hills recorded the highest dry weight (1.20 ton per faddan) in cut4.

The number of shoots per square metre differed significantly as a function of row spacing, with averages of 357, 226 and 172 shoots m^{-2} for row widths of 20, 40 and 60 cm respectively. The row spacing did not affect the number of racemes per shoot (23.1), the number of pods per raceme (7.2), the number of seeds per pod (6.5) or the thousand seed weight (1.667 g). The average forage production was 20.1, 18.5 and 17.9 Mg DM ha^{-1} for row distances of 20, 40 and 60 cm, respectively, with higher yields associated with smaller row distances (**Chocarro and Lloveras, 2014; Khalil *et al.*, 2018**).

Results presented in Tables 2, 3, 4, and 5 revealed that planting distances, varieties, and the interaction on some vegetative parameters in cut1, cut2, cut3 and cut4.

Hamd Alla *et al.* (2013) found that they fthe Wady local genotype enjoyed the highest values in all studied traits and recorded values of 68.6, 81.1 cm; 472.0, 644.0 with an average of 558.0, 45.8, 47.4%; 104.3, 106.5 with an average of 105.4 kg and 19.1, 27.7 kg for plant height, number of tillers/m2, leaf/plant ratio, seasonal fresh and dry forage yield/ plot in the two successive seasons, respectively.

The results in agreement with those obtained by **Tlahig *et al.*, (2017),** who reported the difference among averages of fresh matter yield between spring and summer seasons was around 4%. Nevertheless, it decreased by 19.40% and 64.04% respectively at autumn and winter seasons compared with those of summer.

Concerning the dry matter yield, the production of spring season was 9.17% higher than those of summer season. Whereas, it decreased by 11.17% and 66.41% respectively, during autumn and winter season. **Zhang (2008**) stated three alfalfa cultivars to evaluate the effects of three between row spacing treatments (60, 80, and 100 cm) and four within-row spacing treatments (15, 30, 45, and 60 cm) on seed yield, seed yield components, plant height, basal stem diameter, and lodging. The results suggest that 80-cm between row spacing and 30-cm within-row spacing can decrease the risk of lodging and optimize seed yields in the third and fourth harvest years. The perusal of data revealed that the Giza variety significantly affected seed yield**,** the maximum seed Whole plant dry yield were (2.750, 3.605 and 4.405) kg per polt in 2013, 2014 and 2015 seasons, respectively **(Diaa *et al.*, 2017).**

Abd El-Aziz and A. Helmy (2001) studied variation in the six alfalfa cultivars: viz Ismailia 1 and 94, Siwa-1, New Valley, Salt tolerant and introduced cultivar WL-605. Significant differences were found among the studied genotypes for dry yield, plant height and leaf/stem ratio. The cultivars WL-605, New Valley and Ismailia 94 were superior to the others for dry yield and leaf/stem ratio. However, Siwa and Ismailia 1 cultivarspossessed largest values for plant height.

Selection of drought-tolerant genotypes should be well adapted to stress and non-stress conditions. Therefore, they can discriminate drought tolerant genotypes with high root yield at the same manner under stress and non-stress conditions. It can be recommended that genotypes 6 and 7 are promising to be cultivated under drought stress or drought prone areas in Egypt **(Okasha and Mubarak, 2019**). The obtained results indicated that sowing variety Samba at 500 ppm Capillin level had the highest sugar extraction and sugar percentages as well as sugar yield/fed **(Mubarak and Abd El Rahman, 2020)**.

Conclusion

Generally, it could be recommended that Ramah1 variety planting in 25 cm recorded the highest fresh and dry weight ton per faddan increased alfalfa production under sandy soil conditions.

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الملخص العربي

إنتاجية العلف لبعض أصناف البرسيم الحجازي تحت ظروف شمال سيناء

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أجريت هذه الدراسة بمزرعة كلية العلوم الزراعية البيئية بالعريش في عام 2020 لدراسة تأثير المسافة بين الجور (الخط 25 و50 و75 سم) على أربعة أصناف من البرسيم الحجازي (الوادي الجديد- 1- سيوة 1 – اسماعيلية - رماح1). تمت دراسة صفات النمو في تصميم قطاعات كاملة العشوائية في تجربة منشقة مرة واحدة في ثلاث مكررات. أعطي الصنف سيوة1 المزروع علي الخط علي مسافة 25سم متوسط صفة ارتفاع النبات (73.05سم) في الحشة الأولي، وأعطي صنف الوادي الجديد أعلي متوسط عدد للسيقان (20.88) في الحشة الأولي، والتفاعل بين الأصناف والمسافة بين الجور لمتوسط صفة ارتفاع النبات اظهر صنف الوادي الجديد 1 المزروع علي الخط 75سم سجلت أعلي متوسط لعدد السيقان (23.01) في الحشة الأولي، وعلي الجانب الآخر لم تظهر فروق معنوية لصفة الوزن الغض وأعطت أعلي متوسط للوزن الغض للوحدة التجريبية عند مسافة الزراعة بين الجور 25سم (5.057 طن/فدان) في الوحدة التجريبية في الحشة الأولي، الأصناف أظهرت تأثير معنوي لصفة الوزن الغض وسجل الصنف رماح أعلي متوسط للوزن الغض للوحدة التجريبية (6.260 كجم) في الحشة الأولى، أظهر الصنف رماح 1مع المسافة 25سم أعلي متوسط (3.260 طن/فدان) في الحشة الأولي. للوحدة التجريبية وكان تأثير المسافة بين الجور على الخط معنوي لصفة ارتفاع النبات في الحشة الرابعة، وسجلت أعلي متوسط لارتفاع النبات (80.22سم) عند مسافة 25سم في الحشة الرابعة، وأعطي الصنف رماح مع المسافة 25سم أعلي متوسط لارتفاع النبات (92.55سم) في الحشة الرابعة. وأخيرا، النتائج توصي بأن زراعة الصنف رماح1 على مسافة 25سم على الخط تعطي أعلي إنتاجية في الأراضي الرملية.

الكلمات الإسترشادية: المسافة بين الجور داخل الخط، الأصناف، البرسيم الحجازي.

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