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SEED YIELD OF TWO ALFALFA GENOTYPES UNDER DIFFERENT ENVIRONMENTS

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ABSTRACT

A field experiment was conducted at the Agricultural Experiments and Researches Station, Cairo University, Giza, Egypt from 2008 to 2011 to study the influence of cutting treatment before seed production and plant densities on seed yield of two alfalfa genotypes (Laboon and El-wadi El-Gadid).

In General, El-wadi El-Gadid surpassed Laboon in seed yield/feddan. Cutting genotypes twice before seed production recorded the highest seed yield and its components. Seed yield was significantly increased with increasing plant density from 8.400 to 134.400 plant/fed. The interaction between harvesting treatment and genotypes was significant for seed yield in 2010 and 2011 years. El-wadi El-Gadid produced the highest seed yield when cut twice. It also recorded the heaviest seed yield under plant density of 134.400 plant/fed. The second order interaction (El-wadi El-Gadid× cutting twice ×134.400 plant/fed) gave the highest seed yield in both years. Highly significant and negative correlation was observed between seed yield and number of pods /plant (-0.32) and seed index (-0.34).

Keywords: Alfalfa, Medicago sativa, cutting treatment, plant density, genotype.

INTRODUCTION

Alfalfa seed production has a little stability and differs from region to region and year to year depending on environmental conditions. Seed yield of alfalfa is generally poor due to lack of pollination, pod abortion and a few seeds per pod. Seed yield of alfalfa cultivars receives a little attention for producing alfalfa in Egypt.

The adoption of improved cultivars that perform better under different harvesting treatment, and plant densities that play an important role for increasing seed production are important factors for alfalfa seed production.

Seed yield significantly is affected by the number of forage harvests prior to seed production. The number of harvestings has a significant effect on number of pods/raceme but seeds/pod and 1000 seed weight are not affected. The highest seed yield was obtained from plants that have been cut twice (Khrbeet and Al-Shama, 1987). The highest three-year average seed yield of alfalfa was achieved in second harvesting (386.9 kg/ha), than third (189.3 kg/ha) and was lowest in the first harvesting (179.4 kg/ha) (Eric *et al*., 1995). Pod setting was at its best value in July, while April had the lowest value. June and July appeared to be the most stable blooming period for high alfalfa seed yield (Al-Doss and Alsuhaibani, 2003). There was a significant and negative correlation between seed yield and 1000 seed weight (Hosein and Lotfollah, 2004). The single, late cut achieved the best balance among the yield components and thus the highest seed yield (633 kg ha^{-1}). The highest correlations with seed yield were recorded for number of pods per raceme (r=0.932) (Karagic, 2006). (Abu Elgasim and Abusuwar, 2011) found that harvesting once (C_1) had a significant effect on number of pods/plant in the first year compared to the other harvesting treatment. Harvesting treatment had no significant effect on thousand seeds weight in the two years. No harvesting (C_0) had a high significant effect on total seed yield in both years compared to other harvesting treatment.

In other experiments, low density and increased row space were important elements in increasing alfalfa seed production (Koocheki and Marashi, 1989: Koocheki *et al*., 1987; Kowithayakorn and Hill, 1982 and Melthon *et al*., 1979). Low density decreased the plant challenge from light, nutrition and water point of view, so strong and more branches are produced, finally plants will have more flowered branches (Koocheki and Marashi, 1989). The 50-cm plant spacing produced alfalfa with the highest seed yield per plot (Abu-shakra *et al*., 1969). The optimum spaces were 0.8 m between rows and 0.4 m between plants for producing the best number of stems, number of inflorescences and seed yield (Carvajal and Benitez, 1986). Increasing row width increased the number of stems/plant, racemes/stem, pods/raceme and seeds/pod. Seed yield was negatively correlated with 1000-grain wt (Al-Dulaimi *et al*., 1987). Alfalfa seed yield (kg/ha) tended to be maximum with 36-cm row spacing or broadcast seeding (Moyer *et al*. 1991). The 60 and 75 cm row spacing gave the highest seed yield of 426 and 436 kg/ha, respectively. The 75 cm row spacing significantly gave the highest 1000-seed weight (Al-Noaim and Koriem, 1992). Seed yield was highest at 30 and 45 cm row spacings (Askarian *et al*., 1995). The suitable density for alfalfa seed production should be around 55.550 plants/ha (Yongjun and Jichun, 1998). Using row spacing of 25 cm had the highest seed yield (Niya and Zadeh, 2003). Row spacing had a large effect on seed yield, number of reproductive shoots/m^2, florets/shoot, pods/floret and seeds/pod. The highest seed yield was reached when row spacing was 100 cm (Wen-hua *et al*., 2007). The 80-cm between-row spacing and 30-cm within-row spacing produced the best seed yield. With the increase of within-row spacing, stems per square meter decreased, while racemes per stem increased significantly (Zhang *et al*., 2008). Seed yield and raceme per m^2 increased when row spacing decreased. Seed yield changes and its components are related to row spacing (Abadouz *et al*., 2010).

The main objective of this investigation was to determine the optimum number of cuts before seed production and plant density that gives the highest seed yield of two genotypes under Giza conditions.

MATERIALS AND METHODS

A field experiment was carried out at the Agricultural Experiment and Research Station, Cairo University in Giza, Egypt from 2008 to 2011. The texture of the field experiment was loamy with pH (8.5).

The experiment included 24 treatment combinations between two genotypes (Laboon and El-Wadi El-Gaded), three cutting treatment (one cut (M_1), two cuts (M_2) and three cuts (M_3)) before seed setting and four plant densities (134.400 (D_1), 33.600 (D_2), 14.933 (D_3) and 8.400 (D_4) plant/ fed).

The Experimental design was spilt-spilt plot arranged in a randomized complete block design with three replications. The main plots were devoted to genotypes, the sub-plots to harvesting treatment and the sub-sub plots to plant densities. Plot size was 2×3 m.

Seeds were sown by hand in hills on 30th October 2008. So the establishment year was 2008/09. The growing years were 2010 and 2011. The following table shows the treatments and date of harvesting for forage and seed yield. Two colonies of honey bees were provided to the experimental field at flowering for pollination. Seed harvesting was done at the stage of 75 % of black brown pods. Number of pod / raceme, number of pods /plant, pods weight (g)/plant, number of seeds /plant, seeds weight (g)/plant, seed index (the weight of 1000 seeds in grams) were recorded and seed yield (kg/fed) was taken by harvesting the whole plot (6 m^2).

Table 1. Alfalfa cutting treatments and date of harvest for seed in 2010 and 2011.

Growing year	No. of Cuts	Harvesting date	Harvest date for Seed
2010	**One**	21 March 2010	5 July 2010 after 106 days from cutting)
	Two	21 March 2010 23 April 2010	19 July 2010 (after 87days from final cut)
	Three	21 March 2010 23 April 2010 19 May 2010	28 July 2010 (after 70 days from final cut)
2011	**One**	20 April 2011	5 July 2011 (after 76 days from cutting)
	Two	20 April 2011 23 May 2011	25 July 2011 (after 63 days from final cut)
	Three	20 April 2011 23 May 2011 13 June 2011	14 August 2011 (after 42 days from final cut)

Data obtained from each year were statistically analyzed according to procedures outlined by Steel *et al.* (1997) using Mstat-C computer program (Freed *et al*, 1989). The difference among treatment means were compared by the Least Significant Difference Test (LSD) at 0.05 level of probability. Simple correlation coefficients were computed between seed yield and its components.

RESULTS AND DISCUSSION

Effect of genotypes

Data in Table 1 show the effect of alfalfa genotype on seed yield and seed yield components in 2010 and 2011 years. Results show the insignificant effects of genotypes on number of pods/plant, number of seeds/plant and seed index (g) in both years. Meanwhile, genotypes had a significant effect on number of pods / raceme, pods weight (g)/plant, seed weight (g)/plant and seed yield (kg/fed) at 2010 year comparing with 2011 year.

It is clear from the results in Table 3 that El-Wadi El-Gadi surpassed Laboon in seed yield/fad in both years.

Effect of harvesting treatment

Data in Table 2 indicate a significant effect of harvesting treatment on number of pods/plant, pods weight /plant, number of seeds/plant, seed weight /plant and seed yield except number of pods / raceme and seed index in 2010 and 2011.

Harvesting twice times before seed setting was the best suitable harvesting treatment for most of the studied characters during both years. This may be due to the enhanced shoot growth after harvesting and consequent increase in the number of flowers, pods and seeds per plant due to supply of high amount of assimilates from the root. This is agreement with Abu Elgasim and Abusuwar (2011), Nayel and Khider (2003) and Messengal (1974). This results are disagreement with Abu Elgasim and Swar 2011 who indicated that harvesting once gave more time for flowering and seed production.

Two cuts achieved the highest seed yield. This may be due to the high root reserves and these reserves decreased by increasing number of cuts. These results are in line with Khrbeet and Al-Shama (1987), Eric *et al*. (1995), Simko (1995), Hosein and Lotfollah (2004), Pedersn *et al* (1961) and Rattan (1995) who reported that any delay in the last harvesting may lead to poor seed setting, due to poor pollination in the ensuing dry and hot weather. Similarly, a long gap, by taking the last cut earlier, may lead to lodging due to excessive vegetative growth resulting in poor seed setting. This is in disagreement with Koocheki and Marashi (1989). Karagic *et al*. (2005) and Abu Elgasim and Abusuwar (2011)

Effect of plant density

Data in Table 3 indicate the effect of plant density on number of pods / raceme, number of pods/plant, pods weight /plant, number of seeds/plant, seed weight /plant, seed index and seed yield in 2010 and 2011.

Results show that plant density had a significant effect on the most of studied characters except seed index during both years.

Plant density of 8.400 plants/feddan achieved the highest number of pods / raceme (5.32) compared with the other plant densities during the two years. This result may be due to increased plant spacing between plants that provide more light for plants and more photosynthesis and food reserves for the reproductive organs. This is in line with Al-Dulaimi *et al.* (1987), and Koocheki and Marashi (1989) who concluded that decreasing density caused less plant competition for lights, nutritious and water, so plants with more stems and leaves were produced with more flowers and pods. However, this is in disagreement with Askarian *et al.* (1995) who reported that pods per raceme which tended to decrease as row spacing increased.

The number of pods /plant was significantly affected by plant density. The highest number of pods /plant (2097.5 and 1627.6) was achieved by the fourth plant density, while the first plant density gave the lowest number of pods /plant (326.00 and 471.72) during both years, respectively. This may be due to increased plant density from 8.400 to 134.400 plants/fed, increased competition between plants and less productive pods/plant. This is line with Koocheki and Marashi (1989) who reported that an increase in number of pods per plant due to increasing plant spacing, seems to be attributed to a low plant population.

The pods weight was significantly affected by plant density. The heaviest pod weight was achieved by 8.400 plant/fed, but the lightest pods weight was obtained by 134.400 plant/fed in both years. Pods weight increased with decreasing plant density as a result of high light penetration through plants. This is in agreement with Koocheki and Marashi (1989) who concluded that decreasing density caused less plant competition, so plants with more stem and leaf were produced, after it, they themselves produced more flower and pod that resulted in pods weight.

Number of seeds/plant was significantly affected by plant density. Plant density of 8.400 plants/fed achieved the highest number of seeds /plant (4897.42 and 3937.54) during both years respectively, while 134.400 plant/fed gave the lowest number of seeds /plant (1211.74 and 1027.21, respectively) during both years. These results may be due to less competition between plants. This is in agreement with Copeland and McDonald (2004) who reported that alfalfa stands respond to lower plant populations by producing more seed per plant, thus increasing total production. Spacing the plants individually or in hills within the row often increases seed yields, although it may also increase weed problems.

Seeds weight was significantly affected by plant density. The heaviest **s**eeds weight (11.47 and 9.56 g/plant, respectively) was achieved by 8.400 plants/fed during both years, while 134.400 plant/fed gave the lightest **s**eeds weight (3.05 and 2.88g/plant, respectively) during both years. By increasing plant density, plant competition increased resulting in less seed production /plant. This is line in with Koocheki and Marashi (1989) and Zhang (2008) who reported that an increase in seed weight per plant due to increasing plant spacing seems to be attributed to a low plant population as a result any pod usage of nutrition.

Seed yield was significantly affected by plant density. The highest seed yields (156.54 and 146.55 kg/fed) were recorded by D_1 and D_2, while D_3 and D_4 gave the lowest seed yields (98.25 and 98.62kg/fed) during 2010 year. It is clear from the results in Table (3) that the highest seed yield (164.65 kg/fed) was obtained from D_1, but the lowest seed yield (101.81 kg/fed) was recorded with D_4 during 2011 year. These results may be due to increased number of plants per unit area that resulted in high seed yield per unit area. This is in agreement with Abadouz *et al*. (2010), Niya *et al*. (2003), Yongjun and Jichun (1998),Vuckovic (1996), Askarian *et al*. (1995), Abu-shakra *et al*. (1969), Moyer *et al*. (1991) and Dovrat *et al*. (1968) who reported that seed yield increased with row spacing decreased because of suitable plant in unit, suitable settlement condition was provided, so the plant could produce more reproductive parts by using light and environment. This is disagreement with Carvajal and Benitez (1986), Koocheki and Marashi (1989), Al-Noaim and Koriem. (1992), and Mao *et al*. (2009).

Effect of the interaction

1) Effect of genotype× harvesting treatment

The interaction between harvesting treatment and genotypes (Table 4) had a significant effect on number of pods / raceme, number of pods/plant, pods weight/plant, number of seeds/plant, seed weight/plant and seed yield with the exception of seed index in 2010 and 2011.

Number of pods/ raceme was not significantly affected by the genotype× harvesting treatment interaction in the first year. The interaction between Laboon× two cuts achieved the highest number of pods / raceme (6.45), but the interaction of Laboon× three cuts, El-Wadi El-Gadid× one cut and El-Wadi El-Gadid× two cuts gave the lowest number of pods / raceme (4.70, 5.02 and 5.21, respectively).

The interaction between genotype and harvesting treatment had a significant effect on number of pods/plant (Table 4). The interaction between Laboon× two cuts and El-Wadi El-Gadid× two cuts achieved the highest number of pods /plant (1466.78 and 1455.91), but the interaction of El-Wadi El-Gadid× one cut gave the lowest number of pods /plant (1128.84) in the first year. The interaction of El-Wadi El-Gadid× two cuts recorded the highest number of pods/plant (1172.28), but Laboon× three cuts gave the lowest number of pods /plant (908.24) compared with other interactions during the second year.

Data in Table 4 indicate that the interaction between genotype and harvesting treatment had a significant effect on pods weight/plant. The interaction between Laboon× two cuts achieved the heaviest pods weight during both years.

The interaction between genotype and harvesting treatment had a significant effect on number of seeds /plant and seed weight /plant. The interaction between Laboon× two cuts and El-Wadi El-Gadid× two cuts achieved the highest number of seeds/plant compared with other interactions between genotype and harvesting treatment during both years.

Seed yield (kg/fed) was significantly affected by the interaction between genotype and harvesting treatment. The interaction between El-Wadi El-Gadid× two cuts achieved the highest seed yield (195.92 and 154.88 kg/fed). Meanwhile, Laboon× one cut gave the lowest seed yield (64.62 and 100.81 kg/fed) in both years, respectively.

2) Effect of genotype× plant density

The interaction between genotypes and plant density (Table 5) had a significant effect on number of pods / raceme, number of pods/plant, pods weight/plant, number of seeds/plant, seed weight/plant, seed index and seed yield in 2010 and 2011 years.

The interaction between genotype and plant density had a significant effect on number of pods / raceme during the first year. The interaction of Laboon× D_4 achieved the highest number of pods / raceme (5.96 and 5.92); in contrast with the other interactions between genotype× plant density during both years.

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The interaction of genotype and plant density had a significant effect on number of pods/plant during both years. In the first year, the interaction between laboon× D_3 achieved the highest number of pods /plant (2367.33). The interaction of Laboon× D_1 and El-Wadi El-Gadid× D_1 gave the lowest number of pods /plant (270.22 and 381.79, res.). In the second year, the interaction between El-Wadi El-Gadid× D_4 recorded the highest number of pods /plant (1681.64), but the lowest number of pods /plant (413.62) was obtained from El-Wadi El-Gadid× D_1.

The interaction between genotype and plant density had a significant effect on pods weight (g/plant) during both years (Table 5). The interaction of Laboon×D_3 achieved the heaviest pods weight (30.04 and 24.82 g/plant, res.) at the first year and the interaction of Laboon×D_4 at the second year. El-Wadi El-Gadid×D_1 gave the lightest pods weight (5.27 and 5.71g/plant) during both years, respectively.

The number of seeds /plant was significantly affected by the interaction between genotype and plant density during both years (Table 5). The interaction between Laboon× D_4 at first year and El-Wadi El-Gadid× D_4 at second year achieved the highest number of seeds /plant (5524.89 and 4092.01, res.). El-Wadi El-Gadid× D_1 recorded the lowest number of seeds /plant (1015.69 and 986.93) in both years.

The interaction between genotype and plant density had a significant effect on seeds weight/plant in both years. Laboon×D_4 at first year and El-Wadi El-Gadid×D_4 at second year achieved the heaviest **s**eeds weight (13.25 and 9.84 g/plant). The interaction of El-Wadi El-Gadid×D_1 gave the lightest **s**eed yield/plant (1.98 and 2.54 g/plant) during both years.

The interaction between genotype and plant density had a significant effect on seed index (g). The interaction between El-Wadi El-Gadid×D_2 at first year and El-Wadi El-Gadid× D_4 achieved the highest seed index (2.58 and 2.74g).

Seed yield (kg/fed) was significantly affected by the interaction between genotype and plant density in both years. The interaction of El-Wadi El-Gadid×D_1 achieved the highest seed yields (187.92 & 179.37 kg/fed) during the first and second years, respectively. The interaction El-Wadi El-Gadid×D_3 at first year and laboon×D_4 at second year gave the lowest seed yields (90.63 and 99.79 kg/fed, respectively).

3) Effect of genotype ×harvesting treatment× plant density

Data in (Table 6) show that the interaction between genotype ×harvesting treatment× plant density had a significant effect on number of pods / raceme in two years. In the first year, Laboon×two cuts×D_4 achieved the highest number of pods / raceme (7.22). The lowest number of pods / raceme (3.31) was was obtained from El-Wadi El-Gadid×one cut×D_3. In the second year, Laboon×two cuts×D_2 recorded the highest number of pods / raceme (7.09), but the lowest number of pods / raceme (4.27) was obtained from Laboon×three cuts× D_3.

The interaction between genotype ×harvesting treatment× plant density had a significant effect on number of pods /plant in both years (Table 6).

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In the first year, Laboon×one cut×D_3 achieved the best number of pods /plant (2738.73). The lowest number of pods /plant (190.31) was given by Laboon×two cuts×D_2. In the second year, Laboon×one cut×D_4 and El-Wadi El-Gadid×one cut×D_4 recorded the highest number of pods /plant (1893.42 and 1900.78), but the lowest number of pods /plant (307.67) was obtained from El-Wadi El-Gadid×one cut×D_1.The interaction between genotype ×harvesting treatment× plant density had a significant effect on pods weight (g/plant) in both years. In the first year, Laboon×two cuts×D_3 and Laboon×three cuts×D_4 achieved the heaviest pods weight (39.37 and 38.70g/plant). The lightest pods weight (4.70g/plant) was given by El-Wadi El-Gadid ×two cuts×D_1. In the second year, Laboon×one cut×D_4 recorded the heaviest pods weight (29.16g/plant), but the lightest pods weight (5.63 and 4.23g/plant) was obtained from Laboon×one cut×D_1 and El-Wadi El-Gadid×one cut×D_1.

Data in Table 6 show that genotype ×harvesting treatment× plant density interaction had a significant effect on number of seeds /plant in 2010 and 2011. In the first year, Laboon× two cuts×D_4 produced the highest number of seeds (7511.00/plant). The lowest number of seeds /plant (884.92 and 566.33) were obtained from El-Wadi El-Gadid ×three cuts×D_1 and Laboon ×one cut×D_1. In the second year, El-Wadi El-Gadid×one cut×D_4 and El-Wadi El-Gadid×two cuts×D_4 recorded the highest number of seeds (4331.96 and 4331.63/plant), but the lowest number of seeds (740.38, 772.38, 714.93 and 851.93/plant) were obtained from Laboon×one cut×D_1, Laboon×one cut×D_2, El-Wadi El-Gadid×one cut×D_1 and El-Wadi El-Gadid×three cuts×D_1.Data in Table 6 show that genotype ×harvesting treatment× plant density interaction had a significant effect on **s**eeds weight (g/plant) in both years. In the first year, Laboon×two cuts×D_3 achieved the heaviest **s**eed weight (17.19 g/plant) compared with other interactions between genotype ×harvesting treatment× plant density. In the second year, El-Wadi El-Gadid×two cut×D_2 recorded the heaviest **s**eeds weight (10.72 g/plant). In contrast the lightest **s**eeds weight (2.81 and 1.73 g/plant) were obtained from Laboon×one cut×D_1 and El-Wadi El-Gadid×one cut×D_1.

The interaction between genotype ×harvesting treatment× plant density had a significant effect on seed index in both years as shown in Table 6. In the first year, El-Wadi El-Gadid ×one cut×$D_{1,2,3}$, El-Wadi El-Gadid ×three cuts×D_3, Laboon×one cut×$D_{1,3,4}$ and El-Wadi El-Gadid×two cuts×D_4 achieved the best seed index (2.64, 2.61, 2.71, 2.55,2.64,2.61, 2.60 and 2.61g), respectively. The lowest seed index (2.04g) was given by El-Wadi El-Gadid ×three cuts×D_4. In the second year, El-Wadi El-Gadid×two cuts×D_4 recorded the highest seed index (2.91g), but the lowest seed index (2.24g) was obtained from the combination of Laboon×three cuts×D_4.Seed yield (kg/fed) was significantly affected by the interaction between genotype ×harvesting treatment× plant density in both years. El-Wadi El-Gadid× two cuts×D_1 achieved the heaviest seed yield (245.12 and 218.42 kg/fed) in both years. The lowest seed yield (54.81, 54.93 and 83.58 kg/fed) was obtained by El-Wadi El-Gadid×one cut×D_3 and El-Wadi El-Gadid×three cuts×D_3 in the first year and Laboon× cut twice ×D_4 in the second year.The correlation coefficients between seed yield and most studied characteristics were significant (Table 7).

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Significant and negative correlation was observed between seed yield and number of pods /plant (-0.32**) and seed index (-0.34**). The correlation coefficients between seed weight/plant and most characteristics were significant (Table 7). Significant and positive correlation was observed between seed weight/plant and number pods/plant (0.72**), pods weight (0.88**), number of seeds /plant (0.85**) and peed index (0.72**) in 2010.

The correlation coefficients between seed yield and most studied characteristics were significant (Table 8). Significant and negative association was observed between seed yield and number pods/plant (-0.48**), pods weight (-0.45**), number of seeds /plant (-0.36**) and seeds weight (-0.35**). The correlation coefficients between seed weight/plant and most characteristics were significant (Table 8). Significant and positive correlation was observed between seed weight /plant and number of pods/plant (0.88**), pod weight/plant (0.84**) and number of seeds/plant (0.90**). In contrast, significant and negative association was observed between seed weight/plant and seed yield (-0.35**).

Table 8. Simple correlation coefficient among alfalfa seed yield and its components in 2010 and 2011.

	2010							2011						
Traits	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1. Seed yield (kg)/fed	1.00							1.00						
2. No. pods/raceme	-0.05	1.00						-0.16	1.00					
3. No. pods/plant	-0.32**	0.08	1.00					-0.48**	0.19	1.00				
4. Pods weight (g)/plant	-0.11	0.01	0.72**	1.00				-0.45**	0.17	0.83**	1.00			
5. No. seed/plant	-0.01	0.32**	0.78**	0.76**	1.00			-0.36**	0.09	0.84**	0.87**	1.00		
6. Seeds weight (g)/plant	-0.13	0.13	0.72**	0.88**	0.85**	1.00		-0.35**	0.11	0.88**	0.84**	0.90**	1.00	
7. Seed index	-0.34**	0.22	0.80**	0.61**	0.71**	0.72**	1.00	-0.20	0.12	0.14	0.08	0.17	0.05	1.00

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حاصل البذور لتركيبين وراثيين من البرسيم الحجازى تحت ظروف بيئية مختلفة

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أجريت تجربة حقلية بمحطة التجارب والبحوث الزراعية، جامعة القاهرة، الجيزة، مصر خلال الفترة ٢٠٠٨ -٢٠١١ بهدف دراسة تأثير معاملات الحش (حشة واحدة وحشتين وثلاث حشات قبل إنتاج التقاوى) والكثافات النباتية (١٣٤،٤٠٠ ، ٣٣،٦٠٠، ١٤،٩٣٣ ، ٨،٤٠٠ نبات/فدان) على حاصل البذور لتركيبين وراثيين من البرسيم الحجازى هما لابون والوادى الجديد.

واتضح من النتائج بصفة عامة تفوق الصنف الوادى الجديد علي العشيرة لابون بالنسبة لحاصل البذور للفدان.أدى حش التراكيب الوراثية مرتين قبل إنتاج التقاوى إلى أعلي حاصل للبذور ومكوناته. وأظهرت النتائج أيضاً زيادة معنوية لغلة البذور بزيادة الكثافة النباتية من ٨،٤٠٠ إلى ١٣٤،٤٠٠ نبات/فدان.. وبما يتعلق بالتفاعل بين معاملات الحش والتراكيب الوراثية أظهرت النتائج وجود تأثير معنوي لهذا التفاعل علي حاصل البذرة للفدان خلال موسمى الدراسة ٢٠١٠ و٢٠١١. حيث أعطى التركيب الوراثى الوادى الجديد أعلى حاصل من البذور عندما تم حشه مرتين قبل إنتاج التقاوى. كما أظهر هذا التركيب الوراثى الوادى الجديد أفضل حاصل من البذور عندما تم زراعته بكثافة نباتية ١٣٤،٤٠٠ نبات فى الفدان. وكان التفاعل الثلاثى بين التراكيب الوراثية ومعاملات الحش والكثافة النباتية تأثيراً معنوياً خلال سنتى الدراسة. حقق التفاعل الثلاثي بين صنف الوادى الجديد والنباتات التى أخذ منها حشتين قبل إنتاج التقاوى و ١٣٤،٤٠٠ نبات/فدان أعلى حاصل من البذور للفدان. وكان هناك إرتباطاً معنوياً سالباً بين حاصل البذور للفدان وكل من عدد القرون على النبات (-٠،٣٢) ومعامل البذرة (-٠،٣٤).

قام بتحكيم البحث

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Table 2. Seed yield and yield components of two alfalfa genotypes in 2010 and 2011.

Genotypes	N0. pods/plant		No. pods/raceme		Pods weight/plant (g)		No. seeds/plant		Seeds weight (g)/plant		Seed index		Seed yield (kg)/fed	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
Laboon	1390.59	1068.32	4.89	5.60	21.20	15.55	3558.99	2357.94	9.04	6.12	2.50	2.58	114.38	119.91
El wadi	1282.17	1132.75	4.49	5.32	14.82	14.99	2699.15	2777.99	6.07	6.92	2.46	2.65	135.60	138.20
LSD	n.s	n.s	n.s	*	*	n.s	n.s	n.s	*	n.s	n.s	n.s	*	n.s

Table 3. Seed yield and yield components of two alfalfa genotypes as affected by cutting treatment before seed production during 2010 and 2011.

Cutting treatment	No. pods/plant		No. pods/raceme		pods weight(g) /plant		No. seeds/plant		seeds weight (g)/plant		seed index		seed yield (kg)/fed	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
One cut	1227.86^{b}	1113.19^{a}	4.53^{a}	5.33^{a}	15.42^{c}	14.65^{a}	2173.87^{c}	2268.97^{b}	6.72^{b}	6.05^{b}	2.59^{a}	2.70^{a}	67.06^{c}	111.21^{b}
Two cuts	1461.35^{a}	1168.65^{a}	4.71^{a}	5.83^{a}	20.60^{a}	16.92 ^{a}	3997.14^{a}	3103.21^{a}	9.06^{a}	7.12^{a}	2.46^{a}	2.73^{a}	168.10^{a}	134.89^{a}
Three cuts	1319.94^{ab}	1019.77^{b}	4.83^{a}	5.22^{a}	18.02^{b}	14.23^{a}	3216.21^{b}	2331.71^{b}	6.88^{b}	6.39^{ab}	2.39^{a}	2.41^{a}	139.81^{b}	141.06^{a}

Table 4. Seed yield and yield components of two alfalfa genotypes as affected by plant density during 2010 and 2011.

Plant density	N0. pods/plant		No. pods/raceme		pods weight(g) /plant		No. seeds/plant		seeds weight (g)/plant		seed index		seed yield (kg)/fed	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
D_1	326.00^{c}	471.72^{d}	4.73^{b}	5.38^{a}	7.56^{c}	6.17^{d}	1211.74^{d}	1027.21^{d}	3.05^{d}	2.88^{d}	2.53^{a}	2.60^{a}	156.54^{a}	164.65^{a}
D_2	828.86^{b}	858.50^{c}	4.29^{b}	5.51^{a}	15.55^{b}	11.87^{c}	2497.92^{c}	2038.50^{c}	5.89^{c}	5.64^{c}	2.46^{a}	2.60^{a}	146.55^{a}	127.43^{b}
D_3	2093.64^{a}	1444.30^{b}	4.42^{b}	5.33^{a}	23.71^{a}	19.66^{b}	3909.21^{b}	3268.61^{b}	9.80^{b}	8.00^{b}	2.49^{a}	2.61^{a}	98.25^{b}	122.33^{b}
D_4	2097.03^{a}	1627.62^{a}	5.32^{a}	5.62^{a}	25.23^{a}	23.37^{a}	4897.42^{a}	3937.54^{a}	11.47^{a}	9.56^{a}	2.44^{a}	2.65^{a}	98.62^{b}	101.81^{c}

D_1 = 134.400 plant/fed D_2 = 33.600 plant/fed D_3 = 14.933 plant/fed D_4 =8.400 plant/fed

Table 5. Seed Yield and yield components of alfalfa as affected by the interaction between harvesting treatment and genotypes in 2010 and 2011.

Interactions	N0. pods/plant		No. pods/raceme		pods weight(g) /plant		No. seeds/plant		seeds weight (g)/plant		seed index		seed yield (kg)/fed	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
M_1- G_1	1326.88^{ab}	1131.69^{a}	4.81^{a}	5.64^{ab}	12.92^{cd}	15.94^{a}	2188.06^{c}	2140.11^{b}	5.99^{c}	5.95^{b}	2.59^{a}	2.68^{a}	64.62^{c}	100.81^{c}
M_1- G_2	1128.84^{b}	1094.68^{a}	4.26^{a}	5.03^{b}	17.93^{b}	13.35^{a}	2159.67^{c}	2397.83^{b}	7.44^{c}	6.16^{b}	2.59^{a}	2.71^{a}	69.50^{c}	121.61b^{c}
M_2- G_1	1466.78^{a}	1165.02^{a}	4.98^{a}	6.45^{a}	25.74^{a}	17.12^{a}	4879.18^{a}	2711.24^{ab}	11.57^{a}	5.99^{b}	2.51^{a}	2.70^{a}	140.28^{b}	114.90^{c}
M_2- G_2	1455.91^{a}	1172.28^{a}	4.43^{a}	5.21^{b}	15.46^{bc}	16.73^{a}	3115.11^{b}	3495.18^{a}	6.56^{c}	8.26^{a}	2.40^{a}	2.77^{a}	195.92^{a}	154.88^{a}
M_3- G_1	1378.12^{ab}	908.24^{b}	4.88^{a}	4.70^{b}	24.94^{a}	13.58^{a}	3609.74^{b}	2222.46^{b}	9.55^{b}	6.42^{b}	2.39^{a}	2.37^{b}	138.24^{b}	144.01^{a}
M_3- G_2	1261.77^{ab}	1131.29^{a}	4.78^{a}	5.73^{ab}	11.09^{d}	14.89^{a}	2822.69^{bc}	2440.96^{b}	4.21^{d}	6.35^{b}	2.40^{a}	2.46^{b}	141.37^{b}	138.11^{ab}

M_1 = plants cut one time before seed setting M_2 = plants cut two times before seed setting M_3 = plants cut three times before seed setting
G_1 = Laboon G_2 = El-Wadi El-Gadid

Table 6. Yield and yield components of alfalfa as affected by the interaction between plant densities and genotypes in 2010 and 2011.

Interactions	N0. pods/plant		No. pods/raceme		pods weight (g)/plant		No. seeds/plant		seeds weight (g)/plant		seed index(gm)		seed yield (kg)/fed	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
D_{1} - G_1	270.22^{e}	529.82^{f}	4.74^{b}	5.44 ^{a}	9.84^{f}	6.64^{d}	1407.79^{e}	1067.48^{cd}	4.11^{e}	3.23^{d}	2.54^{ab}	2.^{60b}	125.15^{bc}	149.93^{b}
D_{1} - G_2	381.79^{e}	413.62^{f}	4.73^{b}	5.31 ^{a}	5.27^{g}	5.71^{d}	1015.69^{e}	986.93^{d}	1.98^{f}	2.54^{d}	2.53^{ab}	2.61^{b}	187.92^{s}	179.37^{a}
D_{2}- G_1	921.40^{d}	772.72^{e}	4.17^{b}	5.69 ^{a}	17.68^{d}	10.96^{c}	2684.83^{cd}	1605.52^{c}	6.39^{cd}	4.65^{c}	2.34^{ab}	2.56^{b}	126.04^{b}	115.35^{de}
D_{2} - G_2	736.32^{d}	944.28^{d}	4.41^{b}	5.32 ^{a}	13.42^{e}	12.78^{c}	2311.01^{d}	2471.48^{b}	5.40^{d}	6.62^{b}	2.58^{a}	2.63^{ab}	167.06^{a}	139.52^{bc}
D_{3} - G_1	2367.33^{a}	1397.14^{c}	4.69^{b}	5.34 ^{a}	30.04^{a}	19.77^{b}	4618.46^{b}	2975.67^{b}	12.40^{a}	7.31^{b}	2.53^{ab}	2.62^{b}	105.87^{bcd}	114.57^{de}
D_{3} - G_2	1819.94^{c}	1491.45^{bc}	4.14^{b}	5.33 ^{a}	17.37^{d}	19.54^{b}	3199.96^{c}	3561.54^{a}	7.21^{c}	8.69^{a}	2.44^{ab}	2.60^{b}	90.63^{d}	130.10^{cd}
D_{4} - G_1	2003.41^{bc}	1573.60^{ab}	5.96 $^{\backslash a}$	5.92 ^{a}	27.23^{b}	24.82^{a}	5524.89^{a}	3783.08^{a}	13.25^{a}	9.27^{a}	2.57^{ab}	2.55^{b}	100.46^{cd}	99.79^{e}
D_{4} - G_2	2190.65^{ab}	1681.64^{a}	4.67^{b}	5.33^{a}	23.23^{c}	21.92^{ab}	4269.96^{b}	4092.01^{a}	9.69^{b}	9.84^{a}	2.31^{b}	2.74^{a}	96.78^{d}	103.83^{e}

D_{1} = 134.400 plant/fed D_{2} = 33.600 plant/fed D_{3} = 14.933 plant/fed D_{4} =8.400 plant/fed G_1 = Laboon G_2 = El-Wadi El-Gadid

Table 7. Yield and yield components of alfalfa as affected by the interaction between harvesting treatment (M), plant densities (D) and genotypes (G) in 2010 and 2011.

G	M	D	N0. pods/plant		No. pods/raceme		pods weight(g) /plant		No. seeds/plant		seeds weight (g)/plant		seed index		seed yield (kg)/fed	
			2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
Laboon	One cut	D_1	271.84	469.73	4.46	5.30	6.06	5.63	566.33	740.38	1.41	2.81	2.64	2.62	72.98	128.30
		D_2	653.51	454.95	4.80	5.08	11.51	6.50	1592.27	772.38	4.23	3.03	2.51	2.74	69.42	90.61
		D_3	2738.73	1708.67	4.42	5.48	19.35	22.48	3435.43	3211.52	9.35	7.52	2.61	2.73	56.95	97.09
		D_4	1643.42	1893.42	5.56	6.70	14.76	29.16	3158.22	3836.17	8.98	10.44	2.60	2.63	59.12	87.25
	Two cuts	D_1	190.31	663.47	4.96	6.23	9.02	8.13	2076.47	1307.33	4.68	3.66	2.52	2.6	166.75	153.22
		D_2	1583.13	1105.27	3.43	7.09	26.32	14.01	3947.40	2544.09	8.10	4.88	2.44	2.75	153.83	109.70
		D_3	2203.52	1355.67	4.31	6.27	39.37	20.22	5981.84	3214.32	17.19	6.90	2.48	2.64	122.76	113.10
		D_4	1890.16	1535.68	7.22	6.21	28.24	26.13	7511.00	3779.20	16.30	8.51	2.61	2.79	117.80	83.58
	Three cuts	D_1	348.5	456.25	4.81	4.80	14.45	6.16	1580.58	1154.73	6.24	3.22	2.45	2.58	135.72	168.28
		D_2	527.56	757.93	4.27	4.89	15.20	12.37	2514.83	1500.09	6.84	6.06	2.08	2.20	154.87	145.73
		D_3	2159.75	1127.08	5.35	4.27	31.41	16.60	4438.11	2501.17	10.65	7.52	2.51	2.48	137.89	133.50
		D_4	2476.67	1291.70	5.11	4.85	38.70	19.17	5905.44	3733.87	14.46	8.88	2.50	2.24	124.48	128.54
El-Wadi El-Gadid	One cut	D_1	335.64	307.67	6.30	5.47	5.53	4.23	769.15	714.93	2.24	1.73	2.64	2.73	77.82	134.35
		D_2	368.23	596.77	3.98	4.95	18.77	7.85	985.26	1199.22	6.80	3.26	2.61	2.74	83.22	128.50
		D_3	1550.67	1573.51	3.31	5.13	20.10	17.18	2757.05	3345.20	8.76	9.10	2.71	2.71	54.81	123.51
		D_4	2260.83	1900.78	3.44	4.56	27.31	24.14	4127.22	4331.96	11.96	10.53	2.42	2.67	62.17	100.07
	Two cuts	D_1	473.33	482.53	4.22	4.53	4.70	6.77	1393.00	1393.93	2.29	3.34	2.45	2.74	245.12	218.42
		D_2	1208.37	1308.60	4.42	5.60	14.42	17.84	3305.14	4004.93	6.77	10.72	2.63	2.82	227.50	155.09
		D_3	1937.35	1356.25	4.00	5.05	18.21	21.18	3400.64	4250.22	7.55	8.92	2.07	2.62	162.15	139.03
		D_4	2204.60	1541.72	5.09	5.67	24.49	21.11	4361.65	4331.63	9.62	10.06	2.46	2.91	148.9	106.98
	Three cuts	D_1	336.39	450.67	3.67	5.93	5.59	6.13	884.92	851.93	1.42	2.54	2.49	2.37	240.83	185.34
		D_2	632.38	927.47	4.84	5.42	7.07	12.65	2642.62	2210.28	2.62	5.89	2.51	2.34	190.47	134.96
		D_3	1971.80	1544.60	5.11	5.8	13.80	20.27	3442.2	3089.2	5.31	8.05	2.55	2.47	54.93	127.74
		D_4	2106.50	1602.42	5.48	5.77	17.91	20.5	4321.00	3612.43	7.47	8.93	2.04	2.65	79.26	104.42
LSD			373.40	209.50	1.42	1.33	4.15	6.54	1126.00	974.40	1.84	2.03	0.47	0.21	43.51	31.45

D_1 = 134.400 plant/fed D_2 = 33.600 plant/fed D_3 = 14.933 plant/fed D_4 =8.400 plant/fed G_1 = Laboon G_2 = El-Wadi El-Gadid