

## Assessment of Fodder Cowpea (*Vigna unguiculata*, Walp) Genotypes Selected for Forage Yield

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### ABSTRACT

Ten Cowpea (*Vigna unguiculata* L. Walp) genotypes were evaluated for forage yield, forage characters during 2014 and 2015 summer growing seasons at Sakha Agricultural Research Station in Egypt, to evaluate cowpea genotypes selected for high green forage yield and yield components under this study. Experiments were arranged in a randomized completely block design with four replications. Data indicated that highly significant different for genotypes, significantly ( $p < 0.01$ ) affected by year, cutting and genotypes. The highest significant green forage at the first cutting of the first year (31.85 kg/plot). While the least significant green forage yield at the second cutting of the first year. The highest genotypes for green forage yield were 4, 5, 7, 8 and 9 in the first cutting at the first year, while the least genotypes for green forage yield were 1, 7 and 8. Also, most genotypes for green forage yield at the first cutting were significantly higher than the second cutting except for genotypes 2, 3 and 8 at the second year. Also, dry forage yield for all genotypes in the first cutting of the first year (3.622 kg/plot) were significantly higher than values at the second cutting of the first year (2.748 kg/plot). Genotypes 4, 5, 7 and 9 in dry forage yield were superiorities in the two years (3.566 and 3.55), (3.482 and 3.362), (3.45 and 3.362) and (3.47 and 3.35), respectively. In addition, results showed leaves/stem ratio at the first cutting in both seasons were significantly lower than those recorded for second cutting in both seasons (83.4 and 83.5 versus 86.2 and 86.1%). Over cuttings, the highest significant at genotypes 5, 6 and 7 in the first year (90, 87 and 87.5%). While in the second year the highest significant at genotypes 1, 5, 9 and 10 (89.9, 90, 87 and 87.5%). Stem diameter was significantly reduced with progress of growth season from the first to the second cutting (0.749 and 0.620 cm.). Genotype 2 was the least significant (0.657 cm.) over years and cutting. Also, branching/ plant was significantly increased with progress of growth from the first to the second cuttings (4.525 and 4.705). While the obtained values at the first season was significantly lower than those of the second season (4.8 and .75 branch/plant). Over the studied years and cuttings, genotype 4 was the highest ground cover by 5.638 branch/plant<sup>-1</sup>. While less ground cover were genotypes 2 and 10 (4.219 and 4.182 branch/plant<sup>-1</sup>).

**Key words:** fodder cowpea, (*Vigna unguiculata*), green forage yield, dry forage yield, leaves/stem ratio, stem diameter and branches/plant.

### INTRODUCTION

Cowpea (*Vigna unguiculata*, L. Walp) is one of the most important crops native to central Africa. It is an annual legume crop that thrives in warm conditions. In the summer season of Egypt, there is acute shortage of animal feed (Hathout, 1987). Cowpea grain contains 23.4% protein, 1.8% fat and 60.3% carbohydrates and is a rich source of calcium and iron (Gupta, 1998). Because of its high protein (about 25%), vitamins and minerals content, cowpea plays an important role in both human and animal nutrition (Nielsen *et al.*, 1997; Singh *et al.*, 1997, Krasova-Wade *et al.*, 2006 and Nwosu *et al.*, 2013). Cowpea is generally consumed in many forms. The haulms are highly digestible and useful as fodder for livestock (Singh, 2007; Tarawali *et al.* 1997a and Tarawali *et al.* 1997b). So, cowpea forms excellent forage and it gives a heavy vegetative growth and covers the ground, so that, checks soil erosion. It fixes about 70-240 kg. ha<sup>-1</sup> of nitrogen per season through its root nodules and grows well in poor soils (Singh, *et al.* 2003 and Lesly, 2005). Cowpea produced the highest forage yields in sandy loam soils with proper irrigation regime (Ali *et al.* 2004). Also, because of its ability to tolerate drought, cowpea is well adapted to the semi- arid tropics

(Kamara *et al.*, 2010, De Ronde and Spreeth, 2007). It is subsistence crop, often intercropped with sorghum, maize and pearl millet. (FAO, 2004). Resistant to some important diseases and pest has significantly increased the yield and cultivated area of cowpea, (Ehlers and Hall, 1996). So that, growing cowpea became one of the solutions to face the shortage of summer forage (Shereen EL-Nahrawy 2018), also found that genotype (G12) had the highest values for the total fresh yield (25.8 kg/plot) and dry yield (2.639 kg/plot), in addition she revealed that highly significant differences exist among the genotypes for most the studied traits (fresh, dry, stem diameter and No. of branches/plant). Identification of the recommended genotypes and actual breeding requirement of cowpea growers are essential for continuous genetic improvement of genotypes for high yield and tolerance to biotic and abiotic stresses, (Millawithanachchi, *et al.*, 2015). So there is a need for new genotypes to fill forage gap in this period (Ayan *et al.* 2012). Genetic distances were observed between new genotypes and local cultivar which recommended using it in breeding program to develop cowpea productivity, also genotypes G1, G2 and G3 were found suitable for obtained higher fresh and dry fodder yields, the values for fresh and

dry forage yields obtained from G1 which recorded 19.72 and 5.83 t/fad) followed by G2 and G3. (Sultan *et al.* 2016).

The aim of this study was to evaluate cowpea genotypes selected for high green forage yield.

### MATERIALS AND METHODS

The present study was conducted at Sakha Agricultural Research Farms, Field Crops Research Institute (FCRI) Agricultural Research Center (ARC), Egypt, during 2014 and 2015 seasons. Genotypes were selected from the local cultivar *Balady*.

First, selection was based on shape and color of grains namely G1 to G9. After that, they were evaluated on green forage yield resulting on the best nine genotypes. The nine genotypes plus the base *balady* population were included in the experiment. A randomized completely block design (RCBD) with four replicates was used. Plot area was (12.25m<sup>2</sup>). Each plot consisted of five rows 0.7m apart and 3.5m long. Seeds were hand drilled on top rows at the seeding rate 30 kg/fad. 150 kg super phosphate (15.5% P<sub>2</sub>O<sub>5</sub>) was applied before sowing and 20 unit nitrogen fertilizer after every cutting. Other recommended agricultural practices were applied. Two cuts were taken at every season. Sowing dates were 10<sup>th</sup>, May and 6<sup>th</sup> May in 2014 and 2015, respectively. The 1<sup>st</sup> and 2<sup>nd</sup> cuts were taken after 63 and 96 days from sowing at the first season while, 55 and 92 days from the sowing at the 2<sup>nd</sup> Season, respectively. Data were recorded as following traits;

- 1-Green forage yield (kg.plot<sup>-1</sup>).
- 2-Dry forage yields (kg.plot<sup>-1</sup>).
- 3-Stem diameter (cm).
- 4- Number of branches.plants<sup>-1</sup>.
- 5-Leaves/stem ratio (dry base).

#### Statistical analysis

All data were statistically analyzed by the analysis of variance (ANOVA) using MSTAT-C

(1986). Analysis of variance for the data collected in each cutting per year as well as combined analysis over years and cuts was performed as described by Cochran and Cox (1957). Combined analysis over cuts and years was performed, when the assumption of homogeneity of error was not rejected. The split-split design was used for analyzed, while year in the main plot, cutting was in the sub-plot and the genotypes were in the sub- sub plots. Means were separated using Least Significant Difference (LSD) test at 0.05 and 0.01 levels probability.

### RESULTS AND DISCUSSION

Ten genotypes of fodder cowpea were evaluated through two cuttings in each of the two years of this study. Table (1) illustrated the analysis of variance over years and cuttings for green and dry forage yields. Cowpea genotypes maintained constant green and dry forage yields across variable years. Meanwhile, forage yields significantly ( $p \geq 0.01$ ) varied between cuttings. Also, the rank or the magnitude of the obtained green and dry fodder yields significantly ( $p \geq 0.01$ ) varied with variable cuttings in variable years. Genotypes expressed significantly ( $p \geq 0.01$ ) different green and dry forages. While, cutting  $\times$  genotypes interaction, and year  $\times$  cutting  $\times$  genotype interactions were significantly ( $p \geq 0.01$ ) different. This might indicate variable yields at different cutting in different years. This results are in agreement with those revealed by Ayan *et al.* (2012).

Table (2-a) showed means of the interaction among year  $\times$  cutting  $\times$  genotype for green forage yield (kg/plot). The highest significant green forage yield expressed at the first cutting of the first year (31.85 kg/plot). Whereas, the least significant green yield, recorded at that same year of the second cutting (23.99 kg/plot). That might explain the reason for cutting  $\times$  year interaction.

**Table 1: Analysis of variance for green and dry forage yields combined over years and cuttings.**

S.O.V.	d.f.	Green forage yield (kg .plot <sup>-1</sup> )	Dry forage yield (kg .plot <sup>-1</sup> )
Years (Y)	1	15.990 <sup>n.s</sup>	0.006 <sup>n.s</sup>
Rep / years	6	11.579	0.325
Cutting (C)	1	711.577**	10.477**
Y $\times$ C	1	530.639**	5.193**
Error	6	5.201	0.209
Genotypes (G)	9	65.064**	1.045**
Y $\times$ G	9	0.448 <sup>n.s</sup>	0.035 <sup>n.s</sup>
C $\times$ G	9	26..790**	0.958**
Y $\times$ C $\times$ G	9	15.887**	0.955**
Error	108	2.380	0.129

\*\* :Significant at 1% level probability.

n.s: not significant.

**Table 2-a: Means of interaction among year × cutting × genotype for green forage yield (kg/plot).**

Year	Genotype	Cutting		Mean
		1 <sup>st</sup>	2 <sup>nd</sup>	
1	1	31.75	19.75	25.75
	2	30.25	23.00	26.63
	3	29.75	24.75	27.25
	4	33.25	28.13	30.69
	5	32.63	28.25	30.44
	6	30.45	23.00	31.73
	7	35.35	22.63	28.99
	8	32.98	22.63	27.81
	9	34.33	25.50	29.92
	10	27.75	22.25	25.00
Means		31.85	23.99	
2	1	27.63	24.43	26.03
	2	25.88	29.10	27.49
	3	25.75	29.70	27.73
	4	31.88	30.70	31.29
	5	31.88	29.12	30.50
	6	28.88	26.60	27.74
	7	32.75	27.25	30.00
	8	25.88	31.12	28.50
	9	31.75	30.00	30.88
	10	26.13	24.60	25.37
Means		28.84	28.26	
L.S.D. cutting <sub>0.01</sub> ;		1.337		
L.S.D. genotypes <sub>0.01</sub> ;		1.451		
L.S.D. year × cutting <sub>0.01</sub> ;		1.89		
L.S.D. cutting × genotype <sub>0.01</sub> ;		2.052		
L.S.D. year × cutting × genotype <sub>0.01</sub> ;		2.908		

The highest significant green forage yields were expressed by any of genotype 4, 5, 7, 8 and 9 in the first year at the first cutting (33.25, 32.63, 35.35, 32.98 and 34.33 kg/plot for the aforementioned genotypes, respectively). Meanwhile, the least green forage values were expressed by genotypes 1, 7 and 8 in the second year at the second cutting (19.75, 22.63 and 22.63 kg/plot for the three genotypes, respectively). Also, green forage yield expressed by each genotype at the first cutting was significantly higher than the corresponding yield at the second cutting of each study year, except for, genotypes 2, 3 and 8 at the second year (25.88 vs. 29.10; 25.75 vs. 29.70 and 25.88 vs. 31.12 kg/plot for the three genotypes at the first vs. the second cutting of the second year, respectively). The results are in agreement with those indicated by EL-Nahrawy (2018).

Table (2-b) presented dry forage yield of cowpea genotypes as affected by year × cutting × genotype interaction. Figures for dry forage yield for all fodder cowpea genotypes in the first cutting of the first year were significantly higher than the corresponding values at the second cutting. While, *vas vers* were obtained for genotypes 1, 2, 3 and 8 at

the second year. This might contribute to the significant interaction between year × genotype × cutting.

Superiority in dry forage production were expressed by genotypes 4(3.566 and 3.55 kg.plot<sup>-1</sup>), 5(3.482 and 3.362 kg.plot<sup>-1</sup>), 7 (3.454 and 3.362 kg.plot<sup>-1</sup>) and 9 (3.474 and 3.359 kg.plot<sup>-1</sup>) in the two season, respectively. Productivity of these genotypes in term of dry forage in the first cutting of both study years were superior to those scored by the second cutting. The second dry forage.plot<sup>-1</sup> were 3.886 vs. 3.016, 3.725 vs. 3.239, 4.307 vs. 2.600, 3.811 vs. 3.136 for genotypes 4, 5, 7 and 9 at the first cutting versus second cutting of the first year. Also, 4.099 vs. 3.000, 3.924 vs. 2.800, 3.924 vs. 2.800 and 3.618 vs. 3.100 for genotypes 4, 5, 7 and 9 at the first cutting versus second cutting of the second year of the study. The results are in agreement with those indicated by Davis *et al.* (1986).

Mean squares of fodder cowpea genotypes plant characters as affected by year and cutting and their interactions were presented in Table (3). The only plant character that showed variation with years was number of branches.plant<sup>-1</sup>.

**Table 2-b: Means of interaction among year × cutting × genotype for dry forage yield (kg/plot).**

Year	Genotype	Cutting		Mean
		1 <sup>st</sup>	2 <sup>nd</sup>	
1	1	3.470	2.403	2.937
	2	3.488	2.617	3.053
	3	3.366	2.686	3.026
	4	3.886	3.016	3.566
	5	3.725	3.239	3.482
	6	3.442	2.508	2.975
	7	4.307	2.600	3.454
	8	3.743	2.557	3.15
	9	3.811	3.136	3.474
	10	2.985	2.185	2.735
Means		3.622	2.748	
2	1	2.545	3.200	2.873
	2	2.570	3.550	3.06
	3	2.633	3.650	3.142
	4	4.099	3.000	3.55
	5	3.924	2.800	3.362
	6	3.408	2.570	2.989
	7	3.924	2.800	3.362
	8	2.826	3.480	3.153
	9	3.618	3.100	3.359
	10	2.949	2.830	2.89
Means		3.250	3.116	
Mean of cutting		3.436	2.932	
L.S.D cutting <sub>.0.01</sub>		0.268		
L.S.D genotypes <sub>.0.01</sub>		0.338		
L.S.D year × cutting <sub>.0.01</sub>		0.379		
L.S.D cutting×genotypes <sub>.0.01</sub>		0.478		
L.S.D year x cutting×genotypes <sub>.0.01</sub>		0.676		

**Table 3: Analysis of variance for plant characters of fodder Cowpea genotypes as affected by year and cutting.**

S.O.V.	d.f.	Dry leaves/stem ratio	Stem diameter	No. of branches.plant <sup>-1</sup>
Years (Y)	1	0.000 <sup>n.s</sup>	0.110 <sup>n.s</sup>	2.814 <sup>**</sup>
Rep / years	6	4.5	0.02	0.234
Cutting (C)	1	291.600 <sup>*</sup>	0.676 <sup>**</sup>	1.229 <sup>*</sup>
Y × C	1	0.400 <sup>n.s</sup>	0.036 <sup>n.s</sup>	3.487 <sup>**</sup>
Error	6	8.983	0.011	0.144
Genotypes (G)	9	214.997 <sup>**</sup>	0.014 <sup>*</sup>	3.383 <sup>**</sup>
Y × G	9	30.264 <sup>**</sup>	0.005 <sup>n.s</sup>	0.293 <sup>n.s</sup>
C × G	9	51.975 <sup>**</sup>	0.009 <sup>n.s</sup>	1.109 <sup>**</sup>
Y × C × G	9	54.442 <sup>**</sup>	0.008 <sup>n.s</sup>	0.265 <sup>n.s</sup>
Error	108	8.177	0.006	0.234

\* Significant at 5% level probability.

\*\* Significant at 1% level probability.

n.s.: not significantly different.

All three plant characters significantly varied with cutting and genotypes. The interaction between year and cutting showed significant variation only for number of branches.plant<sup>-1</sup>. Genotypes significantly varied in all plant characters.

Genotypes × year interaction was only significant for dry leaves/stem ratio. Meanwhile, cutting × genotypes interaction expressed significant variations in dry leaves/stem ratio and number of branches.plant<sup>-1</sup>. The second order interaction

among year  $\times$  cutting  $\times$  genotype was only significant for dry leaves stem ratio. It was variable to notice that, stem diameter was not affected by any of years or year  $\times$  cutting, year  $\times$  genotype, cutting  $\times$  genotype and year  $\times$  cutting  $\times$  genotype interaction.

Means of leaves/stem ratio (dry base) for fodder cowpea genotypes as affected by year  $\times$  cutting  $\times$  genotype interaction were presented in (Table 4). Overall fodder cowpea genotypes, leaves/stem ratio at the first cutting of the both study seasons were significantly lower than those recorded for second cutting (83.4, 83.5 vs. 86.2, 86.1 percent for first cutting at both seasons *versus* the second cutting at both seasons). Over cuttings, the highest significant leafiness were those presented by genotypes 5, 6 and 7 in the first year (90.0, 87.0 and 87.5 percent for the three genotypes, respectively). Meanwhile, the highest significant leafiness were presented by genotypes 1, 5, 9 and 10 in the second year (89.9, 90.0, 87.0 and 87.5 percent for the previously mentioned genotypes, respectively). Leaves/stem ratio (dry base) of the studied fodder cowpea genotypes presented variable magnitude and/or trend with variable cutting. This might explain the reasons for year  $\times$  cutting  $\times$  genotypes significant

interaction. The results are in agreement with those showed by (Magashi *et al.* 2014) and (Sultan and Salem 2016).

Stem diameter which stand for softness of forage tissue and easiness of chewing and swallow ness for fodder cowpea genotypes as affected by year  $\times$  cutting  $\times$  genotype interaction were presented in (Table 5). Stem diameter was significantly reduced with progress of growth season from the first to the second cutting (0.749 and 0.620 cm for the first and the second cuttings, respectively). Over years and cutting, fodder cowpea genotype number 2, presented the least significant stem diameter (0.657 cm), whereas, the other studied genotypes had significantly higher stem diameter ranged between 0.644 and 0.719 cm. These results are in agreement with those (Sharawy and EL-Fiky, 2003).

Ground indicated by the number of branches of fodder cowpea genotypes as affected by year  $\times$  cutting  $\times$  genotype interaction were shown in (Table 6). Overall years, cuttings and genotypes, branching was significantly increased with progress of growth from first to second cutting (4.525 and 4.705 branch.plant<sup>-1</sup> for the first and the second cuttings, respectively).

**Table 4: Means of the interaction among year  $\times$  cutting  $\times$  genotype for Leaves/stem ratio(dry base) for cowpea.**

Year	Genotype	Cutting		Mean
		1 <sup>st</sup>	2 <sup>nd</sup>	
1	1	85	87	86.0
	2	80	83	81.5
	3	81	84	82.5
	4	79	83	81.0
	5	88	92	90.0
	6	86	88	87.0
	7	87	88	87.5
	8	78	80	79.0
	9	84	87	85.5
	10	86	90	88.0
Means		83.4	86.2	
2	1	86.5	93.3	89.9
	2	77	90	83.5
	3	77.5	93.3	85.4
	4	80	83	81.5
	5	92	88	90.0
	6	85	81	83.0
	7	83	85	84.0
	8	77	75	76.0
	9	87	87	87.0
	10	90	85	87.5
Means		83.5	86.1	
Over all mean		83.45	86.16	
L.S.D. cutting <sub>0.05</sub>		1.16		
L.S.D. genotype <sub>0.01</sub> ;		2.689		
L.S.D. year $\times$ genotype and cutting $\times$ genotype <sub>(0.01)</sub>		3.803		
L.S.D. year $\times$ cutting $\times$ genotype <sub>0.01</sub> ;		5.379		

**Table 5: Means of the interaction among year × cutting × genotype in stem diameter (cm) for fodder cowpea genotypes.**

Year	Genotype	Cutting		Mean
		1 <sup>st</sup>	2 <sup>nd</sup>	
1	1	0.725	0.575	0.650
	2	0.700	0.525	0.613
	3	0.675	0.600	0.638
	4	0.750	0.650	0.700
	5	0.725	0.625	0.675
	6	0.700	0.625	0.663
	7	0.675	0.675	0.675
	8	0.650	0.600	0.625
	9	0.775	0.600	0.688
	10	0.700	0.600	0.650
Means		0.708	0.610	
2	1	0.725	0.650	0.688
	2	0.825	0.575	0.700
	3	0.775	0.675	0.725
	4	0.825	0.625	0.725
	5	0.850	0.675	0.763
	6	0.775	0.600	0.688
	7	0.775	0.700	0.738
	8	0.800	0.550	0.675
	9	0.800	0.725	0.763
	10	0.750	0.525	0.638
Means		0.790	0.630	
Over all mean		0.749	0.620	
L.S.D. cutting <sub>0.01</sub>		0.062		
L.S.D. genotype <sub>0.05</sub>		0.055		

**Table 6: Means of the interaction among year × cutting × genotype in No. of branches/plant for cowpea.**

Year	Genotype	Cutting		Mean
		1 <sup>st</sup>	2 <sup>nd</sup>	
1	1	4.500	5.700	5.100
	2	3.875	4.175	4.025
	3	4.125	4.725	4.425
	4	5.000	6.125	5.563
	5	4.625	4.125	4.375
	6	4.000	3.525	3.763
	7	3.500	5.050	4.275
	8	4.500	4.800	4.650
	9	4.570	4.575	4.573
	10	3.750	4.350	4.050
Means		4.240	4.720	4.48
2	1	5.075	4.500	4.788
	2	4.475	4.350	4.413
	3	4.625	4.825	4.725
	4	5.375	6.050	5.713
	5	5.125	4.650	4.888
	6	4.500	3.925	4.213
	7	4.650	5.225	4.938
	8	5.000	4.525	4.763
	9	4.850	4.550	4.700
	10	4.375	4.250	4.313
Means		4.810	4.690	4.75
Over all mean		4.525	4.705	
L.S.D. years <sub>0.01</sub>		0.284		
L.S.D. cutting <sub>0.05</sub>		0.147		
L.S.D. genotype <sub>0.01</sub>		0.455		
L.S.D. years x cutting x genotype <sub>0.01</sub>		0.643		

Meanwhile, the obtained values at the first season was significantly lower than those of the second season (4.48 and 4.75 branch.plant<sup>-1</sup> for the first and the second season, respectively). Over the studied years and cuttings, genotype 4, enjoyed the highest ground cover expressed by 5.638 branch.plant<sup>-1</sup>. Meanwhile, less ground cover were presented by genotypes 2 and 10 (4.219 and 4.182 branch.plant<sup>-1</sup>, respectively). The results are in agreement with (Gad EL-Hak *et al.* 1988).

### CONCLUSION

Genotypes (4, 5, 7 and 9) were the superiorities in this study, so we can use its in the breeding programme to high forage yield.

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## الملخص العربي

### تقييم التراكيب الوراثية من لوبيا العلف المنتخبة لمحصول العلف

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- تم تقييم ١٠ تراكيب وراثية من لوبيا العلف (٩ تراكيب منتخبة + صنف المقارنه) لمحصول العلف والصفات النباتية اثناء موسمي الدراسه ٢٠١٤، ٢٠١٥ بمزرعة محطة البحوث الزراعيه بسخا، لتقييم تراكيب وراثيه منتخبه للمحصول الاخضر العالى ومكوناته.
- اوضحت البيانات وجود اختلافات عالية المعنويه ناتجه عن تأثير السنوات، الحشات والتراكيب الوراثيه، وكانت عالية المعنويه لمحصول العلف الاخضر فى الحشه الاولى للسنة الاولى (٣١,٨٥ كجم/قطعه) بينما اقل معنويه لمحصول العلف الاخضر فى الحشه الثانية للسنة الاولى.
- كانت التراكيب الوراثيه لمحصول العلف الاخضر ٤، ٥، ٧، ٨، ٩ اعلى فى الحشه الاولى للسنة الاولى (٣٣,٢٥، ٣٢,٦٣، ٣٥,٣٥، ٣٢,٩٨، ٣٤,٣٣ كجم/قطعه) وكانت اقل التراكيب الوراثيه لمحصول العلف الاخضر كانت ١، ٧، ٨ (١٩,٧٥، ٢٢,٦٣، ٢٢,٦٣ كجم/قطعه) فى الحشه الثانية للسنة الاولى. ايضا كانت معظم التراكيب الوراثيه لمحصول العلف الاخضر للحشه الاولى اعلى معنويه عن الحشه الثانية عدا التراكيب الوراثيه ٢، ٣، ٨ فى الموسم الثانى.
- دلت البيانات للتراكيب الوراثيه لمحصول العلف الجاف فى الحشه الاولى للموسم الاول اختلافات عالية المعنويه (٣,٦٢٢ كجم/قطعه) عن قيم الحشه الثانية للموسم الاول (٢,٧٤٨ كجم/قطعه). وبينت التراكيب الوراثيه ٤، ٥، ٧، ٩ تفوقا اعلى فى الموسمين لصفة محصول العلف الجاف (٣,٥٦٦، ٣,٥٥، ٣,٣٦٢، ٣,٤٥٤)، (٣,٣٦٢، ٣,٤٧٤، ٣,٣٥٩ كجم/قطعه) على التوالى.
- اظهرت نتائج نسبة ورق/سوق (على اساس الوزن الجاف) معنويه اقل فى الموسمين للحشه الاولى عن الحشه الثانية للموسمين (٨٣,٤، ٨٣,٥ مقابل ٨٦,٢، ٨٦,١%) وكانت التراكيب الوراثيه ٥، ٦، ٧ اعلى معنويه للحشات فى الموسم الاول (٨٧,٩٠، ٨٧,٥%) وكانت التراكيب الوراثيه ١، ٥، ٩، ١٠ اعلى معنويه (٨٩,٩، ٨٧,٩٠، ٨٧,٥%) فى الموسم الثانى للحشات.
- قلت معنويه سمك الساق بالتقدم فى موسم النمو من الحشه الاولى الى الحشه الثانية (٠,٦٢٠ سم) وكان التركيب الوراثى ٢ هو الاقل معنويه كمتوسط (٠,٦٥٧ سم) للسنوات والحشات.
- زادت معنوية عدد الفروع / نبات مع التقدم فى النمو من الحشه الاولى الى الحشه الثانية (٤,٧٠٥، ٤,٥٢٥) فرع / نبات). بينما كانت القيم المتحصل عليها كمتوسط للموسم الاول اقل معنويه عن الموسم الثانى (٤,٤٨، ٤,٧٥ فرع / نبات). وكان متوسط التركيب الوراثى ٤ للسنوات والحشات هو الاعلى تغطيه لارض (٥,٦٣٨ فرع / نبات). بينما كان متوسط التراكيب الوراثيه ٢، ١٠ (٤,٢١٩، ٤,١٨٢ فرع / نبات).

الخلاصة:-

كانت التراكيب الوراثيه ٤، ٥، ٧، ٩ هى المتفوقه فى هذه الدراسه ويجب استخدامها فى برنامج التربيه لمحصول العلف العالى.