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Evaluation And Stability Estimation For Upland Cotton Varieties

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ABSTRACT

Four Varieties of Upland cotton Coker-310, Lachata, Ashoor and Halab-90 were tested under nitrogen fertilization levels 60,80,100 and 120 kg. N/hectare in a factorial experiment with randomized complete block design during the summer season 2011 in Mosul governorate at Technical Agricultural College to evaluate it performance and estimate their genetic stability by Eberhart & Russell method. The results revealed that Lachata variety recorded significant increase in plant height, number of monopodia branches per plant, number of bolls per plant, boll weight (gm.), seed index (gm.), lint index (gm.) and lint percentage. Fertilization of Lachata variety 100 kg. N/hectare with revealed significant increase in plant height, number of bolls per plant and boll weight (gm.), while the level 60 kg. N/hectare with Lachata variety record significant increase in lint index (gm.) and lint percentage, whereas fertilization with level 100 kg. N/hectare with Halab-90 variety gave the higher seed cotton yield (kg./hectare). Lachata variety revealed genetic stability for plant height, number of monopodia branches per plant, number of sympodia branches per plant, number of bolls per plant, boll weight (gm.), seed index (gm.) and seed cotton yield (kg./hectare). The variety Ashoor ranked the second order in genetic stability for earliness percentage and seed cotton yield (kg./hectare), followed by Koker-310 variety in genetic stability for the number of sympodia branches per plant, seed index (gm.) and lint percentage.

INTRODUCTION

Cotton is one of the important industrial crops since it is called the white gold in many producing countries and it is one of the important fiber crops in addition to oil extraction from the seeds. Though cotton plays an important role in the world economy. The studies of stability in cotton is an important and necessary part of breeding programs for the release of new varieties or a recommendation for use in an adapted variety for a wide range of environments which could be several locations or years or plant densities or planting dates or fertilizing levels. Laghari et al. (2003) stated that the selection of any variety and interpretation of this choice from evaluation trials can become difficult if the genetic-environmental interference is significant, on the other hand the variation in the response of varieties for different environments pushed the plant breeders to estimate the phenotypic stability of the genotypes using statistical methods, including Eberhart and Russell (1966) method, since the linear response of the crop to the favorite environmental conditions gives an alternative evidence which help to explain the genetic-environmental interference. Genetic-environmental interference, acclimatization and stability in cotton were studied by many researchers, since Laghari et al. (2003) referred to

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the low stability of the genotype and the commercial variety as they have shown low yield average compared to the general average, with high values for each of the regression coefficient (bi) and deviation from the regression line (S^2di) and so it has a low average stability and is adapted to a special environmental conditions. Also Unay et al. (2004) revealed that the mean square interaction of genotypes × environment (linear) in the analysis of variance of stability was significant, and they used many stability markers and they achieved similarity of markers in determining one of the most stabile genotypes of drought resistance and adaptation to all environmental conditions. Anandan et al. (2005) recorded that genetic-environmental (linear) interaction and total deviation (Pooled) was significant for seed cotton yield per plant, number of bolls per plant and boll weight, and they pointed out that there were five hybrids were stabile for seed cotton yield and three hybrids stabile for both seed cotton yield and boll weight characters. In a comparison of the correlation coefficients for several ways to estimate yield stability Blanche (2005) has achieved that by using a regression model in Eberhart and Russell (1966) method had a high correlation coefficient which reached 0.91 and was higher than the correlation coefficients of other methods used to estimate the stability of improved varieties of cotton. Genetic stability has been estimated for earliness index of cotton varieties in 12 environments obtained from 3 planting distances and two dates of planting during two years by Shah et al. (2005) and stability markers were calculated following Eberhart and Russell method and recorded the stability of two varieties of cotton that had a regression coefficient close to one, which could mature early under all environmental conditions. They could be advantageous as early maturing parents in the programs of improvement of cotton crop maturation. Ali et al. (2005) also referred to the yield stability of a variety of cotton under saline stress conditions. While Naveed et al. (2006) recorded the Stability of three genotypes of upland cotton in the production rate of seed cotton yield under different environments. Adaptation and stability of cotton varieties were estimated for lint percentage and seed cotton yield by Suinaga et al. (2006) and registered a wide stability and adaptation for four varieties of cotton for seed cotton yield. Naveed et al. (2007) also studied the genetic-environmental interaction effect and pointed referred to it's significant for seed cotton yield, and they were able to conclude a stability and high adaptation for two genotypes. Deshmukh et al. (2008) reached the stability of three hybrids which were found stable across environments in seed cotton yield. Khan et al. (2008) studied the stability and adaptation of 8 strains with two commercial cultivars in 14 environments and reached stability of three varieties which were considered standard varieties in stability, with high adaptation for seed cotton yield and six strains also were considered as medial adaptation. Stability analysis was conducted by Satish et al. (2009) for 70 genotypes at two locations for yield and it's components when they recorded significance variation of genotypes and environments, and the interaction between them for seed cotton yield and yield components, the genetic-environmental (linear) interaction were significant for all traits under investigation except the number of sympodia branches and the number of bolls per plant and seed index. Two genotypes were obtained high average and non significant values of S^2di and significant values for bi for seed cotton yield referring to the acclimatization for the specific environmental conditions. Shinde et al. (2009) studied stability of hybrids and parents at three environments represented by agricultural seasons for seed cotton yield per plant and the number of days for 50% bloom and lint percentage, where they found that the genetic-environmental (linear) interaction was significant with these characters and their linear and non-linear components are of equal importance, and the study of stability parameters suggest that six hybrids were observed stable across environments for seed cotton yield and regression coefficient bi was high and the deviation from regression line S^2di was not significant, while three parents of medium stability for seed cotton yield were found. Maleia et al. (2010) studied the stability of cotton varieties in seven different environments and three varieties were selected which showed a large phenotypic stability of seed cotton yield, and one variety showed special adaptation to low-quality environments, while another variety showed special adaptation to high-quality environments.

The present study aims to evaluate the performance of cotton varieties for growth and yield and yield components and estimation of stability markers by using Eberhart and Russell (1966) method in order to achieve the most adapted variety which have genetic stability for majority number of characters.

MATERIALS AND METHODS

Factorial experiment were carried out with randomized complete block design RCBD and three replicates during the summer season 2011 in the Nineveh province, Technical Agricultural College Mosul, the first factor included four varieties of upland cotton, Coker-310, Lachata, Ashoor and Halab-90, while the second factor has included four levels of nitrogen fertilization 60, 80, 100 and 120 kg. N/ hectare. The date of sowing was on April 25th, and after the completion of germination weeds were manually controlled followed by thinning of cotton plants leaving two plants hole, and after a month of planting nitrogen fertilizer was added twice using urea 47% N as a nitrogen source, the first was after thinning and the second was after a month from the first addition for each level of nitrogen fertilization. Also a super phosphate (45-47% P_2O_5) fertilizer were added at a rate of 50 kg./donam.

The experimental unit included 4 furrows at 75 cm. apart with 5 m. length, regular irrigation were applied and at the end of the season, the first picking was completed on October 15 with a second picking after month from first picking, the following traits were studied, plant height : the average length of the plant at maturity measured in (cm.) from the soil surface to the top of apical meristem, the number of vegetative branches per plant (Monopodia branches) , number of fruiting branches per plant (Sympodia branches), number of bolls per plant : the average number of open bolls per plant for five plants selected randomly, and the average boll weight (gm.) by picking ten bolls randomly from different plants, then the first picking was taken from the central furrows leaving the terminal plants. After samples ginning, seed index were measured, which represents the weight of hundred seeds (gm.) and lint index (gm.), which has been estimated by the following equation: (seed index × lint weight in the sample) / seed weight in the sample, also the lint percentage were estimated following the equation: (lint weight resulting from sample ginning / seed cotton weight sample) × 100, and after a month from the first picking the second picking were taken and the samples was ginned using a cylindrical gin which belonging to the Cotton Research Unit, and then the percentage of earliness were estimated according to the following equation: (seed cotton yield of first picking / seed cotton yield of two picking) × 100 and the calculation of seed cotton yield (gm.) per experimental unit from the summation the two pickings then the yield per unit area were estimated in kg. per hectare (Hamoudi,1988).

Data were statistically analyzed according to the randomized complete block design RCBD Using the SAS program (2004) as mentioned by Al-Rawi and Kalafallah (2000), and in order to determine the direction of the response of cotton varieties to the used environments represented by nitrogen fertilization levels, trend analysis were conducted as mentioned by Dawod, and Abdulyas (1990), in terms of its conditions that it should be applied for quantitative factors which have equal differences between their levels regardless of significance of the F value to determine response direction. Genetic stability of used varieties were estimated using Eberhart and Russell (1966) method which described by Singh and Chaudhary (1977), where three dependable markers are estimated to evaluate the stable variety. The desirable or stable variety is the one who has high average and regression coefficient *bi* close to one, and a low deviation from regression line S^2di (close to zero).

RESULTS AND DISCUSSION

The table (1) refers to analysis of variation of the response of cotton varieties to different environments represented by nitrogen fertilization levels, we noted that varieties showed a significant variation at 0.01 percent level of probability for plant height, boll weight and lint index and at 0.05 percent level for seed index. While used environments variation of stability measurement (nitrogen fertilization levels) showed significant effect at 0.01 percent level for all traits, except the number of sympodia branches/plant and lint percentage. The environments trend analysis indicates that it has a significant effect at 0.05 percent level of first class (Linear) of the lint percentage, and at 0.01 percent level and of second class (Quadratic) for the percentage of earliness and third class (Cubic) for plant height and number of monopodia branches per plant, number of bolls per plant, boll weight, seed index, lint index and seed cotton yield. The interaction between varieties and environments showed significant effect at 0.01 percent level of lint index and lint percentage.

Table (2) refers to the average effect of nitrogen fertilization levels and varieties in cotton characters, it is been noted that fertilization with 100 kg. N/hectare showed a significant increase in plant height (cm.), number of monopodia branches per plant, number of bolls per plant, boll weight (gm.), seed index (gm.), lint index (gm.) and seed cotton yield (kg./hectare), while the 60 kg. N/hectare showed an increase in lint and earliness percentages. While the varieties were varied in growth and yield and it's components traits, were Lachata variety showed significant increase in plant height, number of monopodia branches per plant, number of bolls per plant, boll weight, seed index, lint index and lint percentage, while Ashoor variety recorded highest percentage of earliness with significant different from Lachata variety according to multiple Duncan range test. The effect of interaction between fertilizer levels and varieties, in N level at 100 kg. N/hectare on Lachata variety showed significant increase in plant height, number of bolls per plant and boll weight. While fertilization with 60 kg. N/hectare on Lachata variety showed significant increase in lint index and lint percentage, while fertilization with N at a rate of 100 kg. on Halab-90 variety recorded the highest yield of seed cotton (Table 3).

Table 1: Pooled Analysis of Variance

Source of Variance	Varieties	Environments	*Env. Linear*	*Env. Quadratic*	*Env. Cubic*	Var. X Env.	Error
Degree of Freedom	3	3	1	1	1	9	32
Characters	Means Squares						
plant height (cm.)	1606.61**	10894.17**	20337.53**	4842.09**	7502.90**	248.97	289.55
No. of Monopodia branches/plant	1.65	9.64**	11.09**	13.87**	3.95**	0.19	0.91
No. of Sympodia branches/plant	85.96	204.31	12.06	550.81	50.05	199.55	271.38

No. of bolls/plant	91.09	979.49**	1720.03**	492.16**	726.28**	15.73	45.14
boll weight (g)	1.28**	3.69**	4.76**	3.63**	2.69**	0.10	0.20
seed index (g)	1.67*	21.28**	44.72**	14.0**8	5.05**	0.46	0.49
lint index (g)	5.75**	6.21**	6.78**	4.86**	6.99**	4.51**	1.12
lint percentage	61.56	29.88	65.67*	0.95	23.02	116.06**	21.52
Earliness percentage	35.02	302.59**	618.23**	249.06**	40.49	36.17	19.51
seed cotton yield (kg/hectare)	14724.0	1129695.2**	2158069.5**	1116841.8**	114173.9**	24941.0	42115.1

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

Table 2: Means effect of nitrogen fertilization levels and varieties in cotton characters.

nitrogen fertilization levels (Kg N/ hectare)	plant height (cm.)	No. of Monopodia branches/plant	No. of Sympodia branches/plant	No. of bolls/plant	boll weight (g)
60	71.058 D	5.083 C	11.475	16.308 D	3.450 C
80	87.192 C	6.075 B	20.525	21.108 C	3.858 B
100	139.150 A	7.275 A	18.233	36.900 A	4.775 A
120	115.108 B	6.117 B	13.733	28.892 B	4.083 B
	seed index (g)	lint index (g)	lint percentage	Earliness percentage	seed cotton yield (kg/hectare)
60	4.617 D	3.935 C	43.592 A	74.218 A	972.815 D
80	5.983 C	4.225 BC	41.026 AB	68.095 B	1380.296 C
100	7.717 A	5.585 A	41.837 AB	62.421 C	1700.815 A
120	6.917 B	4.602 B	39.834 B	65.410 BC	1498.148 B
Varieties	plant height (cm.)	No. of Monopodia branches/plant	No. of Sympodia branches/plant	No. of bolls/plant	boll weight (g)
Coker -310	94.167 C	5.992 B	14.425	27.025 AB	4.050 B
Lachata	119.608 A	6.617 A	15.250	28.858 A	4.500 A
Ashoor	96.092 C	5.742 B	14.333	22.483 C	3.800 B
Halab- 90	102.642 B	6.200 AB	19.958	24.842 BC	3.817 B
	seed index (g)	lint index (g)	lint percentage	Earliness percentage	seed cotton yield (kg/hectare)
Coker -310	6.558 A	4.782 B	41.760 AB	66.723 AB	1369.185
Lachata	6.692 A	5.481 A	44.626 A	65.517 B	1439.926
Ashoor	6.050 B	3.976 C	39.327 B	69.002 A	1364.963
Halab- 90	5.933 B	4.109 C	40.576 B	68.902 A	1378.000

Means followed by the same letters no difference between them at 0.05 probability level .

Table 3: Effect means of nitrogen fertilization levels and varieties interaction in cotton characters.

nitrogen fertilization levels (Kg N/ hectare)	Varieties	plant height (cm.)	No. of Monopodia branches/ plant	No. of Sympodia branches/ plant	No. of bolls/plant	boll weight (g)
60	Coker -310	65.267 I	4.867 GH	12.933 B	15.067 G	3.500 EF
	Lachata	85.200 GH	5.767 D-G	13.100 B	17.900 FG	3.700 D-F
	Ashoor	61.700 I	4.467 H	10.200 B	14.667 G	3.267 F
	Halab- 90	72.067 HI	5.233 F-H	9.667 B	17.600 FG	3.333 EF
80	Coker -310	66.400 I	6.167 B-G	14.300 B	23.233 D-F	4.000 C-E
	Lachata	101.867 EF	6.467 A-F	12.833 B	23.733 D-F	4.300 B-D
	Ashoor	83.433 GH	5.367 E-H	12.433 B	16.167 FG	3.767 D-F
	Halab- 90	97.067 FG	6.300 B-F	42.533 A	21.300 E-G	3.367 EF
100	Coker -310	135.100 BC	7.033 A-D	17.467 B	39.333 AB	4.833 AB
	Lachata	152.867 A	7.600 A	21.433 AB	42.833 A	5.367 A
	Ashoor	142.133 AB	7.100 A-C	18.733 AB	33.367 BC	4.333 B-D
	Halab- 90	126.500 CD	7.367 AB	15.300 B	32.067 BC	4.567 BC
120	Coker -310	109.900 EF	5.900 C-G	13.000 B	30.467 CD	3.867 D-F
	Lachata	138.500 BC	6.633 A-E	13.633 B	30.967 CD	4.633 BC
	Ashoor	97.100 FG	6.033 C-G	15.967 B	25.733 C-E	3.833 D-F
	Halab- 90	114.933 DE	5.900 C-G	12.333 B	28.400 C-E	4.000 C-E

Table 3: Continue

nitrogen fertilization levels (Kg N/ hectare)	Varieties	seed index (g)	lint index (g)	lint percentage	Earliness percentage	seed cotton yield (kg/hectare)
60	Coker -310	4.200 H	2.780 FG	39.806 BC	73.621 A-C	1062.2 GH
	Lachata	5.033 FG	7.413 A	59.653 A	70.666 B-D	987.0 H
	Ashoor	4.633 GH	2.822 FG	37.827 C	75.335 AB	952.6 H
	Halab- 90	4.600 GH	2.724 G	37.082 C	77.251 A	889.5 H
80	Coker -310	6.300 C	4.894 CD	43.481 BC	64.086 D-F	1253.0 FG
	Lachata	6.400 C	3.959 D-F	37.835 C	67.609 C-E	1496.9 C-E

	Ashoor	5.733 DE	3.486 E-G	37.655 C	70.452 B-D	1352.6 E-F
	Halab- 90	5.500 EF	4.562 DE	45.131 B	70.234 B-D	1418.7 D-F
100	Coker -310	8.500 A	6.295 B	42.394 BC	65.360 D-F	1626.1 A-D
	Lachata	7.733 B	6.026 BC	43.729 BC	64.372 D-F	1659.9 A-C
	Ashoor	7.200 B	4.951 CD	40.714 BC	61.021 EF	1741.3 AB
	Halab- 90	7.433 B	5.069 CD	40.513 BC	58.930 F	1776.0 A
120	Coker -310	7.233 B	5.159 B-D	41.359 BC	63.826 D-F	1535.4 B-E
	Lachata	7.600 B	4.524 DE	37.285 C	59.419 F	1616.0 A-D
	Ashoor	6.633 C	4.645 DE	41.111 BC	69.200 B-D	1413.3 D-F
	Halab- 90	6.200 CD	4.080 DE	39.580 BC	69.193 B-D	1427.9 D-F

Means followed by the same letters no difference between them at 0.05 probability level .

The analysis of variance and stability using Eberhart and Russell (1966) is illustrated in Table 4 and we noted that varieties showed significant variation at 0.05 level for boll number per plant and boll weight, and the effect of linear interaction between varieties and environments (nitrogen fertilization levels) was significant at 0.05 level for all characters except the number of Sympodia branches per plant, suggesting the existence of genetic differences between varieties in it's regression values across environmental indices, as the fragmentation of corporate deviation (Pooled deviation) to it's components indicates that the Coker-310 variety shows significant variation at the 0.01 level for earliness percentage and at the 0.05 level for plant height, boll weight, lint index and seed cotton yield (kg./hectare), while the Lachata variety showed significant variation at 0.01 level for lint and earliness percentages and at the 0.05 level for seed index and seed cotton yield, Ashoor variety showed significant variation at the 0.01 level for plant height, lint index and earliness percentage, while Halab-90 variety showed significant variation at the 0.01 level for number of sympodia branches per plant, lint and earliness percentages and at the 0.05 level for plant height, boll weight, seed index and lint index. A number of researchers has obtained similar results including Laghari, et al. (2003) and Unay et al. (2004), Shah et al. (2005), Anandan et al. (2005), Deshmukh et al. (2008) and Satish et al. (2009).

In reference to dependable stability markers in the Eberhart & Russell analysis (*average* and regression coefficient *bi* and deviation from the regression line S^2di) indicated in table (5) we noted that the Duncan test for averages indicate that Lachata variety showed significant superiority in all traits except a number of sympodia branches per plant and earliness percentage and also showed a superiority in seed cotton yield but did not reach a significant limit, while the Ashoor variety recorded the highest significant earliness percentage which differed from Lachata variety. The least significant value was recorded for the regression coefficient which was close to one for the Coker-310 variety in the number of monopodia branches per plant and boll weight (gm.), the values of regression coefficient (bi) became close to one significantly for Lachata variety in term of plant height, seed index (gm.) and seed cotton yield (kg./hectare) and was non significant for the number of sympodia branches per plant, while for the Ashoor variety there were significance for bolls number per plant and earliness percentage and non significant for the number of sympodia branches per plant, while for Halab-90 variety it was significant for lint index and lint percentage.

Table 4: analysis of variance by Eberhart and Russell (1966) method.

Characters		plant height (cm.)	No. of Monopodia branches/plant	No. of Sympodia branches/ plant	No. of bolls/plant	boll weight (g)
Source	d.f	M.S.				
Total	15					
Varieties	3	1606.614	1.646	85.956	91.091*	1.277*
Environments + (Varieties × Environments)	12	8730.805	7.645	602.209	770.004	3.003
Environments (Linear)	1	24511.888	21.686	459.689	2203.847	8.309
Variety × Environments (Linear)	3	25156.818**	22.186**	1315.303	2300.825**	8.621**
Pooled deviation	8	598.415	0.438	352.614	16.716	0.233
Coker -310	2	689.429*	0.336	37.711	17.295	0.325*
Lachata	2	276.087	0.057	207.581	15.144	0.061
Ashoor	2	961.439**	0.856	169.042	22.924	0.084
Halab- 90	2	466.706*	0.500	996.120**	11.503	0.464*
Pooled Error	32	96.515	0.302	90.461	15.048	0.066

Table 4: Continue

Characters		seed index (g)	lint index (g)	lint percentage	Earliness percentage	seed cotton yield (kg/hectare)
Source	d.f			M.S.		
Total	15					
Varieties	3	1.667	5.753	61.564	35.015	14724.011

Environments + (Varieties × Environments)	12	16.992	14.797	283.543	308.332	903388.593
Environments (Linear)	1	47.888	13.973	67.230	680.834	2541814.259
Variety × Environments (Linear)	3	50.651**	22.981**	889.701**	752.703**	2603053.435**
Pooled deviation	8	0.508	11.831	83.273	95.130	61211.068
Coker -310	2	0.274	6.623*	23.299	93.137**	84920.486*
Lachata	2	0.884*	32.587	162.466**	136.225**	82929.881*
Ashoor	2	0.037	2.755**	31.510	61.693**	33211.816
Halab- 90	2	0.837*	5.358*	115.817**	89.464**	43782.090
Pooled Error	32	0.162	0.374	7.174	6.502	14038.362

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

Table 5: Genetic stability parameters for cotton cultivars characters.

Characters	plant height (cm.)	No. of Monopodia branches/plant	No. of Sympodia branches/plant	No. of bolls/plant	boll weight (g)
Varieties	*Means*				
Coker -310	94.167 C	5.992 B	14.425	27.025 AB	4.050 B
Lachata	119.608 A	6.617 A	15.25	28.858 A	4.500 A
Ashoor	96.092 C	5.742 B	14.333	22.483 C	3.800 B
Halab- 90	102.642 B	6.200 AB	19.958	24.842 BC	3.817 B
	Regression Coefficient and Standard Error (bi ± S.E.)				
Coker -310	1.113 ± 0.168	0.980 ± 0.124	0.317 ±0.286	1.138 ±0.089	0.976 ±0.198
Lachata	1.032 ± 0.106	0.840 ± 0.051	0.318 ±0.672	1.183 ±0.083	1.247 ±0.086
Ashoor	1.092 ± 0.198	1.206 ± 0.199	0.318 ±0.606	0.958 ±0.102	0.774 ±0.100
Halab- 90	0.762 ± 0.138	0.974 ±0.152	3.046 ±1.472	0.721 ±0.072	1.003 ±0.236
	Deviation from Regression line (S^2di)				
Coker -310	592.914	0.034	-52.749	2.247	0.259
Lachata	179.572	-0.245	117.120	0.096	-0.005
Ashoor	864.924	0.554	78.581	7.876	0.018
Halab- 90	370.191	0.198	905.659	-3.546	0.399

Table 5: Continue

Characters	seed index (g)	lint index (g)	lint percentage	Earliness percentage	seed cotton yield (kg/hectare)
Varieties	*Means*				
Coker -310	6.558 A	4.782 B	41.760 AB	66.723 AB	1369.19
Lachata	6.692 A	5.481 A	44.626 A	65.517 B	1439.93
Ashoor	6.050 B	3.976 C	39.327 B	69.002 A	1364.96
Halab- 90	5.933 B	4.109 C	40.576 B	68.902 A	1378.00
	Regression Coefficient and Standard Error (bi ± S.E.)				
Coker -310	1.357 ±0.076	1.791 ±0.688	-0.539 ± 0.589	0.763 ±0.370	0.804 ± 0.183
Lachata	0.925 ±0.136	-0.116 ±1.527	6.236 ±1.555	0.719 ±0.447	0.977 ± 0.181
Ashoor	0.841 ±0.028	1.232 ±0.444	-0.649 ±0.685	1.104 ±0.301	1.042 ± 0.114
Halab- 90	0.878 ±0.132	1.093 ±0.619	-1.049 ±1.313	1.413 ±0.362	1.177 ± 0.131
	Deviation from Regression line (S^2di)				
Coker -310	0.112	6.249	16.124	86.634	70882.124
Lachata	0.722	32.214	155.292	129.722	68891.519
Ashoor	-0.125	2.381	24.335	55.191	19173.454
Halab- 90	0.674	4.984	108.642	82.961	29743.728

S^2di = Means squares for varieties deviation from linear regression.
bi = regression Coefficient for the variety i

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