ACCLIMATIZING INTRODUCED GENOTYPES OF SOYBEAN AT TWO LOCATION IN IRAQ

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ABSTRACT

Two experiments were carried out at the Abu-Ghraib Research Station (Baghdad governorate) and the Ishaqi station (Salah AL-Din governorate) of the Agricultural Research Office in 2 June 2010, using RCBD with three replicates for five genotypes of soybean introduced from Vietnam. A local variety (Lee-74) was used for comparison. Analysis of variance for genotypes and for each location was performed individually at level 5% (LSD). The results showed significant differences among all genotypes for all the traits excepting the number of seeds per pod.The yield mean of the genotype Sel-9 superior the others genotypes except local verity Lee 74 has no significant between them (649.3, 609.6 g). Genotype Se-220 gave the lowest mean for this trait (275.4 g). The different cultivation locations effect significantly on plant yield. Ishaqi location was significantly superior to Abu-Ghraib which location giving the highest mean for this trait (599 and 397 g) for the two locations respectively. We conclude that 50% of the genotypes introduced, responded to the environment of Iraq by giving high yield above the grand mean, and that most of the genotypes had early harvest compared to the local variety.

Keyword: soybean variety, adaptation, location, combined analysis

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أقلمة تراكيب وراثية من فول الصويا لموقعين في العراق

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الملخص

نفذت تجربتان في محطة ابحاث أبو غريب (محافظة بغداد) ومحطة ابحاث الإسحاقي (محافظة صلاح الدين) التابعتين لدائرة البحوث الزراعية في الثاني من 2 شهر حزيران عام 2010، بتصميم RCBD بثلاثة مكررات لخمسة تراكيب وراثية من فول الصويا مدخلة من فيتنام واستخدم الصنف محلي Lee-74 للمقارنة. تم إجراء تحليل التباين للتراكيب الوراثية بشكل فردي ولكل موقع بشكل مستقل، اجري التحليل التجميعي لبيانات الموقعين على مستوى اقل فرق معنوي عند 5%. لوحظت فروق معنوية بين جميع صفات التراكيب الوراثية باستثناء عدد البذور بالقرنة. تفوق التركيب الوراثي Sel-9 على بقية التراكيب الوراثية واعطى أعلى متوسط غلة البذور للنبات عدا الصنف المحلي Lee74 اذ لم يكن يختلف معنويا عنه (649.3 و609.6 غم) بالتتابع، فيما أعطى التركيب الوراثي Se-220 أقل متوسط لهذه الصفة (275.4 غم). اثرت مواقع الزراعة معنويا على متوسط غلة البذور للنبات، اذ تفوق موقع الإسحاقي على موقع أبو غريب بأعطائه أعلى متوسط لهذه الصفة (599 و 397 غم) للموقعين بالتتابع. من نتائج التجربتين نستنتج أن 50٪ من التراكيب الوراثية المدخلة قد استجابت لظروف البيئة العراقية بإعطائها حاصل حبوب أعلى من المتوسط العام، وأن معظم التراكيب الوراثية قد بكرت في مواعيد الازهار والنضج مقارنة بصنف المقارنة.

كلمات مفتاحية: أصناف فول الصويا، تكيف، مواقع مختلفة، تحليل تجميعي

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INTRODUCTION

Soybean is an oil crop, seeds contain 14-24% oil, and a major source of protein (50%). Environmental conditions effect on growth and productivity traits, quantity and quality. Variation of genetic material (genotype or germplasm) being in two sets of traits are quantitative and qualitative, secondary genes controlled quantitative traits and that is extremely affected by environment (1). Therefore, it's difficult to collect improved quantitative traits in plants, due to environmental genetic interaction (GE) (2, 3, 4), or the presence of silent genes that show their expression in another environment called the gene ecology (5). Studies of the environmental variability of genotypes are complex because they are closely related to the characteristics of two key variants, special and genetic variables and which associated with them (6, 7, 8). Therefore, plant breeders prioritize particular attention to study them, treating their problems through the application of quantitative statistical methods in the analysis of genetic features special distribution and its relationship to environmental factors (6, 7, 8).

In order to reach specific numerical results that summarize many phenotypic and adaptive analysis which help diagnose and interpret these interactions (6, 9, 10, 11), and to know the future projections of their growth indicators. (12) The study of genotypes in different locations is important to determine the most stable traits and affects in yield and can be adopted as selective evidence (13, 12) because of its importance in achieving progress in the selection process (2, 14). The study of the environmental genetic variation impact independently or overlapping for the crop yield or some of the traits of growth is important for this crop as it is very sensitive to changing environmental conditions (15, 10). The adaptation of the genotype to a particular environment there is interrelationship depends on the capacity of the genetic base and its own genetic information that adds genetic diversity to a particular environment (16, 17, 5, 18). It was pointed out that the variation of genotypes cultivated in several environments leads to a difference in the date of flowers, the number of pods, the number and weight of seeds and yield (18, 19, 20, 21, 22).Variation of soybean genotypes was found in plant's height and flowering period due to genetic variation as well as independent environmental impact in its developmental stages (12, 18, 16, 14).The number of branches varies depending on the genotype and the influential environmental factor (23, 2, 5).The variation of the genetic structure of the cultivated genotype is the main reason for the variation of plant height, the number of pods associated with the number of active branches and the number of seeds per pod (23, 24, 3, 14).The researchers (25, 6, 8, 24, 3) indicated that the environment is the most influential factor in the weight and number of seeds per pod and seed yield, they are also linked to the genetic factor and their interaction (25, 23, 18), and seed yield is a quantitative trait that often interacts with the environment, therefore continually used to assess the stability of differentiated varieties of environmental variation (15). Genotypes

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and other quantitative traits are important in determining the viability of a cultivated variety in a particular environment (9). High soybean seed yield has been linked to stability under different environments (26). Because of plant breeders adopt a series of genotypes cross locations in several years before releasing new genotypes to be adopted in agriculture, therefore two different local environment experiments were carried out with the aim of acclimating genotypes introduced for different environments to select the best genotype suitable for each location conditions in Iraq.

Materials and Methods

Field experiments were implemented at two locations, the first at Abu Ghraib Research Station (Baghdad) and the second at the Ishaqi Research Station (Salah al-Din), more than 50 km north of Baghdad belong to Agricultural Research office, Planted on 2 June, 2010, with randomized split-plot design and three replicates for five genotypes were introduced from Vietnam and not classified on the basis of US maturity groups (Fu-15, Sel-9, Fu-13, Se-220, Mx-7) with local variety Lee-74 which is classified to sixth maturity group for comparison. The seeds of the genotypes were planted in rows, the length of the row is 5 m, the distance between the row center and the other was 75 cm after plowing, smoothing, leveling and rowing the land into four plots per experimental unit, and the area of each experimental unit was 15 m^2. Superphosphates fertilizer was added at a rate of 200 kg. h^{-1} when preparing the soil, and urea fertilizer was added at a rate 240 $kg.h^{-1}$ in three equal doses (15 days after field germination, flowers and the beginning of the buds). Data were extracted as an average of five plants planted randomly from the experimental units, then recorded the growth traits includes a number of days from planting till to 50% flowering (day), plant's height (cm), number of $pods.plant^{-1}$, number of $seeds.pod^{-1}$, the weight of 500 seeds (g) and seed yield $(g).plant^{-1}$.The variance analysis to the traits of the genotypes were performed individually, and for each location independently. Then the combined -analysis was performed to the two locations data for all the studied traits at the level of 5% to extract the least significant difference using the statistical program Genstat.

Results and Discussion

Flowering Duration

We could notice from Table 1 that varieties Se-220 and Mx-7 are similar in a number of days and were early significantly flowering compare to other, the local variety (Lee-74), was significantly delayed by giving the highest number of days to reach the stage of flowering (85.33 day), probably reasons of the flowering delay in each of the two locations of cultivation as it took 71.67 and 99.00 days for the locations Ishaqi and Abu Ghraib Sequentially due to the varieties are different in terms of their response nature of to the growth environment and their content of the genetic material generation, responsible for the different response of genotypes

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when planted in different environments, as well as the effect of environmental factors to this trait, and this is confirmed by the means of the two locations Ishaqi and Abu Ghraib (58.94 and 68.50) respectively, which differed significantly from each other and was the location of Ishaqi earlier flowering of the soybean crop. The variation of soybean genotypes in the duration of their flowering is due to their genetic variation as well as the independent environmental impact and interactive in their developmental stages (14, 10).

Height of Plant

The results of Table 2 indicate that the genotype Fu-15 was significantly superior by giving it the highest plant height (101.32 cm) compared to the other cultivars which decreased significantly in the mean of this trait, especially the genotype Fu-13, which reached a height (90.27 cm) lower than other varieties, While the height of the comparison variety Lee 74 (97.07 cm). It is noted that plant height differed in both study locations and Fu-15 genotype remained superior in the Ishaqi location (94.67 cm), whereas Se-220 and Mx-7 outperformed in this a trait's mean (114.27 and 114.30 cm). The average height of the plant was significantly different between the two locations. Abu Ghraib is significantly superior in the mean height of the plant (106.34 cm) compared to the Ishaqi location which recorded the lowest height for this trait (86.56 cm), it may be due to the different genetic structure between genotypes, and other hand to the different environmental conditions between the two sites which affected the behavior of the genotypes in terms of their heights. It was evident in the delay of most genotypes in their flowering for the Abu Ghraib location (Table 2). Genetics is most responsible for the variation of this trait (24, 14).

Branches Number

The results in Table 3 showed that the number of branches of the plant differed significantly between all genotypes and ranged between (1.00-3.97 branches. plant^{-1}) in the study locations. Sel-9 excelled by giving the highest mean of this trait (3.32 branches.plant^{-1}), Mx-7 achieved the lowest mean for this trait (1.75 branches. Plant $^{-1}$), and comparison variety was close to the overall mean of the two study sites (2.75 branches. Plant $^{-1}$). It is noticed that genotypes Sel-9, Fu-13 are similar in a number of branches of the plant and they achieved the highest average (2.67 branches. Plant^{-1}) whereas the genotype Mx-7 recorded the lowest significant value of this trait (1.00 branches. Plant^{-1}) in Ishaqi location, the same behavior of the genotype Sel-9 was higher in a number of branches (3.97 branches. Plant^{-1}). The significant decrease to Mx-7 genotype which achieved the lowest mean for this trait (2.50 branches.plant^{-1}) in Abu Ghraib location. Abu Ghraib (3.28 branches. plant^{-1}) outperformed Ishaqi (1.94 branches. plant^{-1}) in the number of portable branches per plant. The main reason may be since the difference in among genotypes that affected the period of their flowering and height of, and therefore differed in the number of branches formed on the plant.Most of

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the genotypes that had late-flowering were upper height and have more branches due to may have sufficient time and period that have provided growth of new branches,In addition, the variation in the environmental factors has helped to vary in the number of portable branches among genotypes (23, 3 and 14).

Number of Pods per Plant

The results of Table 4 showed that the mean of genotypes varied significantly in the number of plant pods. The highest number of pods was 119.7 pods.plant^{-1}, for sel-9 but the genotype of Se-220 recorded the lowest value for this trait (73.2 pod. plant^{-1}) and was insignificantly. The comparison variety Le74 was relatively close to the overall mean (83.7 pods.plan^{-1}), the behavior of the genotype Sel-9 was identical in terms of significant increase (72.67, 166.7 pods.plant^{-1}). As well as the behavior of the genotype Sel-220 in terms of significant decline (47.00 and 99.4 pods. Plant^{-1}) for the locations Ishaqi and Abu Ghraib sequentially, Perhaps the reason is due to the superiority of the same genotypes in the duration of flowering and the number of pods significantly and the number of branches growing on the plant, which gave them a greater chance to format more pods per plant. The number of pods varied significantly according to the different study locations. Abu Ghraib achieved the highest mean of this trait (114.9 pods.plant^{-1}). compared to the location of Ishaqi, which recorded the lowest mean in number of pods (60.83 pods.plant^{-1}) due to the decrease of all genotypes in the mean of this trait of this site, where the number of pods varies depending on flowering date of genotype and the environmental conditions associated with the formation of pods (21 and 22).

Weight of 100 Seeds

The results of Table 6 indicate that the genotypes differed significantly in the weight of the seeds for the mean of the two locations, The se-220 genotype superior with the highest mean weight of 100 seeds (13.70 g) and did not differ significantly to the genotype Fu-15 in the mean of this trait (13.52 g).The different cultivation locations affected behavior of genotypes, where the tow genotypes Fu-15, and Se-220 superior by giving the highest seed weight (14.23 and 14.0 g). Whereas local cultivar Lee74 and Sel-9 genotypes recorded the lowest mean (12.93, 9.5 g) for the two study locations sequentially. The study locations significantly affected the mean of the genotypes. Ishaqi was superior on Abu Ghraib location in the weight of 100 seeds (13.33 and 12.04 g) respectively. The different genotypes significantly affected by the duration of flowering, the number of growing branches on the plant and the number of pods formed on those branches, Consequently, these influences were reflected in the seeds fullness capacity growing within these pods, due to the varying ability of the genotype to transport the dry matter of photosynthesis to fill its seeds (18).

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Plant Seed Yield (g)

The results of Table 7 indicate that the total mean genotypes of both study locations differed significantly in their yield from seeds. The genotype Sel-9 outperformed all other introduced genotypes, with the exception of the local variety Lee74, which did not significantly different in a mean plant yield (649.3 and 609.6 $g.plant^{-1}$) respectively. While the rest of the genotypes decreased significantly in the mean of this trait, especially the genotype Se-220 which recorded the lowest mean for this trait (275.4 $g.plant^{-1}$). The genotype Sel-9 at Ishaqi location was superior to its highest mean (862 $g.plant^{-1}$), the genotype Mx-7 achieved the highest value of plant yield (498 $g.plant^{-1}$) at Abu Ghraib, whereas Se-220 significantly decreased from other genotypes and recorded (270, 281 $g.plant^{-1}$) in both study locations respectively. Variation in two study locations impacted yield plant seed mean. Ishaqi significantly outperformed to the Abu Ghraib location by giving the highest mean for this trait (599 and 397 $g.plant^{-1}$) for the two study locations respectively, and This indicates that the variation of the genetic factors of the studied genotypes and environmental conditions affected most of their growth traits and seeds yield components, which reflected on seed yields per plant and each location differently, because of seeds yield is one of a quantitative trait that often interacts with the environment it is the most influential factor in the weight and number of seeds per pod and seed yield and also linked with the genetic factors and the interaction between them, it affected plant yield significantly (25, 23, 18).

We conclude that 50% of the introduced genotypes adapted to the conditions of the Iraqi environment, for its responding and giving good growth and a seed yield above the overall mean under local experiment conditions, most genotypes had early maturity compared to the local cultivar but did not superior in seed yields except the genotype Sel-9, which outperformed in most of its growth traits and seed. Therefore, we propose to conduct more studies of yield and quality for environmental locations in which more variant and the impact of new technologies to serve the soil and crop to determine the most appropriate genotype to each location and the best farming techniques to it.

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Table 1. Mean duration of flowering (days) for introduced soybean genotypes in two the Ishaqi and Abu Ghraib sites in 2010.

Genotypes	50% flowering		
	Sites		Genotype mean
	Ishaqi	Abu Ghraib	
Fu-15	57.67	65.00	61.33
Sel-9	71.67	64.67	68.17
Fu-13	50.00	64.33	57.17
Se-220	51.00	59.67	55.17
Mx-7	51.67	58.67	55.17
Lee74	71.67	99.00	85.33
L.S. D 5% for each site	2.317	1.102	L.S.D 5% genotype
Site´s mean	58.94	68.50	1.150
L.S.D 5% for sites	0.664		
L.S.D 5% interaction S x V	1.626		

Table 2. Mean plant height of soybean introduced genotypes at Ishaqi and Abu Ghraib sites

Genotypes	Height of plant		
	Sites		Genotype mean
	Ishaqi	Abu Ghraib	
Fu-15	94.67	107.97	101.32
Sel-9	96.33	96.83	96.58
Fu-13	82.67	97.87	90.27
Se-220	77.67	114.27	95.97
Mx-7	80.67	114.30	97.48
Lee74	87.33	106.80	97.07
L.S. D 5% for each site	7.259	3.624	L.S.D 5% genotype
Site s mean	86.56	106.34	3.617
L.S.D 5% for sites	2.088		
L.S.D 5% interaction S x V	5.115		

Table 3. Mean a number of branches. Plant $^{-1}$ for the introduced soybean genotypes at the Ishaqi and Abu Ghraib sites in 2010**.**

Genotypes	Branches of plant		
	Sites		Genotype mean
	Ishaqi	Abu Ghraib	
Fu-15	1.67	3.03	2.35
Sel-9	2.67	3.97	3.32
Fu-13	2.67	2.72	2.69
Se-220	1.67	3.97	2.82
Mx-7	1.00	2.50	1.75
Lee74	2.00	3.50	2.75
L.S. D 5% for each site	0.86	0.75	L.S.D 5% genotype
Site s mean	1.94	3.28	0.55
L.S.D 5% for sites	0.32		
L.S.D 5% interaction S x V	0.78		

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Table 4. Mean a number of pods.plant^{-1} of soybean introduced genotypes at Ishaqi and Abu Ghraib sites in 2010

Genotypes	Number pods.plant^{-1}		
	Sites		Genotype mean
	Ishaqi	Abu Ghraib	
Fu-15	57.67	115.7	86.7
Sel-9	72.67	166.7	119.7
Fu-13	72.00	105.1	88.6
Se-220	47.00	99.4	73.2
Mx-7	50.33	100.2	75.3
Lee74	65.33	102.2	83.7
L.S. D 5% for each site	5.135	14.35	L.S.D 5% genotype
Site´s mean	60.83	114.4	7.55
L.S.D 5% for sites	4.36		
L.S.D 5% interaction S x V	10.68		

Table 6. Mean weight of seeds 100 for introduced genotypes of soybean at Ishaqi and Abu Ghraib sites in 2010.

Genotypes	Weight of 100 seeds (g)		
	Sites		Genotype mean
	Ishaqi	Abu Ghraib	
Fu-15	14.23	12.2	13.22
Sel-9	13.27	9.5	11.37
Fu-13	13.03	10.7	11.85
Se-220	13.37	14.0	13.70
Mx-7	13.13	13.9	13.52
Lee74	12.93	11.97	12.45
L.S. D 5% for each site	1.20	1.84	L.S.D 5% genotype
Site´s mean	13.33	12.04	1.147
L.S.D 5% for sites	0.662		
L.S.D 5% interaction S x V	1.623		

Table 7. Mean seed yield g. plant $^{-1}$ for the introduced genotype of soybean in the Ishaqi and Abu Ghraib sites in 2010

Genotypes	Seed yield (g)		
	Sites		Genotype mean
	Ishaqi	Abu Ghraib	
Fu-15	578	390	484.4
Sel-9	862	436	649.3
Fu-13	764	338	551.1
Se-220	270	281	275.4
Mx-7	337	498	417.6
Lee74	781	438	609.6
L.S. D 5% for each site	60.2	36.89	L.S.D 5% genotype
Site´s mean	599	397	53.26
L.S.D 5% for sites	30.75		
L.S.D 5% interaction S x V	75.32		

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