Effect of Electric Shock on Morphological Traits, Yield, Yield Components and Protein Content of Three Varieties of Faba Beans *(Vicia faba L.)*

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Abstract

To investigate the effect of electric shock (ES) on morphological variations of faba bean traits, seeds of three varieties of the crop were germinated. When radical was 2-5 mm, seedling were soaked in a 1% NaCl solution for 3h, then transferred to glass container with same solution. Wire with two polar were connected to the container solution and AC current 220 V was switched on for 3,6 and 9 minutes. Seedling then washed and planted at the field in winter 2010-2011,. Factorial Experiment was arranged in randomized Complete Block Design (RCBD) with three replicates were used. Seeds were collected first season of treatments, including the treatment comparison and then planted in the winter season of 2011-2012.The results obtained in the first season causing morphological variations in most of the traits, electric shock for 9 minutes gave less day to flowering was 81.21 days, increase number of pods/plant 23.94 pod , number of seeds / pod 4.23 seed and seeds yield was 3716.42 kg/ha. Shock for 3 minutes early the flowering of plants in the second season was 74.16 days and the number of branches / plant 13.66 Branch ,number of pods / plant 14.5 Pod and gave the highest height of the plant 76.92 and 62.12 cm for both seasons, respectively. While shock for 6 minutes gave the highest seed weight in the second season, which not differ significantly with treatment comparison was also, characterized with superiority in the percentage of protein in the first season (23.1%).The Zaina variety was earlier in flowering (77.91 and 78.87 days) for the first and second seasons respectively, also gave the highest number of pods/ plant 24.91 in the first season, and highest number of seeds/pod 3.98 and 2.83 seed for two seasons and which did not differ significantly from other varieties Aguadulce and Local respectively and exceed seeds yield in the first season was 3433.99 kg / ha. Aguadulce variety was superior in plant height for two seasons77.91 and 62.12 cm, respectively. Local variety , gave highest percentage of protein which did not differ significantly with Aguadulce variety reached to 22.26 and 22.25% respectively, and in the second season showed the highest number of branches / plant 13.5 and number of pods/ plant 14.12 Pod. The interaction between the varieties and shocking treatments were significant, as given in Aguadulce variety for 9 minutes in the first season gave the highest seeds yield was 4261.02 kg / ha, while in the second season Local variety showed the highest seeds yield was 4873 kg/ha in a period of 6 minutes shock also the interaction in the first season with 6-minute period of shock was significant only in the percentage of protein was 23.98 and 23.38% for the varieties Aguadulce and Local respectively, and protein yield of Local variety was 1110.28 kg / ha in the second season. In conclusion different varieties gave different responses to period of ES indicating that one period of ES could not be recommended for all varieties due to differences in response .

Keyword: Electric Shock (ES) Faba bean varieties, Morphological variations Protein, Seed yield

تأثير الصعق الكهربائي في الصفات المورفولوجية والحاصل ومكونات الحاصل ونسبة البروتين لثلاثة أصناف من الباقلاء *(Vicia faba L.)*

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الخلاصة

لمعرفة تأثير الصعق الكهربائي في التغايرات المظهرية لصفات الباقلاء ,استنبتت بذور ثلاثة أصناف من المحصول (Zaina و Aguadulce و Local) عند بلوغ الجذ ير متوسط طول 2-5 ملم نقعت البادرات بمحلول 1% كلوريد الصوديوم لثلاث ساعات ثم نقلت إلى أناء زجاجي يحوي نفس المحلول. أوصل قطبان كهربائيات إلى المحلول وفتح التيار الكهربائي AC 220 فولت لفترات 3 و6 و9 دقائق ، إضافة إلى معاملة المقارنة (بدون صعق كهربائي) غسلت البادرات بالماء الجاري ثم زرعت في الحقل في الموسم الشتوي 2010-2011, استخدمت تجربة عاملية بتصميم القطاعات الكاملة المعشاة (RCBD) بثلاثة مكررات وعند النضج تم جمع بذور المعاملات بضمنها معاملة المقارنة وزرعت في الموسم الشتوي 2011-2012. أوضحت النتائج التي تم الحصول عليها في الموسم الأول إحداث تغايرات مظهرية في معظم الصفات، إذ بكرت النباتات المعاملة بالصعق الكهربائي لمدة 9 دقائق في التزهير الى 81.21 يوم و أعطى أعلى عدد قرنات/نبات 23.94 قرنه وعدد بذور/قرنه 4.33 بذرة وحاصل بذور 3716.42 بلغ كغم /هكتار .أما معاملة الصعق لمدة 3 دقائق فقد بكرت نباتاتها في التزهير في الموسم الثاني بأقل عدد من الأيام بلغ 74.16 يوم و زاد عدد فروع /نبات 13.66فرع وعدد قرنات/نبات 14.5 قرنة في الموسم الثاني، وأعطت هذه المعاملة أعلى ارتفاع للنبات 76.92 و 62.12 سم في كلا الموسمين على التوالي , في حين أعطت معاملة الصعق لمدة 6 دقائق أعلى معدل وزن بذرة في الموسم الثاني ولم تختلف معنويا مع معاملة المقارنة , كما تميزت البذور المعاملة بهذه المدة من الصعق بتفوقها في النسبة المئوية للبروتين في الموسم الأول بلغت 23.1%. أما الأصناف فقد بكر صنف Zaina في التزهير والذي بلغ 77.91 و78.87 يوم للموسمين الأول والثاني على التوالي، كما أعطى أعلى عدد قرنات/نبات 24.91 في الموسم الأول وأعلى عدد بذور/قرنه 3.98 و2.83 بذرة للموسمين والذي لم يختلف معنويا مع الصنف Aguadulce وتفوق بحاصل البذور في الموسم الأول بلغ 3433.99 كغم /هكتار.أما الصنف Aguadulce بلغ أعلى ارتفاع له في الموسمين 77.91 و 62.12 سم على التوالي. بينما الصنف Local فقد اظهر في الموسم الأول أعلى نسبة مئوية للبروتين ولم يختلف معنويا مع صنف Aguadulce بلغ 22.26 و22.25% على التوالي أما في الموسم الثاني اظهر أعلى عدد فروع/نبات13.5 فرع وعدد قرنات/نبات 14.12 قرنة. وجد تداخل معنوي بين الأصناف ومعاملات الصعق إذ أعطى صنف Aguadulce في مدة الصعق 9 دقائق في الموسم الأول أعلى حاصل بذور 4261.02 كغم/هكتار أما في الموسم الثاني فقد اظهر الصنف Local أعلى حاصل بذور 4873 كغم /هكتار في مدة صعق 6 دقائق كما وجد تداخل معنوي في الموسم الأول فقط في فترة صعق 6 دقائق في النسبة المئوية للبروتين بلغ 23.98 و23.38% للصنفLocal و Aguadulce على التوالي وحاصل بروتين للصنف Local بلغ 110.28 كغم/هكتار في الموسم الثاني. يستنتج في هذه الدراسة أن الأصناف سلكت سلوكاً مختلفاً في استجابتها لفترات الصعق الكهربائي من خلال تغاير الصفات موضحة بذلك انه لا يمكن التوصية بفترة صعق واحدة لكافة الأصناف ذلك لاختلافها في الاستجابة .

Introduction

The beans plant is the most important legume crops as it is one of the meat of the poor so as to fit on a high percentage of proteins and amino acids is, also used in animal nutrition as a good source of protein banker, there were some caveats in the use of beans to feed poultry and this is due to the high proportion of Vicine, Convicine resulting to a drop in egg production in laying hens [1].The development of new variations will have an active role in widening the genetic base of the type and increase the

probability of obtaining new varieties distinct qualities ,the cause of the mutation either gene or chromosome [2] or the Somatic [3] .The mutation Spontaneous that occur in nature are different rate depending on the organism and status, gender and environmental factors. The method adopted for the diagnosis of mutation is often based on external appearance of the organism and that means that the alleles may change in the cells of the Organism for some reason and has no clear impact on the character can not be predicted this way, especially in the first generation, either in the second generation appear segregations and the mutations are clear more [3].The first station began programs to improve the characteristics crop plants is a (Svalof) station for plant breeding in Sweden, through the development of mutations and that was before Nelson-Ehle and Gustafsson [2].The adoption of mutations in the breeding programs can be either through the evaluation and propagation mutation and launched a variety, or by use in the cross for the production of hybrids or isolationist generations of new genetic variability invested electric energy to create variations and genetic in the plant to consider that an electric current high experienced by plants, a difference in the installation and my genetic or tissue plant as a result of higher difference between voltage low current experienced by plants in the composition of genetic or tissue plant as a result of higher difference between voltage low in seeds from 6 to 26 mV, some researchers have indicated to the presence of electrical energy is low in seeds and that the limits of 6-26 mv[4] Or seedling high voltage and current used in the process of shock [5]. Several researchers [4,6 ,7,8,9] used this energy to isolate the seeds heterogeneous in vitality. This method has encouraged many researchers to test the effect of the difference in the higher voltage on the seed and in them to cause variations in soybean [10] as well as in wheat and barley[11].Also some researchers used this technique to enter the parts DNA with in protoplast cell [12], as well as to break dormancy in potato tubers [13], isolation of seed organisms for dead [7,9] and to overcome the Incompatibility in some plants[14]. In addition to stimulate the germination of some seeds [15]. Mentioned the Jugenheimer [16] it can cause genetic mutations in plants exposed pollen or seeds or fetuses small to effects of physical or chemical, such as types of radiation, heat, electricity and mustard gas, among others. The results showed significant effect of electric shock on the growth parameters (leaf long and breadth) and nutritive value of the plants by stimulation of plant growth by means of electric shock application[17] . Elsahookie [10] results showed that electric shock(until M5) reduced plant height of the lines S7A and S5B by 61.1and 74.2 cm., respectively. On the contrary, seed yields (ton/ha)for the same soybeans lines were increased by 33.5% and 64% , respectively .A study results showed that electric shock periods used on wheat and barley seed gave significant variation in several traits ,such as plant height , tillers/m2 ,seed weight ,number of seeds/spikes. grain yield and protein percentage[11]. Elsahookie and Elsubahi [18] Found that different genotypes gave different responses to periods of ES, indicating that one period of ES can not be recommended for all genotypes to induce variations through the use of electric shock to open a power supply 220 AC for periods 2, 4 and 6 minutes. A study was conducted in the lath house to investigate the effect of electric field on vegetative , flowering growth characters of Antirrhinum majus , Calendula officicnalis and Mathiola incana three levels of electric current severity AC (6,8,10 Ampere) and three periods of electric shock (2,4,6 minutes) the observations revealed that the effect of electric current improved of most of the vegetative and floral traits [19,20 and 21]. The studies that dealt with electric shock of this crop were not enough. To illustrate how the electric shock can affect on the morphological characteristics, production quantity and quality. Therefore, objective research in the events of genetic variability in crop varieties beans using electric shock current AC 220 volts for periods of 3, 6 and 9 minutes to seeds germinated to determine its effect on the phenotypic characteristics, the yield components, seed yield and protein content. For future use as a method may be useful in plant breeding programs.

Materials and Methods

Seeds of brod beans plant Vicia faba L. varieties used were Zaina (Italian origin),Aguadulce (France origin) and Local (Production of Iraq). 600 seed was calculated from each varieties and germinated inside cheese cloth even phase out the radical length of 2-5 mm. seedling Soaked then in aqueous solution (1% sodium chloride) for three hours [10 ,11 and 18] , so that the salt enters the plant

tissue to facilitate the delivery of electrical current into the cells, then transferred to a glass vessel in which the same solution and connected by two electric poles AC 220 volt power source where it was put inside the seedling aluminum perforated paper with the weight of iron to make them dipped in the solution. Electric current to open the period 3,6 and 9 minutes on the different samples were treated seedlings as compared to the other the same way except electric shock. After completing the process of shock transferred the seedling vessel in running water for three hours to expel the salt does not affect them so that in the percentage of emergence. Seedling then planted in the field during winter 2010-2011, in the Experimental Station of the Biology Department, College of Sciences, University of Baghdad. Factorial Experiment was arranged in randomized Complete Block Design(RCBD)with three replicates, the area of experimental unit was 10 m2 contain five lines , the space between lines were 0.70m and between plants 0.30m. seedling sowing at 24 October. The fertilizes Superphosphate (P2O5 45%) at a rate of 80 kg/ha was added to the soil before seedling sowing [22].Also urea fertilizer N46% at rate of 50 kg/ha, was applied before the first irrigation in a form of urea [23].The other required culture practices for growing faba bean were followed as recommended. After harvesting seeds were collected and planting in the second season 2011-2012 in the same way that has been cultivated in the first season. Morphological characteristics and yield components and protein content of the both sowing seasons were calculated. Five plants were randomly chosen from central line of each experimental unit to estimate days from planting to 50% flowering .Plant height(cm)was measured one week before harvest ,it was measured from the tip to the ground level of the plant [24].Leaf Area Index (L.A.I) was calculated at the beginning of pod filling stage [25], using the disk method as described by [26]. Five plants were randomly chosen in each plot ,and were marked in the field from the start of flowering to harvest time, from three inner rows the following characters were recorded ,number of branches /plant, number of pods/plant, number of seeds/pod, Seed weight rate (g)50 dry seeds were randomly counted and weighted, then the average was taken. Five plants were harvested from each experimental unit and weight of seeds were taken, on the basis of the experimental unit area the seed yield was converted to kg/hectare. Total nitrogen percentage of Vicia faba seeds was determined by Kjeldahl method ,the percentage of protein in the seeds was calculated by multiplying total nitrogen by factor 6.25[27] and Protein yield (kg/ha) was calculated by multiplying the protein percentage by seed yield (kg/ha).The obtained data were analyzed by Analysis of variance for all studied characters, the means were compared by Least Significant Differences (L.S.D.) at level 5%.

Results and Discussion

Represents the rate of trait flowering days from sowing (irrigation first) up to 50% flowering and early maturity in the desirable character in order to avoid entering the stage of deposition of carbohydrates in the seed in the high-temperature.Table 1 indicatesa significant differences for periods of shock and varieties of the two seasons, it was observed that electric shock treatment for 9 minutes was early in the season, the first flowering as it took less number of days and up to 50 days flowering was 81.21 days .While shock for 3 minutes in the second season took less days to 50% flowering was 74.16.day. Zaina variety flowering early than others was 77.91 and 77.87 days for two seasons, respectively. The different varieties, including the impact of treatment with shocks can be explained to a group of genes and action responsible for this trait early in the crop [18].Interaction between varieties and electric shock treatments were also detected variety Zaina when shocked for a period of 9 minutes in the first season was 76.33 day as early, the same variety at the treatment of shock in a period of 3 minutes in the second season was 67 days.

Table 1- Mean number of days from planting to 50% flowering, higher values represent season 2010-2011 and the lower values represent season 2011-2012

Treatment / Varieties	Electric shock for 3 minutes	Electric shock for 6 minutes	Electric shock for 9 minutes	Control	Mean
Zaina	80.33 67	76.66 80	76.33 84	78.33 80.5	77.91 77.87
Aguadulce	80.33 79.5	82.33 82	85.66 85	84 82.5	83.08 82.25
Local	85.66 76	87.33 79	81.66 79	86 87.5	85.16 80.37
Mean	82.1 74.16	82.1 80.33	81.21 82.66	82.77 83.5	
L.S.D0.05	(V)= 1.1 (V)= 1.9	(T)=1.27 (T)= 2.19	(V*T)=2.2 (V*T)=3.8		

Impact electric shock in general (positive or negative) difference in plant height as the status of plant height governed by genes as quantitative genetics has given shock treatment for 3 minutes, the highest height of 76.94 and 66.16 cm for the two seasons respectively., and the Aguadulce variety reached to 77.91 and 62.12 cm for the two seasons respectively, and which not differ significantly from Local variety in the first season. Interaction between varieties and electric shock treatments gave the highest plant height of the variety Local shocked for 3 minutes in the first season was 83 cm, which did not differ significantly from Aguadulce variety, while in the second season Aguadulce variety top height was 74.5 cm This is consistent with Gardner [3]. This character isolated in the second generation were graded and this was observed in the second season reduced height plant Table 2.

Table 2- Mean plant height (cm), higher values represent season 2010-2011 and the lower values represent the season 2011-2012

Treatment / Varieties	Electric shock for 3 minutes	Electric shock for 6 minutes	Electric shock for 9 minutes	Control	Mean
Zaina	66.83 60	67.5 58	59.66 52	68 52	65.49 55.5
Aguadulce	81 74.5	74.83 65.5	77 48.5	78.83 60	77.91 62.12
Local	83 64	72.33 58	82.5 52	73.16 54	77.74 57
Mean	76.94 66.16	71.55 60.5	73.05 50.83	73.33 55.33	
L.S.D0.05	(V)= 2.36 (V)= 2.37	(T)=2.73 (T)= 3.61	(V*T)=4.73 (V*T)=4.74		

Table 3 shows no significant differences in the leaf area index in both seasons, except electric shock in second season, electric shock for 6 and 9 minutes caused significant reduction in LAI in compare with electric shock for 3 minutes, this result agreed with [18].

Table 3- Mean leaf area index (cm2),higher values represent season 2010-2011 and the lower values represent season 2011-2012

Treatment / Varieties	Electric shock for 3 minutes	Electric shock for 6 minutes	Electric shock for 9 minutes	Control	Mean
Zaina	1.43 1.85	1.68 1.9	1.65 1.85	1.6 2.45	1.59 2.01
Aguadulce	1.8 1.1	1.74 2.35	1.81 1.95	1.99 2.55	1.83 1.98
Local	1.85 1.5	1.7 2.2	1.59 2.45	1.44 1..45	1.64 1.9
Mean	1.65 1.54	1.7 2.15	1.68 2.08	1.67 2.15	
L.S.D0.05	(V)= n.s (V)= n.s	(T)=n.s (T)= 0.47	(V*T)=n.s (V*T)=n.s		

Number of branches/plant appeared only significant difference between the electric shock treatments in the first season. The comparison treatment(not shocked) gave the highest number of branches/plant, which did not differ significantly with the treatment of shock 9,6 minutes. For the second season shock for 3 minutes gave the highest number of branches per plant, either the variety of Local gave the highest number of branches Table 4. This agreed with Sahib[28] when cultivate the same varieties used in this study.

Table 4- Mean number of branches/plant , higher values represent season 2010-2011 and the lower values represent season 2011-2012

Treatment / Varieties	Electric shock for 3 minutes	Electric shock for 6 minutes	Electric shock for 9 minutes	Control	Mean
Zaina	6.5 11.5	6.5 13.5	6.33 11.5	7.33 9.5	6.66 11.5
Aguadulce	5.33 15	5.66 11	6.33 11	5.5 8.5	5.7 11.37
Local	5.33 14.5	5.66 13.5	6.33 13	6.66 13	5.99 13.5
Mean	5.72 13.66	5.94 12.66	6.33 11.83	6.49 10..33	
L.S.D0.05	(V)= n.s (V)= 0.64	(T)=0.69 (T)= 0.74	(V*T)=n.s (V*T)=1.28		

Appeared in Table 5 that the shock treatment for a period of 9 minutes in the first season gave the highest number of pods/plant, which did not differ significantly from comparison treatment was 23.94 and 23.66, respectively, and shock treatment for 3 minutes gave the highest number pods/ Plant was 14.5 in second season. Zaina variety gave in the first season, the highest number pods/ plant was 24.91. whereas local variety gave the highest number pods/ plant was 14.12 in the second season. The difference between varieties in their response to shocks,

may be due to their differences in the degree of stability of DNA [18,29] In other words resistance to genetic drift [30] or cells differ in the absorption of saline solution that varies the effect of shock. Significant interaction found in the second season between the Local variety and period of shock 3 minutes was16.5 pods / plant

Table 5- Mean number of pod/plant , higher values represent season 2010-2011 and the lower values represent season 2011-2012

Treatment / Varieties	Electric shock for 3 minutes	Electric shock for 6 minutes	Electric shock for 9 minutes	Control	Mean
Zaina	22	25.66	27.66	24.33	24.91
	14	14	12.5	12.5	13.25
Aguadulce	14.16	16.5	21.83	19.5	17.94
	13	11	13	14.5	12.87
Local	16.16	16	22.33	27.16	20.38
	16.5	15	12.5	12.5	14.12
Mean	17.44	19.38	23.94	23.66	
	14.5	13.33	12.66	13.16	
L.S.D0.05	(V)= 3.19	(T)=3.69	(V*T)=n.s		
	(V)= 0.47	(T)= 0.54	(V*T)=0.94		

The number of seeds per pod is one of the important components of yield, it was found that the highest number of seeds / pod when seeds shocked for a period of 9 minutes was 4.23 seeds, while did not shows significant difference between treatments in the second season. The Zaina and Aguadulce varieties gave the highest number of seeds/ pod were 3.98 and 3.94 respectively in the first season, whereas Zaina and Local in the second season gave the highest number of seeds per pod reached to 2.83 and 2.5 respectively,. this difference in response clearly indicates that varieties are differ in their response to ES periods. As shown Interaction between the Aguadulce variety and a period of 9 minutes shock gave the highest number of seeds per pod in the first season was 4.54, while Zaina variety not shocked gave the highest number of seed / pod in the second season reached to 4.1 seed / pod Table 6.

Table 6- Mean number of seed/pod , higher values represent season 2010-2011 and the lower values represent season 2011-2012

Treatment / Varieties	Electric shock for 3 minutes	Electric shock for 6 minutes	Electric shock for 9 minutes	Control	Mean
Zaina	4.04	3.9	4.04	3.95	3.98
	1.87	2.45	2.93	4.1	2.83
Aguadulce	3.97	4	4.54	3.25	3.94
	2.92	1.7	2.03	2.26	2.22
Local	3.28	3.13	4.13	3.49	3.5
	2.4	2.95	2.2	2.45	2.5
Mean	3.76	3.67	4.23	3.56	
	2.39	2.36	2.38	2.93	
L.S.D0.05	(V)= 0.26	(T)=0.3	(V*T)=0.53		
	(V)= 0.41	(T)= n.s	(V*T)=0.82		

Seed weight did not affected in the first season Table 7. while in the second season, shock for 3 minutes reduced seed weight significantly to 0.94 g compare with the comparison treatment and other shock treatments which did not differ significantly. This result agreed with [11,18] Indicates variables do not appear on the plants for the first generation and is not affected by the weight of the seed for one of the varieties in the second generation. Zaina variety not shocked gave the highest seed weight 1.49 g , while Local variety shocked for 3 minutes gave the lowest seed weight 0.92 g in the second season.

Table 7- Mean seed weight (g), higher values represent season 2010-2011 and the lower values represent season 2011-2012

Treatment / Varieties	Electric shock for 3 minutes	Electric shock for 6 minutes	Electric shock for 9 minutes	Control	Mean
Zaina	1.62 0.93	1.56 1.01	1.42 0.87	1.43 1.49	1.5 1.07
Aguadulce	1.53 0.99	1.02 1.12	1.53 1.14	1.35 1.43	1.35 1.17
Local	1.7 0.92	1.31 1.29	1.34 1.21	1.28 0.87	1.4 1.07
Mean	1.61 0.94	1.29 1.14	1.43 1.07	1.35 1.26	
L.S.D0.05	(V)= n.s (V)= n.s	(T)=n.s (T)=0.19	(V*T)=n.s (V*T)=0.33		

seed yield was basic character sought by plant breeders know their relationship after trait or phenotypic characteristics that different in the sensitivity for the electric shock as well as the varieties in the sensing or stimulation by shock treatments could be due to positive or negative influence on some enzymes which responsible for some of the processes impact of these factors [11] . Shock-treatment for a period of 9 minutes gave highest seed yield was 3761.42 kg / ha in the first season, Table 8, and that it took the shortest period from planting to 50% flowering Table 1 which gave the best period for the prolongation of the period after flowering until harvest would be raised the possibility of more yield plant [18] as well as its superiority in the number of branches ,the number of pods / plant and number of seeds /pod Tables 4,5,6**.**In the second season, comparison plants gave highest seed yield , which did not differ significantly with the shock period of 6 minutes was 3299, 3067.98 kg/ha, respectively, Zaina variety gave the highest seeds yield was 3433.99 kg/ha and that being early of flowering , which gave a better chance after flowering to avoid entering the stage of deposition of seed carbohydrates in the heat, as well as its superiority in the number of branches/plant and yield components such as number of pod/plant and number of seeds/pod. Varieties did not differ significantly in the second season. Result showed significant interaction between the Aguadulce variety and period of shock 9 minutes in the first season was 4261.02 kg/ha, whereas in the second season the Local variety gave highest seeds yield was 4873.23 kg/ha when shocked in the period of 6 minutes

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Table 8- Mean seed yield(kg/ha), higher values represent season 2010-2011 and the lower values represent season 2011-2012

Treatment / Varieties	Electric shock for 3 minutes	Electric shock for 6 minutes	Electric shock for 9 minutes	Control	Mean
Zaina	3417.62 1934.4	3706.21 2935.14	3349.14 2181.74	3263.01 4526.96	3433.99 2894.56
Aguadulce	2650.31 3105.82	2075.2 1395.57	4261.02 2449.04	2637.31 3848.37	2905.96 2699.7
Local	2858 3384.51	2080.2 4873.23	3539.1 2116.37	3547.94 1521.69	3006.31 2973.95
Mean	2975.31 2808.24	2620.53 3067.98	3716.42 2249.05	3149.42 3299	
L.S.D0.05	(V)= 440.4 (V)= n.s	(T)=508.53 (T)= 626.71	(V*T)=880.8 (V*T)=346.6		

Table 9 shows significant differences in protein percentage between the varieties, electric shock treatment and interaction with each other in the first season. Shock treatment in a period of 6 minutes gave the highest rate was 23.1%. While in the second season, electric shock treatment for 3,6 and 9 minutes, gave the highest percentage of protein in comparison with control. The three periods of electric shock was given variation in the proportion of protein, which is of great value to plant breeders .The Aguadulce and Local varieties gave the highest percentage of protein than Zaina variety reached to 22.26 and 22.25% in the first season, while varieties did not differ significantly in the second season. Significant interaction was found only in the first season of the Local and Aguadulce varieties in a period of 6 minutes shock were 23.98 and 23.38%, respectively.

Table 9- Mean protein percentage, higher values represent season 2010-2011 and the lower values represent season 2011-2012

Treatment / Varieties	Electric shock for 3 minutes	Electric shock for 6 minutes	Electric shock for 9 minutes	Control	Mean
Zaina	22.88 22.36	21.94 22.91	20.73 20.77	19.48 19.02	21.25 21.51
Aguadulce	22.54 23.02	23.38 22.57	20.7 21.71	22.41 21.1	22.25 22.1
Local	22.44 23.55	23.98 22.92	21.73 22.42	20.92 19..12	22.26 22
Mean	22.62 22.97	23.1 22.8	21.05 21.96	20.93 19.74	
L.S.D0.05	(V)= 0.52 (V)= n.s	(T)=0.6 (T)= 1.84	(V*T)=1.04 (V*T)=n.s		

Protein yield (kg/ha) was calculated by multiplying the protein percentage by seed yield (kg/ha). Protein yield did not differ significantly in both seasons ,may be due to the differences in protein percentage and seed yield which increase and decrease due to shock periods and varieties. While found significant interaction between varieties and treatments in the second season only. Local variety in a period of shock 6 minutes gave the highest protein yield was 1110.28 kg/ha which that superiority in the seed yield Table 8. Can be said that an electric current directed to the cells of germinated seeds may impact the size of the already existing current in each living cell, and this increased the capacity which was reflected in the act of some enzymes associated with genes already inside the nucleus or on other bodies in protoplast cell may be inherited as a stable change or not, as the change was unstable as a result of any temporary functional impact. The response of some varieties to electric shocks positively or negatively, in this study does not necessarily mean that these varieties do not respond completely to electric shocks, but can be larger if the response to increase the shock to several minutes or double the voltage after the passage through special adapters.

Table 10- Mean protein yield(kg/ha), higher values represent season 2010-2011 and the lower values represent season 2011-2012

Treatment / Varieties	Electric shock for 3 minutes	Electric shock for 6 minutes	Electric shock for 9 minutes	Control	Mean
Zaina	780.78 433.52	848.62 709.46	694.59 476.78	637.02 863.42	740.25 620.79
Aguadulce	598.15 713.97	485.1 315.61	877.72 535.51	590.8 819.1	637.94 596.04
Local	647.74 796.43	498.98 1110.28	768.65 468	741.87 291.43	664.31 666.53
Mean	675.55 647.97	610.9 711.78	780.32 493.43	656.56 657.98	
L.S.D0.05	(V)= n.s (V)= n.s	(T)=n.s (T)= n.s	(V*T)=n.s (V*T)=315.65		

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