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Study of Faba bean stimulation by spraying different concentrations of Ethel Methane Sulphate on shoot apexes

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ABSTRACT

The experiment was conducted during winter season 2019-2020 in the fields of agriculture college – Wasit university. The experiment was carried out as a split-plot design based on Randomized Complete Block Design with three replications, the main plots were included the genotypes G1 : Luz de Otono, G2 : Mulish and G3 : Lot nr 5771 (the genotypes were characterized in Table 1), sub plots were included four concentrations of mutagenesis Ethyl methane sulphonate (E0 : control, E1 : 1 ppm, E2 : 5 ppm and E3 : 10 ppm) were sprayed on shoot apexes after emergence, the results appeared as : The genotype (G2) recorded the highest average leaf area in a plant and plant seed yield while the genotype (G3) was superior in number pods per plant, number of days until 50% flowering and plant seed yield, the concentration (E3) was given the highest average for the leaf area, number of pods per plant, number of days until 50% flowering and plant seed yield, the interaction (G3*E3) gave the highest average for the leaf area, number pods per plant, number days until 50% flowering and plant seed yield.

Key words : *Ethyle methane sulphonate, Faba bean, Shoot apexes*

Introduction

Faba bean is one of the most important leguminous crops and the most widespread in the world due to its high nutritional importance. The most important sources of plant protein, as it contains approximately (25-30%) of protein rich in multiple amino acids, which replaces animal protein, therefore; plant breeders interest in obtaining genetic varieties with new genetic features, characterized by high yield and good quality in several ways which include the induction of genetic mutation, selection and hybridization, tissue culture technology, gene cloning technology, sexual hybridization technology and other breeding programs.

The development of the mutation is one of the necessary requirements that plant breeders seek to obtain for the purpose of producing varieties with desirable characteristics with high yield, good quality and resistance to various agricultural pests and harsh environmental conditions. Therefore, the mutation is defined as a change in the sequence or number of nitrogenous bases in the DNA that leads to the formation of new sequences of nucleotides that transmit traces of certain traits to offspring (Jabbar and Kadhim, 2019; Jabbar and AL-Fatlawi, 2019). The seed yield is the final outcome of all the metabolic processes of the plant that end with the production of a seed carried by the plant, from which the second generation plants later start, the

increasing of seed yield is the most important characteristic that plant breeders look for it. Rana and Solanki (2015) found that the yield of one plant increase when the concentration increased to 0.2% EMS, as this treatment gave a yield of 4.1 g compared to the control treatment of 3.4 g, while the yield decreased to 3.0 g when exposed to a concentration of 0.4% EMS, and another study showed that the remainder were exposed to mutagenicity with three levels 0.01, 0.02, 0.05% for DES and two types. The Hassawi 2 and ILB4347 cultivars economic yield increase with the increase in concentrations, as the treatment gave 0.05% a seed yield 4.102, 4.070 tons h^{-1} compared to the control treatment, which gave a seed yield of 3.750 and 3.610 tons h^{-1} for both varieties respectively (Nurmansyah *et al*., 2020).

The genotypes differ in growth and yield, The yield is greatly affected by the cultivated variety according to its genetic nature and to a lesser extent the surrounding environment. Usually the yield components are what determine the yield and plant density, and the nature of the variety is what determines the total yield of the plant. Ibrahim (2016) found that the varieties of bacilli varied with each other by the outcome. Of which a yield higher than 4 tons H-1 and one of the items reached 4,893 tons h^{-1}, while other varieties gave a yield between 3-4 tons h^{-1}, and the study showed that the reason for the variation in the yield is due to differences in the yield components. The results of Kandil (2011) showed the variation of the varieties in the total yield in both seasons, as the variety Giza 716 outperformed in giving the highest yield of (4.044, 3.925) tons h^{-1} while the other two varieties gave a yield of less than 3.7 tons h^{-1} for both seasons. Mitiku and Wolde (2015) find that five cultivars gave a yield above 4000 kg h^{-1} and that three varieties gave a yield below 4000 kg h^{-1} . The study explain that the most affected trait on the yield is the weight of 100 seeds.

So this study was conducted to study of seed yield increase stimulation by spraying different concentrations of ethyl methane sulphate on apex shoots after emergence.

Materials and Methods

The experiment was conducted during winter season 2019-2020 in the fields of agriculture college – Was it university. The experiment was carried out as a split-plot design based on Randomized Complete Block Design with three replications, the main plots were included the genotypes G1 : Luz de Otono, G2 : Mulish and G3 : Lot nr 5771 (the genotypes were characterized in Table 1), sub plots were included four concentrations of mutagenesis Ethyl methane sulphonate (E0 : control, E1 : 1 ppm, E2 : 5 ppm and E3 : 10 ppm) were sprayed on shoot apexes after emergence, analysis of variance (ANOVA) and means comparison was carried out by L.S.D. test underincorporeity level 5% (13) with genest at programs.

Treatments was randomized distributed in (3×3.5) m^2 plot, distance among sub-plots 0.5 m and lines 50 cm, the date of planting was 19/11/2019. N fertilizer added as Urea (46%) in rate (10 kg N/ h)on two defrayments : the first was after week from planting and the second was after 20 days from a first, Studies traits was :

Leaf area, Number pods per plant , Number days until 50% flowering and Plant seed yield.

Soil of the field was checking to know (physical and chemical traits) in Soil department laboratories /collage of agriculture, The result was in Table 2.

Table 1. Specifications of the genotypes in this study

Genotypes	Breeding methods	Origin
Luz de Otono	Admission	Spanish
Mulish	Admission	Holland
Lot nr 5771	Admission	New zeland

Table 2. Some physical traits of field soil

Studies traits Rate	Values
pH	6.76
Ec	2.91
Sand	577 g. kg^{-1}
Silt	360 g. kg^{-1}
Clay	63 g. kg^{-1}
Contexture	Sand admixture

Results and Discussion

The results of Table 3 showed that the genotypes were significantly affected by the leaf area, the genotype (G2) recorded the highest average leaf area in a plant, which was 2755 cm^2 $plant^{-1}$, this result agree with (Ibrahim, 2016), the varieties of faba bean differ in the leaf area of the plant, it due to the difference in genotypes in their ability to grow and divide cells related to the genetic nature that di-

rectly affects in vegetative growth (Awaad, 2002). The concentrations of EMS had a significant effect on this trait, the concentration (E3) gave the highest average for the leaf area in the plant 2953 cm^2 $plants^{-1}$, This may be attributed to the high concentration of EMS that stimulates the activity of enzymes , cellular indicators in the leaves, activating the genes responsible for cell division, increasing the vegetative growth and increasing the size of the leaves in the plant (Bhat *et al.*, 2006a). The overlap had a significant effect for the interaction between the genotypes and the levels of EMS, the interaction treatment (G2*E3) gave the highest average paper area of 3045 cm^2 $plant^{-1}$.

The results of Table 3 showed that there was a significant effect between the different genotypes, the genotype (G3) gave the highest average number of pods per plant, which reached 20.83 pods per plant. The reason for the superiority of the G3 genotype may be attributed to the superiority in the number of branches in the plant which affected the increase in the number of pods in the plant by increasing the number of branches in addition to the increase in the number of leaves in the plant, which affected the growth of the plant and the increase of the number of flowering branches (Khattab *et al*., 2016). The results also showed that the levels of concentrations were significant, the concentration (E3) exceeded by giving the highest average number of pods per plant 21.78 pods. The increase in number of pods resulted of the increase in the concentrations used for the mutagen due to the increase in the leaf area (Table 3) which affects the number of pods in each branch, in addition to the increase in other vegetative characteristics which reflected positively on the number of pods in the plant. The interactions had a significant effect on the characteristic of the number of pods in the plant (Bhat *et al*., 2005). The interaction (G3* E3) gave the highest average number of pods per plant with 27 pods.

The results of Table 3 appeared that the genotype (G3) was significantly superior to the rest of the genotypes in the number of days until 50% flowering which gave a value 58.58 days compared to the genotype (G2) which took a longer period to flower was duration 69.50 days, the reason for the discrepancy in the number of days to reach flowering due to the difference in the speed of growth, which depends on the rate of metabolism of nutrients and the rate of photosynthesis. The levels of mutagen also had a significant effect on the number of days until 50% flowering, the concentration (E3) exceeded by fewer days to flower 54.22 days, It may be attributed to the effect of the crop with high concentrations of mutagenic substance to its effect on the formation of early flower buds, the fewer days to the flowering, and this is consistent with (Suthakar *et al.*, 2014), in addition to the role of the mutagen with high concentrations in stimulating rapid vegetative growth and increasing plant height and leaf area. The interactions had a significant effect on the characteristic of the number of days until 50% flowering,

Table 3. Effect EMS concentrations and genotypes in some faba bean traits

Treatments	Leaf area (cm^2)	Number pods per plant	Number days until 50% flowering	Plant seed yield (g $plant^{-1}$)	Treatments		Leaf area (cm^2)	Number pods per plant flowering	Number days until 50% (g $plant^{-1}$)	Plant seed yield
Genotypes	G×E									
G1	2592	14.75	58.92	70.83	E0	G1	2269	13	62.33	53.20
G2	2755	18.08	69.50	117.86		G2	2489	16.33	74	94.40
G3	2726	20.83	58.58	118.86		G3	2447	17.33	63.33	93.82
$L.S.D_{.05}$	28.9	1.126	2.24	5.37	E1	G1	2380	14.67	61.33	67.81
EMS						G2	2659	16.67	70	106.05
E0	2402	15.56	66.56	80.47		G3	2679	18.33	61	105.51
E1	2573	16.56	64.11	93.12	E2	G1	2857	15	61.33	72.84
E2	2836	17.67	64.44	104.36		G2	2829	17.33	72	117.85
E3	2953	21.78	54.22	132.11		G3	2821	20.67	60	122.38
$L.S.D_{.05}$	74.9	0.904	2.46	4.23	E3	G1	2860	16.33	50.67	89.45
						G2	3045	22	62	153.14
						G3	2956	27	50	153.73
					$L.S.D_{.05}$	114	1.59	4	7.48	

the interaction (G3*E3) gave the highest average number of days until 50% flowering 50 days.

The results of Table 3 indicated that there were significant differences between the genotypes in plant seed yield, the genotypes (G3 and G2) gave the highest average plant seed yield 118.68 and 117.86 g plant^{-1} respectively. The superiority of the G3 genotype in the plant seed yield due to the superior genotype in the number of pods per plant (Table 3) and the superiority of the G2 genotype to its superiority in the leaf area (Table 3). The levels of mutagenic concentrations also had a significant effect, the concentration (E3) gave the highest average plant seed yield 132.11 g plant^{-1}. The increase in the yield due to the other components of the yield as the high concentrations of the mutagen led to an increase in the number of pods in the plant (Table 3) . The interactions also had a significant effect in pant seed yield, the interaction (G3*E3) gave the highest average for the trait, which amounted to 153.73 g.

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