Effect of concentration and p]spraying date of thiamine on growth and yield of two cultivars of Mung bean

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Abstract

A field experiment was conducted during the spring and autumn season for 2019. In a private farm in Al-Mussaib project area, north of Babylon province, with the aim of studying the effect of thiamine concentrations and dates on the growth and yield of two cultivars of Mung bean. The experiment was conducted according to the arrangement of split split plots and distributed the treatments using the Randomized complete block design(R.C.B.D) with three replicates, The cultivars(local and Uzbekistan) obtained from local markets represented the main plots. As for the secondary plates, the three spraying stages (a stage after 30 days of emergence, a stage after 45 days of emergence and a stage after 60 days of emergence) and the sub-plots included thiamine concentrations and were as follows (spraying with distilled water only ,100 $mg.L^{-1}$, 200 $mg.L^{-1}$ and 300 $mg.L^{-1}$).The results of the statistical analysis of the data were as follows:

The local cultivar excelled the Uzbekistan cultivar in the number of pods, the pod length for the autumn season, the seed yield, the protein percentage, the Uzbekistan cultivar excelled in the weight of 1,000 seeds. The second date excelled the number of pods, the number of seeds, the weight of 1000 seeds, the seeds yield, the third date excelled in the protein percentage. The fourth concentration 300 ppm excelled in pod length, the number of seeds, protein ratio, second concentration exceeded in a number of pods, the weight of 1000 seeds, seed yield. The interaction between the cultivars and the dates led to a significant effect on the studied traits. The combination the local cultivars with the second date excelled in the number of pods, the number of seeds, while the combination between the local cultivar with the third date excelled in the protein percentage of the autumn season, the combination the Uzbekistan cultivar with the second date excelled in Number of seeds, weight 1000 seeds. Significant interaction appeared between the cultivars and concentrations in the studied traits, where the combination the local cultivar with the fourth concentration 300 $mg.L^{-1}$ excelled in the pod length, number of seeds, and the protein percentage of the spring season, The interaction between the local cultivars with the second concentration 100 ppm excelled in the number of pods, seed yield, for the autumn season, The interaction between the Uzbekistan cultivar with the fourth concentration 300 ppm excelled in the pod length , the combination the Uzbekistan cultivar with the first concentration 100 ppm excelled in the weight of 1000 seeds. The bi-interaction between the dates and the concentrations significantly in the studied traits resulted in the combination the second date with the fourth concentration of 300 ppm excelled in the number of seeds. Pod, The combination between the second date with the first concentration 100 ppm excelled in the number of pods, the weight of 1000 seeds, seed yield, for the spring season, the combination the third date with the fourth concentration of 300 ppm excelled in the protein percentage for the spring season. The triple interaction between the cultivars, dates and concentrations was significant. The triple treatment between the local cultivar with the second date and the second concentration100 ppm excelled in the number of pods. plant for the autumn season, the triple treatment between the local cultivar , the second date with a fourth concentration of 300 ppm excelled in the number of seeds. Pod, The triple interaction between the local

cultivar with the third date with the fourth concentration of 300 ppm excelled in the protein percentage for the spring season, the combination the Uzbekistan cultivar with the second date with the fourth concentration 100 ppm excelled in the weight of 1000 seeds for the autumn season, the combination the Uzbekistan cultivar with the second date with the fourth concentration 300 ppm excelled in the number of seeds. Pod.

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*Research paper from Ph.D. thesis for the first author

تــأثير تركيز وموعد رش الثيامين في نمو وحاصل صنفين من الماش

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الكلية التقنية المسيب

جامعة الفرات الاوسط التقنية

الخلاصة :ـ

نفذت تجربة حقلية خلال العروتين الربيعيه والخريفيه لعام 2019 . في احد المزارع الاهلية في منطقة مشروع المسيب ، شمال محافظة بابل ، بهدف دراسة تاثير تراكيز ومواعيد رش الثيامين في نمو وحاصل صنفين من الماش . نفذت التجربة وفق ترتيب الالواح المنشقة (split split plots) ووزعت المعاملات باستعمال تصميم القطاعات الكاملة المعشاة R.C.B.D وبثلاث قطاعات مثلت الاصناف (المحلي و الاوزبكستان) التي تم الحصول عليها من الاسواق المحلية الالواح الرئيسية (main plots) . اما الالواح الثانوية تضمنت مراحل الرش الثلاث (مرحلة بعد 30 يوم من البزوغ ، مرحلة بعد 45 يوم من البزوغ و مرحلة بعد 60 يوم من البزوغ) والالواح التحت الثانوية تراكيز الثيامين وكانت كالاتي (الرش بالماء المقطر فقط و 100 ملغم / لتر $^{-1}$ و 200 ملغم / لتر $^{-1}$ و 300 ملغم / لتر $^{-1}$) .

وقد اظهرت نتائج التحليل الاحصائي للبيانات كما يأتي :ـ

تفوق الصنف المحلي على الصنف الاوزبكستان في عدد القرنات ، طول القرنة للعروة الخريفية ، حاصل البذور ، نسبة البروتين ، تفوق الصنف الاوزبكستان في وزن 1000 بذرة . ادى موعد الرش الى تفوق الموعد الثاني في عدد القرنات ، عدد البذور ، وزن 1000 بذرة ، حاصل البذور ، تفوق الموعد الثالث في نسبة البروتين . تفوق التركيز الرابع 300 ppm في طول القرنة ، عدد البذور ، نسبة البروتين ، تفوق التركيز الثاني في عدد القرنات ، وزن 1000 بذرة ، حاصل البذور . ادى التداخل بين الاصناف و المواعيد الى تأثير معنوي في الصفات المدروسة وقد تفوقت التوليفة تفوقت التوليفة الصنف المحلي مع الموعد الثاني في عدد القرنات ، عدد البذور ، تفوقت التوليفة الصنف المحلي مع الموعد الثالث في نسبة البروتين للعروة الخريفية ، تفوقت التوليفة الصنف الاوزباكستاني مع الموعد الثاني في عدد البذور ، وزن 1000 بذرة . ظهر تداخل معنوي بين الاصناف و التراكيز في الصفات المدروسة حيث تفوقت التوليفة الصنف المحلي مع التركيز الرابع 300 ppm طول القرنة ، عدد البذور ، نسبة البروتين العروة الربيعية ، تفوقت التوليفة الصنف المحلي مع التركيز الثاني 100 ppm في عدد القرنات ، حاصل البذور ، للعروة الخريفية ، تفوقت التوليفة الصنف الاوزبكستاني مع التركيز الرابع 300 ppm طول القرنة ، تفوقت التوليفة الصنف الاوزبكستاني مع التركيز الاول 100 ppm في وزن 1000 بذرة . ادى تداخل الثنائي بين المواعيد والتراكيز معنويا في الصفات المدروسة قد تفوقت التوليفة الموعد الثاني مع التركيز الرابع 300 ppm في عدد البذور . قرنة ، تفوقت التوليفة الموعد الثاني مع التركيز الاول 100 ppm في عدد القرنات ، وزن 1000 بذرة ، حاصل البذور ، للعروة الربيعية ، تفوقت التوليفة الموعد الثالث مع التركيز الرابع 300 ppm في نسبة البروتين للعروة الربيعية . كان التداخل الثلاثي بين الاصناف والمواعيد والتراكيز معنويا قد تفوقت التوليفة الثلاثية الصنف المحلي مع الموعد الثاني و التركيز الثاني 100 ppm في عدد القرنات . نبات للعروة الخريفية ، تفوقت التوليفة الثلاثية الصنف المحلي مع الموعد الثاني مع التركيز الرابع 300 ppm في عدد البذور . قرنة ، تفوقت التوليفة الثلاثية الصنف المحلي مع الموعد الثالث مع التركيز الرابع 300 ppm في نسبة البروتين للعروة الربيعية ، تفوقت التوليفة الصنف الأوزباكستاني مع الموعد الثاني مع التركيز الرابع 100 ppm في وزن 1000 بذرة للعروة الخريفية ، تفوقت التوليفة الصنف الأوزباكستاني مع الموعد الثاني مع التركيز الرابع 300 ppm في عدد البذور . قرنة .

***جزء من اطروحة دكتوراه للباحث الاول**

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Introduction:

Mung bean(*Vigna radiata* L.) is an important legume crops for food and feed and is a crop with a wide environmental range and is cultivated in South and East Asia , the tropics and subtropics in Africa and western India ,North America and Australia (Al-Younes and Al-Shamaa, 1981). Moreover, it is characterized by its short growth period and can be cultivated after the harvest of wheat and barley (Aldabbagh and Al-Dulaimi, 2017). Mung bean is used for green feed and straw, and to improve soil properties, especially on reclaimed land. While it provided synthesis, it can be used as a cover crop to conserve soil due to its rapid growth (Savage, 1990). The advantages of protein are that it is rich in the amino acid lysine, which many grain lack, and the way to eat different Mung bean seeds (Al-Fartousi, 2005). It is necessary to think about solving the problem of plant nutrition and that relying on chemical fertilizers alone has negative effects on the environment and animal health in addition to the indirect effects on human health and on long prices and the difficulty of obtaining them. From this standpoint, thinking about new ways to increase yields per unit area has become a matter Important One of these methods is the use of thiamine (1Vit.B) is important in metabolic processes and is considered an important co-factor in the Krebs cycle in Thiammin Pyrophosphate (Hamada and Khulaef, 2000 and Kozik, 2008, Bedour and Rawia, 2011) and also improves growth characteristics Al-Khudari (Cox 2010, Rana et al., 2014). This study was conducted to know the effect of thiamine concentrations and dates of spray on growth and yield of two cultivars. The research aims to Response of cultivars in terms of growth and yield,The effect of spraying stage on the growth and yield of mung bean ,The effect of thiamine concentrations on the growth and yield of mung bean,The effect of bi-interaction between cultivars and spraying stages on the growth and yield of mung bean .bi-interaction response between classes and concentrations in growth and yield of mung bean .The effect of bi-interaction between spraying stages and concentrations on the growth and yield of mung bean .The effect of triple interaction between cultivars, spraying stages and thiamine concentrations on growth and yield of mung bean .

Materials and methods

A field experiment was conducted during the spring and autumn season of 2019 in a private field in the Al- Mussaib project region, north of Babylon province, To study the effect of thiamine concentration and thiamine spray dates on growth and yield of two cultivars of mung bean. The experiment was conducted according to the arrangement of split split plots and distributed the treatments using the randomized complete block design (RCBD) with three replicates .where the cultivars (local and Uzbekistan) that were obtained from the local markets occupied the main plots. As for the secondary plots included the three spraying stages (a stage after 30 days of emergence , a stage after 45 days of emergence and a stage after 60 days of emergence) and the sub secondary plots included thiamine concentrations and were as follows (spraying with distilled water only , 100 mg.L- ¹and 200 mg.L-¹, 300 mg.L-¹). The land of the experiment plowed two perpendicular plowings, then it was smoothing, leveling and then divided into experimental units with dimensions of 2.5 x 3 m² to be the area of the experimental unit 7.5 m^2 follow the cultivation system on lines, the experimental unit contained 4 lines with a length of 2.5 m and the distance between one line and another 60 cm and between pit and another on the line 25 cm. The plots were separated by a distance of 1.5 m wide to prevent spray interaction. The experiment area was fertilized with triple superphosphate fertilizer (P_2O_5 46%) at a level of 75 kg.ha⁻¹ P before cultivation and nitrogen fertilizer was added in the form of urea (N 46%) at the level of 40 $kg.ha^{-1}$ N two weeks after cultivation (Al-Younes, 1993). The cultivated date was on the date of 4/27/2019 for the spring season and 2/7/2019 for the autumn

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season. Immediately after cultivated, the experiment was irrigated and the irrigation process repeated, depending on the plant and soil needs. 5 seeds were placed in one pit, after which the thinning process was performed 14 days after cultivated to keep one plant in pit. Thiamine spraying process (Vitamin B1) was sprayed on the total vegetative for three stages at dates 5/31, 6/15 and 6/30 for the spring season, 3/8, 18/8, 3/9 for the autumn season of the cultivars and concentrations determined for the experimental units. Each level of the vitamin is sprayed until complete wetness on the leaves of plants early in the morning using a 16-liter big back sprayer with the use of a diffuse substance (dishwashing solution) for the spray solution by 3 cm^3 per 20 liters to reduce the surface tension of the water and to ensure complete wetness of the two-season to increase the efficiency of the spray solution in Penetration of the outer surface of the leaf. Thiamine was prepared in a concentration of (100, 200 and 300 mg $.L^{-1}$)and prepared by taking (1) g containing (1) g of active substance and dissolved in a liter of distilled water to obtain the stock base solution and store the solution with a dark bottle in a dark place and take (100 ml) of the base solution and complete the volume to (1000 mL) in order to obtain a concentration (100 mg $.L^{-1}$) and spray it on the vegetative part of the plant. The trait of the average number of pods / plant was measured by calculating the total number of pods for the five plants and then dividing the total number of pods by five to find out the average number of pods per plant. The pod's length was calculated according to the average length of 10 pods of randomly harvested plants. The average number of seeds was calculated and calculated as the average number of seeds in the one plant harvested for each experimental unit separately, The1000 seeds weight was calculated from the weight of 1000 seeds (g) per experimental unit and using a sensitive balance, the seed yield was calculated when the plant yield was extracted One is multiplied by the plant density to extract the seed yield kg.h^{-1} and then it is converted to tons.ha^{-1} by dividing the final number by one million for each experimental unit separately and the rate of the protein percentage.

Results and discussion:

The average number of pods.plant^{-1}: -

Table (1)showed that there are significant differences between the arithmetic means in the average number of pods/plant for genotypes, spray dates, concentrations, and bi and triple interactions between the three factors studied for the spring and autumn season 2019. It is clear from of Table (1) that there is a significant difference in the mean of the genotypes in this trait, where the local cultivar of the spring and autumn season excelled and gave the highest average number of pods (17.22 and 20.54 pods.plant^{-1}), respectively, and the Uzbekistan cultivar gave the lowest average number of pods It reached (15.30 and 18.25 pods.plant^{-1}) for the two-season respectively. This result is consistent with Abdul Ghafour and Al-Jumaili (2016). When using two mung bean, the local cultivar gave higher average than the Indian cultivar in the number of pods / plant. Table (1) indicates that there were significant differences for dates, where the second date excelled the rest of the dates by giving it the highest average of (17.44 and 21.05 pods.plant^{-1})For the spring and autumn season respectively, while the first date was given the lowest average amounted to (14.98 and 17.70 pods.plant^{-1}) for the two seasons, respectively. As for the concentrations, it was significant for both the two seasons, where the second concentration 100 ppm excelled on the rest of the concentrations, as it gave an average of amounted to (19.00 and 22.13 pods.plant^{-1})for both seasons respectively, the first concentration (zero) gave the lowest average amounted to (12.68 and 16.22 pods.plant^{-1}) for the two seasons respectively. As for the bi-interaction between the cultivars and the dates, it was significant, as the combination he local cultivar with the second date excelled. It achieved the highest average number of pods (18.35 and 22.55 pods.plant^{-1} .Where the mixture of the

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Uzbekistan cultivars with the first stage gave the lowest average amounted to (14.43 and 17.33 pods.plant^{-1}) for the two seasons, respectively .As for the bi-interaction between the local cultivars with the second concentration 100 ppm, it gave the highest average amounted to (20.00 and 23.26 pods.plant^{-1})for the two seasons respectively, while the combination the Uzbekistan cultivar with the first concentration zero gave the lowest average amounted to (12.13 and 15.06 pods.plant^{-1}) for both seasons respectively. There was also a significant interaction between dates and concentrations, where the combination the second date with the second concentration 100 ppm gave higher average amounted to (21.30 and 24.63 pods. Plant^{-1}) for the two seasons respectively, while the combination the first date with the first concentration zero gave the lowest average amounted to(12.43 f). 15.23 pods.plant^{-1}) for the two seasons respectively. It indicates from the results of Table (1) that the triple interaction between the cultivars, spray dates and added concentrations were significant for both spring and autumn seasons 2019, where the triple interaction of the local cultivars and the second date and the second concentration 100 ppm gave the highest average reached (22.20 and 25.66 pods.plant^{-1}) For the two seasons, while the triple interaction of the Uzbekistan cultivar and the first date and the first concentration zero gave the lowest average of (12.13 pods.plant^{-1}) for the spring seasons and gave the interaction the Uzbekistani cultivar and the second date and the first concentration zero gave the lowest average of (14.86 pods.plant^{-1}).

Average pod length (cm ^{2})

Table (2) indicates that there are significant differences between the arithmetic means in the average pod length of genotypes, spray dates, concentrations, and bi and triple interactions between the three factors studied for the spring and autumn season 2019.It is noted from Table (2) that there was no significant difference in the mean of the genotypes in this trait of the spring season, where the autumn season had a significant effect of this trait, excelled the local cultivar by giving it the highest average amounted to (6.65 cm ^{2}) and gave the Uzbekistan cultivar the lowest average amounted to 6.36 cm ^{2}). Table (2) data indicates that there was no significant difference for dates in the spring and autumn season. As for the concentrations, it was significant for both the two-season, where the fourth concentration 300 ppm excelled on the rest of the concentrations, where it gave a average amounted to (7.57 and 7.75 cm ^{2}) for the two-season respectively, and the first concentrations zero gave the lowest average amounted to (5.01 and 5.23 cm ^{2}) for the two-season respectively. As for the bi-interaction between the cultivars and the dates, they were not significant for the spring and autumn season. As for the bi-interaction between the cultivars and the concentrations were significant for the spring and autumn season, the combination the Uzbekistan cultivars with the fourth concentration 300 ppm gave the highest average reached (7.57 cm ^{2}) and this did not differ significantly from the local cultivar with the fourth concentration 300 ppm giving it the highest average reached (7.56 cm^2) The spring season, either in the autumn season. The combination gave the local cultivar with the fourth concentration 300 ppm, the highest average reached (7.82 cm^2), and this did not differ significantly from the combination of the Uzbekistan cultivars with the fourth concentration 300 ppm, by giving it the highest average reached (7.68 cm ^{2}). The combination gave the Uzbekistan cultivars and the first concentration zero the lowest average reached (4.72 and 4.81 cm^2) for respectively. Also, there was no interaction between the dates and the concentrations, where they were not significant for the spring and autumn season 2019. Table (2) data indicates that the triple interaction between the cultivars, spray dates, and added concentrations was not significant for both spring and autumn seasons 2019.

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Table (1) effect of cultivars, spraying date , concentration of thiamine, and interaction between them in the average number of pods. Plant^{-1} for spring and autumn season 2019

	The Autumn season 2019					The spring season 2019					
cultivars *spraying dates	Thiamine concentration				cultivars *spraying dates	Thiamine concentration				spraying dates	cultivars
	300 ppm	200 ppm	100 ppm	control		300 ppm	200 ppm	100 ppm	control		
18.08	17.26	19.26	20.53	15.26	15.53	14.80	16.80	17.80	12.73	first	Local
22.55	21.53	22.53	25.66	20.46	18.35	18.20	19.60	22.20	13.40	second	
21.00	21.40	22.60	23.60	16.40	17.80	18.40	19.20	20.00	13.60	third	
17.33	17.26	17.93	18.93	15.20	14.43	14.40	15.20	16.00	12.13	first	Uzbekistan
19.56	19.13	20.40	23.60	15.13	16.53	16.20	17.20	20.40	12.33	second	
17.86	17.53	18.60	20.46	14.86	14.93	14.60	15.60	17.60	11.93	third	
0.633	0.718				0.073	0.145					%5 l.s.d
cultivars					cultivars						
20.54	20.06	21.46	23.26	17.37	17.22	17.13	18.53	20.00	13.24	Local	Cultivars* concentration
18.25	17.97	18.97	21.00	15.06	15.30	15.06	16.00	18.00	12.13	Uzbekistan	
0.822	0.623				0.095	0.092					%5 l.s.d
spraying dates					spraying dates						
17.70	17.26	18.60	19.73	15.23	14.98	14.60	16.00	16.90	12.43	first	spraying dates* concentration
21.05	20.33	21.46	24.63	17.80	17.44	17.20	18.40	21.30	12.86	second	
19.43	19.46	20.60	22.03	15.63	16.36	16.50	17.40	18.80	12.76	third	
0.289	0.428				0.031	0.099					%5 l.s.d
	19.02	20.22	22.13	16.22		16.10	17.26	19.00	12.68		Average of concentration
0.229					0.063						%5 l.s.d

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Table (2) effect of cultivars, spraying date, concentration of thiamine, and interaction between them in the average pod length (cm ²)for spring and autumn season 2019

	The Autumn season 2019					The spring season 2019					
cultivars *spraying dates	Thiamine concentration				cultivars *spraying dates	Thiamine concentration				spraying dates	cultivars
	300 ppm	200 ppm	100 ppm	control		300 ppm	200 ppm	100 ppm	control		
6.80	8.19	6.93	6.38	5.72	6.54	7.82	6.92	6.04	5.38	first	Local
6.76	8.22	6.47	6.48	5.90	6.41	7.86	6.12	6.14	5.52	second	
6.39	7.06	6.44	6.70	5.37	6.29	7.00	6.44	6.68	5.02	third	
6.43	7.58	6.80	6.22	5.14	6.27	7.58	6.80	5.88	4.80	first	Uzbekistan
6.49	8.07	6.73	6.07	5.12	6.24	7.72	6.72	5.72	4.78	second	
6.16	7.40	6.86	6.20	4.17	6.17	7.40	6.86	5.86	4.56	third	
N . S	N . S				N . S	N . S					%5 l.s.d
cultivars					cultivars						
6.65	7.82	6.61	6.52	5.66	6.41	7.56	6.49	6.29	5.31	Local	Cultivars* concentration
6.36	7.68	6.80	6.16	4.81	6.23	7.57	6.80	5.82	4.72	Uzbekistan	
0.11	0.45				N . S	0.26					%5 l.s.d
spraying dates					spraying dates						
6.62	7.88	6.87	6.30	5.43	6.40	7.70	6.86	5.96	5.09	first	spraying dates* concentration
6.63	8.14	6.60	6.27	5.51	6.32	7.79	6.42	5.93	5.15	second	
6.27	7.23	6.65	6.45	4.77	6.23	7.20	6.65	6.27	4.79	third	
N . S	N . S				N . S	N . S					%5 l.s.d
	7.75	6.71	6.34	5.23		7.57	6.64	6.06	5.01		Average of concentration
0.37					0.18						%5 l.s.d

The average number of seeds.pod^{-1} :-

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Table (3) shows that there were significant differences between the arithmetic mean in seed number.pod of genotypes, spraying dates, concentrations, and bi and triple interactions between the three studied factors for the spring and autumn season 2019. Table (3) that there is no significant difference in the mean genotypes in this trait. Table (3) indicates that there were significant differences for dates, where the second date excelled the rest of the dates by giving it the highest average amounted to (8.29 and 9.39 seeds.pod^{-1}) for the spring and autumn season respectively, while the third date was given the lowest average in this trait (6.41 and 7.52 seeds.pod^{-1}) for both seasons respectively. As for the concentrations, it was significant for both the two-season, where the fourth concentration 300ppm excelled in the rest of the concentrations, where it gave an average of (8.98 and 10.18 seeds.pod^{-1}) for the two-season respectively, and the first concentration zero gave the lowest average of (5.49 and 6.51 seeds.pod^{-1}) for the two-season respectively. As for the bi-interaction between the cultivars and the dates, the combination the local cultivars and the second date excelled and gave the highest average reached (8.40 and 9.58 seeds.pod^{-1}) for the two-season respectively, and did not differ from the combination of the interaction of the Uzbekistani cultivars and the second date reached (8.19 and 9.20 seeds.pod^{-1}) for the two-season, respectively. While the combination gave the Uzbekistani cultivar the third date, the lowest average amounted to (6.05 and 7.15 seeds.pod^{-1}).

As for the bi-interaction between the cultivar and the concentrations were significant for the spring and autumn season, the combination the local cultivars and the fourth concentration was 300 ppm.) For the autumn season, while the interaction the Uzbekistan cultivar and the first concentration zero gave the lowest average amounted to (5.41 and 6.44 seeds.pod^{-1}) for the two-season respectively. There is also an interaction between the date and the concentrations, which was significant for the spring and autumn season. The combination the second date and the fourth concentration 300 ppm gave the highest average amounted to (10.26 and 11.56 seeds.pod^{-1}) for the two-season, respectively, while the combination the third date with the first concentration zero gave the lowest average was (4.90 and 5.96 seeds.pod^{-1}) for the two-season respectively. Table (3) indicates that the triple interaction between the cultivars, spray dates and added concentrations were significant for spring and autumn season 2019, where the triple interaction of the local cultivars and the second date and the fourth concentration gave 300 ppm gave the highest average reached (10.33 and 11.86 seeds.pod^{-1}) for the two-season respectively. There was no significant difference from the interaction of the Uzbekistani cultivar and the second date and the fourth concentration 300 ppm (10.20 and 11.26 seeds.pod^{-1}) respectively, while the triple interaction of the Uzbekistani cultivar and the third date and the first concentration gave zero the lowest average of (4.46 and 5.53 seeds.pod^{-1}) for the two-season respectively.

Table (3) effect of cultivars, spraying date, concentration of thiamine, and interaction between them in the average number of seeds. Pod^{-1} for spring and autumn season 2019

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	The Autumn season 2019					The spring season 2019					
cultivars *spraying dates	Thiamine concentration				cultivars *spraying dates	Thiamine concentration				spraying dates	cultivars
	300 ppm	200 ppm	100 ppm	control		300 ppm	200 ppm	100 ppm	control		
7.46	9.80	7.73	6.60	5.73	6.45	8.60	6.80	5.60	4.80	first	Local
9.58	11.86	10.06	8.80	7.60	8.40	10.33	8.86	7.80	6.60	second	
7.90	9.60	8.20	7.40	6.40	6.78	8.60	7.20	6.00	5.33	third	
7.73	9.26	8.13	7.13	6.40	6.68	8.06	7.20	6.20	5.26	first	Uzbekistan
9.20	11.26	9.33	8.80	7.40	8.19	10.20	8.33	7.73	6.50	second	
7.15	9.33	7.20	6.53	5.53	6.05	8.13	6.20	5.40	4.46	third	
0.69	0.78				0.46	0.52					%5 l.s.d
cultivars					cultivars						
8.31	10.42	8.66	7.60	6.57	7.21	9.17	7.62	6.46	5.57	Local	Cultivars* concentration
8.02	9.95	8.22	7.48	6.44	6.97	8.80	7.24	6.44	5.41	Uzbekistan	
N . S	0.67				N . S	0.31					%5 l.s.d
spraying dates					spraying dates						
7.60	9.53	7.93	6.86	6.06	6.56	8.33	7.00	5.90	5.03	first	spraying dates* concentration
9.39	11.56	9.70	8.80	7.50	8.29	10.26	8.60	7.76	6.55	second	
7.52	9.46	7.70	6.96	5.96	6.41	8.36	6.70	5.70	4.90	third	
0.41	0.49				0.36	0.39					%5 l.s.d
	10.18	8.44	7.54	6.51		8.98	7.43	6.45	5.49		Average of concentration
0.21					0.13						%5 l.s.d

The average 1000 seed weight (g): -

Table (4) indicates that there are significant differences between the arithmetic means in the 1000 gm seed weight for the genotypes, spray dates, concentrations, and bi and triple interactions between the three studied

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factors for the spring and autumn season 2019. Table (4) indicates that the significant difference in the mean genotypes in this trait, as the Uzbekistan cultivar excelled the spring and autumn season and gave the highest average weight of 1,000 seeds reached (36.89 and 40.31 g) respectively, and the local cultivar gave the lowest average weight of 1,000 seeds reached (34.42) And 35.39 g), respectively. The reason is that the excelled of the Uzbekistan cultivar in this trait it gave the highest average of leaf area. Table (4) that there are significant differences for the dates, where the second date excelled the rest of the dates by giving it the highest average of (37.00 and 39.89 g) for the spring and autumn season respectively, while the third date was given the lowest average in this trait (34.33 and 35.83 g) respectively. As for the concentrations, it was significant for both season, where the second concentration 100 ppm excelled on the rest of the concentrations, where it gave an average of (41.50 and 44.09 g) for both seasons respectively, and the first concentration zero gave the lowest average amounted to (30.22 and 31.78 g) for both seasons respectively. the bi-interaction between the cultivars and the dates, where the combination the Uzbekistan cultivar with the second date excelled and gave the highest average weight of 1,000 seeds amounted to (38.17 and 41.92 g) for both seasons respectively, while the combination for the local cultivar with the third date gave the lowest average amounted to (33.00 and 33.10 g) for both seasons respectively. Bi-interaction between the Uzbekistan cultivar with the second concentration of 100 ppm gave the highest averages (43.00 and 46.62 g) for both seasons respectively, while the combination the local cultivar with the first concentration zero gave the lowest average was (29.67 and 29.56 g)) for both seasons respectively. There was also a significant interaction between dates and concentrations, where the combination the second date with the second concentration 100 ppm gave the higher average amounted to (43.17 and 46.55 g) respectively, while the combination the third date with the first concentrations zero gave lowest average amounted to (29.83 and 30.00 g) respectively .Table (4) indicates that the triple interaction between the cultivars, spray dates and added concentrations was not significant for the spring season and was significant for the autumn season, where the triple interaction of the Uzbekistan cultivars, the second date and the second concentration 100 ppm gave the highest average reached (48.70 g) for the autumn season, while The triple interaction of the local cultivar, the third date, and the first concentration zero gave the lowest average amounted to (28.50 g) for the autumn season.

Table (4) effect of cultivars, spraying date, concentration of thiamine, and interaction between them in the average 1000 seed weight (g) for spring and autumn season 2019

	The Autumn season 2019		The spring season 2019

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cultivars *spraying dates	Thiamine concentration				cultivars *spraying dates	Thiamine concentration				spraying dates	cultivars
	300 ppm	200 ppm	100 ppm	control		300 ppm	200 ppm	100 ppm	control		
35.21	32.26	37.73	41.66	29.20	34.42	32.67	35.67	39.67	29.67	first	Local
37.86	36.10	39.96	44.40	31.00	35.83	34.67	36.67	41.67	30.33	second	
33.10	30.83	34.46	38.63	28.50	33.00	30.67	33.67	38.67	29.00	third	
40.44	38.73	42.70	45.76	34.56	36.83	35.00	38.67	42.67	31.00	first	Uzbekistan
41.92	39.63	43.40	48.70	35.96	38.17	37.67	39.67	44.67	30.67	second	
38.56	36.40	40.96	45.40	31.50	35.67	33.67	36.67	41.67	30.67	third	
1.219	1.603				1.200	N . S					%5 l.s.d
cultivars					cultivars						
35.39	33.06	37.38	41.56	29.56	34.42	32.67	35.33	40.00	29.67	Local	Cultivars* concentration
40.31	38.25	42.35	46.62	34.01	36.89	35.44	38.33	43.00	30.78	Uzbekistan	
1.452	1.110				1.409	1.489					%5 l.s.d
spraying dates					spraying dates						
37.82	35.50	40.21	43.71	31.88	35.62	33.83	37.17	41.17	30.33	first	spraying dates* concentration
39.89	37.86	41.68	46.55	33.48	37.00	36.17	38.17	43.17	30.50	second	
35.83	33.61	37.71	42.01	30.00	34.33	32.17	35.17	40.17	29.83	third	
0.807	1.099				0.266	1.620					%5 l.s.d
	35.66	39.87	44.09	31.78		34.06	36.83	41.50	30.22		Average of concentration
0.555					1.070						%5 l.s.d

The average seed yield ton.ha $^{-1}$: -

Table (5) to the existence of significant differences between the arithmetic means in the seed yield average for the genotypes, spray dates, concentrations, and bi and triple interactions between the three studied factors for the spring and autumn season 2019.Table (5) data indicates a significant difference in the mean genotypes in this trait, as the local cultivar of spring and autumn season and gave the highest average seed yield reached (0.644 and 0.823 ton.ha $^{-1}$) respectively, and the

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Uzbekistan cultivar gave the lowest average seed yield reached (0.524 and 0.761 ton.ha $^{-1}$) respectively. The seed yield is the result of photosynthesis and storage (metabolites) in the advanced seed, and the factors that affect these activities will affect in one way or another the ability of the plant to show its genetic ability to respond to these influences and nutrients. The most important of these influences is the local cultivar in the seed yield per unit area. it gave the highest plant height and number of branches. Plant, number of leaves, and number of pods (Table 2, 3, 4 and 9). Table (5) that there are significant differences for the dates, where the second date excelled on the rest of the dates by giving it the highest average of (0.641 and 0.923 ton.ha $^{-1}$) for the spring and autumn season respectively, while the first date was given the lowest average in this trait (0.522 and 0.663 ton.ha $^{-1}$), respectively. As for the concentrations, it was significant for both season, where the second concentration 100 ppm excelled on the rest of the concentrations, where it gave an average amounted to (0.745 and 0.966 ton.ha $^{-1}$) for both seasons respectively, and the first concentration zero gave the lowest average of (0.446 and 0.609 ton.ha $^{-1}$) respectively. The reason for increasing the seed yield average at the low concentration (the second concentration 100 ppm) was a positive reflection of the significant effect of increasing the number of pods. Plant and weigh 1000 seeds (Table 9 and 12).

As for the bi-interaction between the cultivar and the dates, it was significant, as the combination]the local cultivar with the second date excelled and gave the highest average seed yield of (0.696 and 0.975 ton.ha $^{-1}$) respectively, while the combination local cultivar and the third date did not differ significantly and gave higher average amounted to (0.653 ton.ha $^{-1}$) for the spring season, while the combination of the Uzbekistan cultivar with the first date gave the lowest average for this trait (0.472 and 0.642 ton.ha $^{-1}$) respectively. As for the bi-interaction between the local cultivar with concentration the second 100 ppm gave the highest average (0.812 and 1.021 ton.ha $^{-1}$)respectively, while the combination gave the Uzbekistan cultivar with the first concentration zero gave the lowest average amounted to (0.395 and 0.612 ton.ha $^{-1}$) respectively. There was also a significant interaction between date and concentrations as the combination the second date with the second concentration 100 ppm gave the higher average amounted to (0.861 and 1.122 ton.ha $^{-1}$) respectively, while the combination the third date with the first concentration zero gave the lowest average was (0.439 and 0.601 ton.ha $^{-1}$) respectively. It indicates from the results of Table (5) that the triple interaction between the cultivars, spray dates and added concentrations was insignificant for both spring and autumn seasons 2019.

Table (5) effect of cultivars, spraying date, concentration of thiamine, and interaction between them in the average seed yield ton.ha - ^{1} for spring and autumn season 2019

	The Autumn season 2019		**The spring season 2019**		
cultivars *sprayin	**Thiamine concentration**	**cultivars *sprayi**	**Thiamine concentration**	**spraying dates**	**cultivars**

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g dates					ng dates						
	300 ppm	200 ppm	100 ppm	control		300 ppm	200 ppm	100 ppm	control		
0.683	0.657	0.714	0.843	0.519	0.584	0.550	0.603	0.688	0.497	first	Local
0.975	0.926	1.068	1.197	0.710	0.696	0.630	0.733	0.919	0.501	second	
0.811	0.723	0.908	1.024	0.590	0.653	0.643	0.643	0.830	0.497	third	
0.642	0.570	0.673	0.792	0.535	0.472	0.457	0.479	0.554	0.399	first	Uzbekistan
0.870	0.819	0.926	1.048	0.688	0.586	0.528	0.608	0.803	0.404	second	
0.771	0.701	0.879	0.892	0.612	0.516	0.483	0.524	0.675	0.381	third	
0.0420	N . S				0.047	N . S					%5 l.s.d
cultivars					cultivars						
35.39	0.769	0.897	1.021	0.606	0.644	0.608	0.660	0.812	0.498	Local	Cultivars* concentration
40.31	0.697	0.826	0.911	0.612	0.524	0.489	0.537	0.677	0.395	Uzbekistan	
0.0437	0.0423				0.062	0.06					%5 l.s.d
spraying dates					spraying dates						
0.663	0.613	0.693	0.818	0.527	0.522	0.503	0.541	0.621	0.448	first	spraying dates* concentration
0.923	0.872	0.997	1.122	0.699	0.641	0.579	0.670	0.861	0.452	second	
0.791	0.712	0.893	0.958	0.601	0.584	0.563	0.583	0.752	0.439	third	
0.0314	0.0516				0.022	0.064					%5 l.s.d
	0.733	0.861	0.966	0.609		0.548	0.598	0.745	0.446		Average of concentration
0.0292					0.041						%5 l.s.d

Protein percentage %: -

Table (6) indicates that there are significant differences between the arithmetic averages in the percentage of the protein to the genotypes, spray dates, concentrations, and bi and triple interaction between the three studied factors for the spring and autumn season 2019.Table (6) data indicates a significant difference in the mean genotypes in this trait, where the local cultivar of the spring and autumn season excelled and gave the highest average percentage of protein reached (23.89 and 26.98%), respectively, and the Uzbekistan cultivar gave the lowest average protein percentage reached (20.11 and 23.91) %) Respectively . These results agree with Nazmun and Hasan (2009). The trait of the protein

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percentage in the seeds is a genetic trait, and because the different cultivars of the Mung bean crop in their genetic composition leads to a difference in their protein content. Table (6) that there are significant differences for the dates, as the third date excelled on the rest of the dates by giving it the highest average of (23.22 and 27.69%) for the spring and autumn season respectively, while the first date gave the lowest average in this trait of (21.01 and 23.60%) on As for the concentrations, it was significant for both season , where the fourth concentration 300 ppm excelled on the rest of the concentrations, where it gave the highest average amounted to (24.63 and 28.54%) for both loops respectively, and the first concentration zero gave the lowest average of (19.57 and 22.47%) for the two-season respectively. The reason for this is greater than the fourth concentration of 300 ppm in this traits due to some indicators of vegetative growth, plant height, leaf area, number of leaves, number of branches and stem diameter (Table 2, 3, 4, 5 and 6) Kozik (2008). As for the bi-interaction between the cultivars and the dates, it was not significant for the spring season, while the autumn season was significant, as the combination the local cultivar with the third date excelled and gave the highest average percentage of protein reached (29.74%) for the autumn season, while the combination was the Uzbekistani cultivar with the first date gave The lowest average was (22.06%). Bi-interaction between the local cultivar with the fourth concentration was 300 ppm gave The highest average was (27.04 and 30.51%) respectively, while the combination the Uzbekistan cultivar with the first zero gave the lowest average amounted to (18.31 and 20.98%) for the two handbags respectively. There was also a significant interaction between dates and concentrations, as the combination the third date with the fourth concentration 300 ppm gave higher average amounted to (27.96 and 31.85%) respectively, while the combination the first date with the first focus zero gave the lowest average was (19.04 and 20.65%) respectively . Table (6) that the triple interaction between the cultivar, spray dates and added concentrations was significant for both spring and autumn season 2019, as the triple interaction of the local cultivar, the third date and the fourth concentration 300 ppm gave the highest average reached (30.86 and 35.65%)respectively. , While the triple interaction of the Uzbekistani cultivar , the first date and the first concentration zero, gave the lowest average amounted to (17.50 and 18.88%) respectively.

Table (6) effect of cultivars, spraying date, concentration of thiamine, and interaction between them in the average Protein percentage (%)for spring and autumn season 2019

	The Autumn season 2019		**The spring season 2019**		
cultivars *spraying dates	**Thiamine concentration**	**cultivars *spraying dates**	**Thiamine concentration**	**spraying dates**	**cultivars**

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	300 ppm	200 ppm	100 ppm	control		300 ppm	200 ppm	100 ppm	control		
25.14	27.58	25.72	24.85	22.41	22.90	25.09	23.76	22.17	20.59	first	Local
26.06	28.29	27.02	25.33	23.58	23.48	25.16	25.07	23.41	20.27	second	
29.74	35.65	29.67	27.76	25.88	25.29	30.86	24.67	24.01	21.62	third	
22.06	25.37	23.09	20.90	18.88	19.13	20.57	20.30	18.15	17.50	first	Uzbekistan
24.02	26.33	25.27	23.13	21.36	20.05	21.06	20.38	19.65	19.11	second	
25.65	28.05	26.98	24.87	22.70	21.16	25.06	21.70	19.54	18.33	third	
2.394	4.142				N . S	1.842					%5 l.s.d
cultivars					cultivars						
26.98	30.51	27.47	25.98	23.96	23.89	27.04	24.50	23.20	20.82	Local	Cultivars* concentration
23.91	26.58	25.11	22.97	20.98	20.11	22.23	20.79	19.11	18.31	Uzbekistan	
0.991	2.113				2.203	1.759					%5 l.s.d
spraying dates					spraying dates						
23.60	26.47	24.40	22.88	20.65	21.01	22.83	22.03	20.16	19.04	first	spraying dates* concentration
25.04	27.31	26.14	24.23	22.47	21.76	23.11	22.73	21.53	19.69	second	
27.69	31.85	28.32	26.32	24.29	23.22	27.96	23.18	21.77	19.97	third	
2.053	3.102				0.957	1.113					%5 l.s.d
	28.54	26.29	24.48	22.47		24.63	22.65	21.15	19.57		Average of concentration
1.686					0.453						%5 l.s.d

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