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ROLE OF BRASSINOLIDE ON N P K CONCENTRATION AND SOME GROWTH PARAMETERS OF MUNG BEAN UNDER DIFFERENT SOWING DATE

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Abstract

A field experiment was carried out to determine the role of brassinolide in improving the growth parameters and NPK content of the mung bean crop sown under different planting dates. The experiment was conducted in the Department of Field Crops, College of Agriculture-University of Baghdad during the autumn season 2017. The experiment was applied with RCBD design arranged in split plots with three replicates and the main plots included planting on different dates (15, 31 of July and 15 of August) while the sub plots included four spray concentrations of the growth regulator brassinolide (0, 1, 2 and 3 mg L^{-1}). The results showed that planting date 15 of July was significantly superior in the most of growth parameters where the average of leaf area was 1438.3 cm^2 $plant^{-1,}$ the number of branches was 7.20 branch $plant^{-1}$, the number of leaves was 93.3 leaf $plant^{-1}$, nitrogen percentage was 1.63% and potassium 0.423%. The brassinolide concentration of 1 mg l^{-1} was superior in the number of branches (7.23 branch $plant^{-1}$), leaf area (1443.7 cm^2 $plant^{-1}$), the leaves number (89.9 leaf $plant^{-1}$) and nitrogen percentage (1.56%).

Key words : Mung bean, Brassinolide, Planting date, Growth, NPK.

Introduction

Mung bean is one of legume crops that characterized by a short growth season, grown for the purpose of obtaining seeds of high nutritional value for humans and animals. The percentage of seeds protein was 29% and the carbohydrates 65% and is used as green fodder and green fertilizer for the purpose of improving soil properties (Guidance Bulletin, 2011). Therefore, determining the appropriate planting date is one of the most important inputs to the growth of crop production management programs in order to utilize the genetic potential of each species in each region of the world, including Iraq, and since the appropriate timing of agriculture has a clear effect at different stages of mung bean crop growth and to increase the efficiency of the mung bean in the climatic conditions available during the season such as temperature, relative humidity, intensity, duration of lighting and others, The mung bean crop is very sensitive to environmental fluctuation, and its optimal planting ensures full integration between the vegetative and reproductive stages, Climate change and global warming are detrimental to crop production in terms of maturity and harvest. Therefore, for sustainable production, effective crop production strategies need to be developed (Singh and Dhingra, 1993). Determining the date of appropriate planting is considered an important agricultural operation for the production of any crop and directly affects the growth and outcome through optimum temperatures required for each stage of crop growth, In the study of the effect of different dates of cultivation of mung bean on 14 and 29 June and 15 and 30 July, there were significant effects in most growth parameters, including growth rate, the number of branches in the plant, the dry weight of the plant and the index of leaf area (Madhu, 2013). Brassinolide has the ability to increase plant efficiency to withstand stresses by increasing the efficiency of the enzymatic system, stimulate differentiation, cell wall elasticity and increase plant growth (Vogler *et al.,* 2014 and Favero *et al.,* 2017). As well as their role in increasing the efficiency of photosynthesis and improving the growth of developing

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plants under different environmental conditions such as heat and others, especially when added with appropriate concentration and appropriate growth stage of the plant (Sasse, 2003, Yu *et al.,* 2004; Bajgus and Shamsul, 2009). Therefore, the present study was carried out to investigate the effect of the brassinolide on growth parameters of the mung bean under different planting dates.

Materials and Methods

A field experiment was conducted in the experimental farm in the Department of Field Crops - College of Agriculture - University of Baghdad- Al Jadriya during the autumn season of 2017 in loam clay soils showing their physical and chemical properties table 1 in order to study the role of the growth regulator of brassinolide in improving the growth criteria of the mung bean sown under different planting dates. RCBD arranged in split-plot the main plots included three dates for planting (15 and 31 of July and 15 of August), while the sub plots included four spray concentrations of the growth regulator, brassinolide (0, 1, 2 and 3 mg L^{-1}) through two times of spraying. The first one was in the vegetative growth stage (2 to 4 leaves) and the second at the beginning of flowering. The soil service operations were carried out by plowing, tilling and settling. The plot area was 4 m^2 (2 m × 2 m), which consisted of 5 rows with 2 meter long for each, 40 cm apart and 30 cm within the plants. The field experiment was conducted according to a recommendation (Ministry of Agriculture, 2011). The basal growth promoter was sprayed on the basis of the concentrations used with a 20L back and 0.15 mL L^{-1} of Al-Zahi as a release material to reduce the surface tension of the water and to ensure the complete wetness of the leaves and increase the efficiency of the spray solution to penetrate the outside surface of the leaf. The studied traits were: plant length (cm), number of leaves (leaf $plant^{-1}$), number of branches (branch $plant^{-1}$), leaf area (cm^2), and nutrient content of N.P.K in leaves (A.O.A.C, 1980). The data were analyzed according to the statistical program Genstat and the least significant difference was used at 5% to compare the average coefficients (Steel and Torrie, 1960).

Table 1: Some chemical and physical properties of the experimental soil for the autumn season 2017.

Traits		Autumn season
Soil separators Mg Kg^{-1}	Sand	21.8
	Clay	30.6
	silt	47.6
Soil texture	Clay loam	
PH	7.53	
$E.C.ds.m^{-1}$	2.6	
N ppm	84.0	
P ppm	22.5	
K ppm	551	
O. Mg kg^{-1}	0.9	

Results

Plant length (cm)

Plant length is mainly controlled by genetic makeup and it can also influenced by environmental conditions and nutrition management. The results showed significant differences between the planting dates, the brassinolide spray concentrations and their interaction in plant length trait (Table 2). The second planting date (July 31) recorded the highest planting length of 122.7 cm, while the planting date 15 of August recorded the lowest average of this trait with mean of 110.0 cm. In addition, spraying with brassinolide resulted in a significant increase in the length of the plant. The concentration of 2 mg l^{-1} was exceeded with the highest mean of 123.4 cm and an increase of 9.23% compared to the comparison treatment (spraying with distilled water only).

Number of branches

The obtained results indicated that significant differences in this trait of mung bean sown in different dates were observed (Table 2). Planting date 15 of July recorded the highest number of branches in the plant with mean of 7.20 branch $plant^{-1}$ while planting date 15 of August recorded the lowest average number of branches in the plant which was 6.12 branch $plant^{-1}$. The spray treatment was superior at a concentration of 1 mg L^{-1} with the highest mean of 7.23 branch $plant^{-1}$ compared to treatment control, which gave a mean average of 6.36 branch $plant^{-1}$.

Leaf area

The results in Table 2 showed significant differences between the dates of planting, the spraying concentrations of brassinolide and their interaction in the average leaf area of the mung bean. The highest average of leaf area was 1438.3 cm^2 $plant^{-1}$ at planting date on 15 of July with an increase of 14.64% compared with planting date on 15 of August which gave the lowest average of this trait amounted to 1227.6 cm^2 $plant^{-1}$. As for the spraying of brassinolide, the highest average leaf area was 1443.7 cm^2 $plant^{-1}$ at a concentration of 1 mg l^{-1} compared with the comparison treatment, which gave an average of 1276.1 cm^2 $plant^{-1}$.

Leaf area index

There were significant differences between the planting dates in the leaf area index (Table 2). The planting

Table 2: Effect of planting dates, spraying with BRs concentrations and their interaction on plant length, number of branches, leaf area and number of leaves in mung bean for the autumn season 2017.

BRs concentrations	Plant length (cm)				BRs concentrations	Branches number (branch plant^{-1})			
	Planting date			Mean		Planting date			Mean
	15 of July	31 of July	15 of August			15 of July	31 of July	15 of August	
0	112.2	0	103.0	112.0	0	6.87	6.72	5.52	6.37
1	125.6	1	105.9	118.2	1	7.94	7.39	6.36	7.23
2	118.0	2	119.8	123.4	2	7.41	6.82	6.54	6.92
3	112.7	3	111.2	113.1	3	6.59	6.41	6.07	6.36
L.S.D $_{0.05}$	4.3			2.1	L.S.D $_{0.05}$	0.47			0.27
Mean	117.1	122.7	110.0		Mean	7.20	6.84	6.12	
L.S.D $_{0.05}$	3.8				L.S.D $_{0.05}$	0.18			
BRs concentrations	Leaf area of the plant (cm^2 plant^{-1})				BRs concentrations	Plant leaves number (leaf plant^{-1})			
	Planting date			Mean		Planting date			Mean
	15 of July	31 of July	15 of August			15 of July	31 of July	15 of August	
0	1373.9	1344.6	1109.9	1276.1	0	91.4	87.2	63.3	80.6
1	1581.9	1475.3	1273.8	1443.7	1	102.0	94.1	73.8	89.9
2	1478.6	1363.5	1308.9	1383.7	2	96.3	89.9	78.4	88.2
3	1318.6	1284.2	1217.9	1273.6	3	83.7	76.1	66.6	75.5
L.S.D $_{0.05}$	91.7			53.0	L.S.D $_{0.05}$	2.4			1.4
Mean	1438.3	1366.9	1227.6		Mean	93.3	86.8	70.5	
L.S.D $_{0.05}$	70.6				L.S.D $_{0.05}$	1.3			

Table 3: Effect of planting dates, spraying with BRs concentrations and their interaction on the leaf area index, the percentage of nitrogen, phosphorus and potassium in mung bean for the autumn season 2017.

BRs concentrations	Leaf area index				BRs concentrations	Nitrogen %			
	Planting date			Mean		Planting date			Mean
	15 of July	31 of July	15 of August			15 of July	31 of July	15 of August	
0	1.145	1.121	0.925	1.063	0	1.51	1.21	0.92	1.21
1	1.318	1.229	1.062	1.203	1	2.14	1.53	1.01	1.56
2	1.232	1.136	1.091	1.153	2	1.84	1.20	1.09	1.37
3	1.099	1.070	1.015	1.061	3	1.02	1.03	0.97	1.01
L.S.D $_{0.05}$	0.076			0.044	L.S.D $_{0.05}$	0.13			0.07
Mean	1.199	1.139	1.023		Mean	1.63	1.24	1.00	
L.S.D $_{0.05}$	0.059				L.S.D $_{0.05}$	0.011			
BRs concentrations	Plant phosphorus %				BRs concentrations	Plant potassium %			
	Planting date			Mean		Planting date			Mean
	15 of July	31 of July	15 of August			15 of July	31 of July	15 of August	
0	0.137	0.240	0.097	0.158	0	0.401	0.344	0.289	0.345
1	0.277	0.270	0.113	0.220	1	0.520	0.405	0.307	0.411
2	0.210	0.360	0.220	0.263	2	0.463	0.342	0.321	0.376
3	0.140	0.200	0.177	0.172	3	0.310	0.311	0.300	0.307
L.S.D $_{0.05}$	0.009			0.005	L.S.D $_{0.05}$	0.018			0.010
Mean	0.191	0.268	0.152		Mean	0.423	0.351	0.305	
L.S.D $_{0.05}$	0.004				L.S.D $_{0.05}$	0.009			

date on 15 of July gave the highest average of 1.199 while the average of 1.023 was the lowest mean of leaf area that recorded on 15 of August. Significantly, the spraying concentrations of brassinolide affected the leaf area index trait where the concentration of 1 mg L^{-1} showed the highest mean of the leaf area index of 1.318

compared with the comparison treatment which gave a mean average of 0.925. The interaction between the planting dates and the concentrations of brassinolide significantly affected the leaf area index, where the combination of planting on 15 of July and spraying with a concentration of 1 mg L^{-1} showed the highest average of this trait amounted to 1.318, while the combination of planting on 15 of August with a concentration of 0 mg L^{-1} recorded the lowest average of 0.925.

Number of leaves

The results of Table 3 showed significant differences between planting dates, spraying concentrations of brassinolide and their interaction in the number of leaves. The date of planting at 15 of August recorded the lowest average number of leaves in the plant with mean of 70.5 leaf $plant^{-1}$, while on 15 of July gave the highest average number of leaves in the plant which was 93.3 leaf $plant^{-1}$. Additionally, spraying the mung bean crop with brassinolide resulted in a significant increase in the number of leaves. The concentration of 1 mg L^{-1} was exceeded with the highest average number of leaves (89.9 leaf $plant^{-1}$) compared to the comparison treatment (80.6 leaf $plant^{-1}$).

Chemical elements (N, P, and K)

The results of Table 3 showed significant differences between the dates of cultivation, concentrations of the spray and their interaction in the percentage of chemical elements (NPK). The plants of the first date (15 of July) were superior in the rate of N and K with recorded values of 0.423 and 1.63% respectively, while the plants of the second planting date (31 of July) were superior in P with mean of 0.268%. However, the third planting date (15 of August) recorded the lowest average of N and K with means of 1.00 and 0.305% respectively. There was a significant response to the spray of brassinolide where the higher average of N and K (1.56 and 0.411% respectively) recorded at the concentration of 1 mg L^{-1} while at a concentration of 0 mg L^{-1}, the comparison treatment recorded averages of 1.21 and 0.345% for both N and K respectively. However, the highest average of the P element was recorded in the treatment of spraying with 2 mg L^{-1} of brassinolide with a proportion of 0.263%.

Discussion

The optimal planting date has a positive reflex in different growth stages of field crops. Mung bean crop is one of the sensitive crops for climate changes therefore, the optimal planting date will improve the growth and absorption of NPK as a result of increasing the crop's efficiency in exploiting climatic conditions available during the growing season. The results of the study showed that there were clear effects of the planting dates in most of the studied traits. Planting at the first date (15 of July) achieved a significant superiority for most of the growth indicators, which led to an increase in the number of branches, number of leaves, leaf area and leaf area index which can be attributed to the appropriate conditions that reduced the height increasing which reflected in the increase of branches and the number of leaves in the plant (Saadoun and Abdullah, 2015). This planting date (15 of July) contributed to the absorption of the most important nutrients, nitrogen and potassium, which responded favorably to provide the largest amount of food manufactured to move to areas of effective growth in the plant, including marshy cells to stimulate growth and elongation (Jassim and Mohsin, 2015).

Plants treated with brassinolide showed a significant response to increase some growth traits and NPK. The spraying treatment with concentration of 1 mg L^{-1} of brassinolide increased the number of branches in the plant, the leaf area and its index, as well as the chemical elements of nitrogen and phosphorus. It can be attributed to the vital role of the important precursor raising the efficiency of the photo synthesis process and increasing the size and expansion of leaf cells (Faizan *et al.*, 2017). The increase of leaf area when spraying with brassinolide may lead to growth and expansion of leaves as well as its positive role in all biological processes within the plant which included the increase in food elements absorption through its impact on the size and weight of the root and increase it is efficiency (Al-Mashhadani, 2018). The obtained results were consistent with Hamid and Rahman, (2014); Mir, (2015); Sengupta and Tamang, (2015) who indicated that leaf area and its index in mung bean crop were increased when treated with brassinolide.

From the current study, it can be concluded that the ideal and appropriate planting date for mung bean crop is 15 of July which led to improve the indicators of vegetative growth and increased nutrients absorption as well as spraying with growth regulator at a concentration of 1 mg L^{-1} has made an effective contribution to most indicators of vegetative growth and increased absorption of nutrients.

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