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USING OF POTASSIUM AND ABSCISIC ACID IN REDUCTASE THE NEGATIVE EFFECTS OF MOISTURE TENSION ON FABA BEAN (VICIA FABA L.)

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ABSTRACT: *This study was carried out in the experiments field of college of Agriculture / Diyala University - Iraq during the planting season 2015 – 2016, Using the split - split plot design in the experiment, and arranging randomized complete block design (RCBD), In three replications. Experimental treatments include: adding water after draining 25% (W1) ,50% (W2) and 75% (W3) of available water, and add potassium concentration of 5000 (K1),5500 (K2) and 6000 (K3) mg.L-1 as potassium sulfate (K 41%), and spraying abscisic acid (ABA) at concentration of 0.0 (ABA0), 10.0 (ABA1) and 20.0 (ABA2) mg. L-1. The results showed: The third potassium level K3 excellence on the levels K1 of proline , chlorophyll , percentage of malic acid and the concentration of potassium in plant leaves increased in values 46.36%, 21.01%, 34.45%, 17.5% respectively under different moisture levels. The results showed that third level of abscisic acid sprayed ABA2 increase the proline acid and abscisic acid concentration as compared with the both of control (ABA0) and the second (ABA1) .The concentration of proline in leaves significant increase of 69.0% by interaction between(K3 + ABA2) compared with (K1+ABA0) .The concentration of Abscisic acid in leaves was not affected by increasing potassium although the concentration of Abscisic acid has doubled with a decrease moisture content of the soil. Increasing the potassium spraying K3 leads to reduce the negative impact of low level of moisture W3 on the concentration of proline, chlorophyll, percentage of malic acid and the potassium concentration in the leaves with a percentage 30.65%, 26.92% , 48.78% ,15.18% respectively. Also the most of characters were significantly influenced by interaction between potassium and Abscisic acid concentrations under moisture tension.*

KEYWORDS: Potassium, Abscisic Acid, Moisture Tension, Malic Acid.

INTRODUCTION

Plant leaves are containing a microscopic valves called stomata and that control the process of water loss by evapo-transpiration Response to the conditions of surrounding medium. Process of gaseous exchange(CO_2/H_2O) in the plant occurs through the holes in the leaves. and many of the environmental factors in addition to Endogenous hormones controls in the development of leaves pores and the degree of openness (Anjum et al. 2015) and these factors also affect the rate of water loss by transpiration, and the rate of net photosynthesis (Lateef , 2015).

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Environmental stresses (abiotic) considers the main factors determining the stability of plant life, the problem of water scarcity been aggravated recently, a lack of rain precipitation annual rate, using irrational irrigation methods and increased evaporation because of the steady increase in the concentration of atmospheric pollutants, especially carbon dioxide (CO_2), and its accompanying height of temperature, leads to Increase severity of the drought and an increased frequency the drought cycle, Especially in the arid and semiarid areas. The drought leads to reduction of plant growth and the inhibition of photosynthesis processes, carbon representation, defect in the metabolic of nitrogen and increase in the production of Reactive oxygen specie (Ros) (Gupta, 2011) that working on digestion of proteins and cellular membranes. The drought also cause disturbance water relations resulting from the decline in relatively water content of plant leaves(Sarhan, 2014). Potassium is considered one of more positive ions in plant, the amount of potassium in the cell, determines the action of enzymes that increase the rate of chemical reactions . Potassium stimulates more than 80 different enzyme and plants depend on potassium to regulate the opening and closing of stomata through pores, that is working on the exchange of CO_2 and water vapor and oxygen in the atmosphere, the work of the stomata is considered essential and necessary work to the process of photosynthesis and the transfer of nutrients and plant cooling.(Taiz and Zeiger ,2010) mention that the potassium is very important for the amount of water in the plant, the water absorption by the cells and tissues depends on the active absorption of potassium and the loss of a little amount of water of the plants well equipped with potassium is due to a decline in the rate of transpiration which does not depend on the Osmosic Potential in medium tissue cells only, but controls the opening and closing of stomata. The process of opening and closing the stomata depends on water and potassium absorption this is because the potassium ion pumping to the outside of the guardian cells leads to the Water comes out the guardian cells to adjacent cells and close the stomata to keep the water in the plant to resist drought, Abscisic acid works to increase the entry of and water absorption in the plant, and maintain them from wilting and raising its efficiency in resisting the drought conditions (Al-Desoki, 2008), some studies indicate that the ABA is responsible for the passage of potassium ion through the plasma membrane to the guardian or outside cells resulting in opening and closing of stomata (Kiani et al 2008) indicate that the accumulation of ABA because of the severity of the drought lead to the closure of the stomata and perfusion potassium ions to outside the guard cells. ABA production is considered a kind of physiological responses associated with resistance to drought. This hormone Extracted for the first time in 1965 by a group of scientists from the fruits of the cotton plant and called the abscisin (II), thereafter abscisin (II) is found in several types of tissues in many plants, ABA contains fifteen atom of carbon ($C_{15}H_{20}O_2$), and characterized a hexagonal composition ring, and non-corresponding center, and six of unsaturated carbon substitution. Studies indicate that the ABA composed in root response to the lack of soil water effort then moves to the leaves when there is a rapidly changing in initial water potentials of the guardian cells because of the contraction and closing of stomata, that the ABA works to close the stomata and reduce the transpiration process and prevents water loss from the leaves in times of low water readiness. Idris (2009) indicate to the ABA synthesizers in chloroplasts and ABA can be synthesizers from caroten and zanthovel and ABA

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concentration increasing in the tissues of plants when exposed to stress conditions such as the thirst (Deprive the plant from the water). Increasing the ABA concentration lead to increase the plant's ability to resist stress conditions through the work of ABA to close the stomata in the leaves, where the ABA is working to transform the sugars existing in the guardian cells to starch then the sugars concentration decreases in the guardian cells compared to adjacent cells leading to the spread of water from the guardian cells to the adjacent cells, this leads to closing the stomata because of a contraction (Zhu et al., 2010). The leave is considered the main center for the manufacture and the representation of food in the plant, so this research aims to study some of the physiological phenomena that occur in the plant leaves and is active during the drought, such as the concentration of proline acid, abscisic acid, malic acid, total chlorophyll and potassium ions, these qualities that make plants more resistant to drought and to improve its system of water works.

FIGURE 1. The chemical structure of abscisic acid.(Taiz and Zeiger ,2010)

MATERIALS AND METHODS

The experiment were conducted at the fields of College of Agriculture / University of Diyala of autumnal season 2015-2016 in sedimentary soil with silty clay classified to Typic Torrifluvent. Table 1 illustrates some of the chemical and physical properties of the soil (Page et al,1982). Using the split - split plot design, and arranging randomized complete block design (RCBD), In three replications, The moisture tension treatment are the main treatment, And spraying in potassium are secondary treatment, and spraying in abscisic acid (ABA) are sub secondary treatment. Experimental treatments include: adding three levels of available water 25% (W1), 50% (W2) and 75% (W3), Gravimetric method was adopted in the addition of water, and three levels of potassium concentration 5000,5500 and 6000 mg K. L-1 spraying on plants as potassium sulfate (K 41%),and three levels for spraying of ABA at concentration of 0.0 (ABAO), 10.0 (ABA1) and 20.0 (ABA2) mg . L¯. The first batch of 200 Kg.ha-1 of urea (46% N) Were added when agriculture, The second batch at the beginning of flowering and the formation of pods, Add 60 Kg.ha-1 trisuperphosphate (20% P) when agriculture only once. Planted the seeds of Faba bean cultivar (Toatha), on the border with the length 4m, and the distance between the barmaid and another is 0.68 m, with a space between treatments to prevent water leakage and transmission of fertilizers, used the method of Bates et al. (1973) for extraction proline by using Aqueous Sulfosalicylic acid. used the method of Srivastava and Prasad (2010) for extraction abscisic acid by using a High Performance Liquid Chromatography (HPLC), on the wavelength of 265 nm. Using Spectrophotometer apparatus in the estimation of the total chlorophyll on the wavelength of 645 و 665 nm according to the method of Hortiz (1975). Followed a method of Dalaly and Hakim (1987) in estimating the

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percentage of malic acid in leaves. Followed a method of Ryan et al.,2002 in estimating the potassium in the extraction of leaves by using Flame photo meter apparatus.

Table1. some of the chemical and physical characteristics of the soil before cultivation

The characteristics	Measurement units	The values
pH 1:1	-	7.48
EC 1:1	ds.m $^{-1}$	4.84
Available Nitrogen	mg.Kg^{-1} soil	57.00
Available potassium	mg.Kg^{-1} soil	286.00
Available Phosphorus	mg.Kg^{-1} soil	19.00
Gypsum	g.Kg^{-1} soil	2.30
Lime	g.Kg^{-1} soil	290
Organic matter	g.Kg^{-1} soil	4.40
SO4-2	cmol .Kg^{-1} soil	1.6
CO3-2	cmol. .Kg^{-1} soil	Nil
HCO3-2	cmol. .Kg^{-1} soil	0.07
Cl-1	cmol. .Kg^{-1} soil	3.20
Ca+2	cmol. .Kg^{-1} soil	30.80
Mg+2	cmol. .Kg^{-1} soil	14.00
Na+	cmol. .Kg^{-1} soil	16.90
Exchange capacity of cationic ions	cmol. .Kg^{-1} soil	20.20
porosity		42.00
Primary Moisture content	Cm^3.Cm^3	0.04
%For Moisture when Available water consumption	% 25	23.75
	50%	19.50
	75%	15.25
Soil texture	Clay g. Kg^{-1} soil	519.20
	Silt g. Kg^{-1} soil	438.20
	Sand g. Kg^{-1} soil	42.60
Texture	Silty clay	
Field capacity	%	28.00
permanent wilting point	%	11.00
Ready Water	%	17.00
Bulk Density	micagram.m -3	1.45

RESULTS AND DISCUSSION

Abscisic acid concentration in the leaves

The overlap results in the table (2) have shown Reduced the concentration of abscisic acid in leaves with increasing the additives potassium concentrations where it recorded the lowest average 0.206 mg .kg^{-1}, at a level of 6000 mg .kg^{-1} potassium and the highest average 0.445 mg .kg^{-1} at a level of 5000 mg .kg^{-1} potassium and this illustrates the inverse relationship

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between potassium and abscisic acid (Increasing the concentration of abscisic acid in the leave leads to a decline in the potassium concentration), where high concentrations of abscisic acid leads to change the water situation in the guardian cells and take out the potassium from the Guardian cells(K^+ Efflux) , increasing the amount of potassium in the Guardian cells leads to maintain the fullness of water, and when potassium deficiency because of abscisic acid, the guardian cells lose fullness in water, leading to the closure of the stomata, and reduce the transpiration process which helps the plant to maintain the water content which leads to resistance and drought tolerance (El-Desoki, 2008). The treatment of spraying abscisic acid outperformed significantly increasing in the quantity of abscisic acid in the plant, the increase at the level of 20 mg .kg^{-1} compared with the first level of 0 mg .kg^{-1} and second 10 mg .kg^{-1} in the different levels of moisture, where increases the plant content of abscisic acid when increasing the spraying of this hormone which is characterized in its positive role in drought resistance, closing the stomata, reduced the transpiration process, and increase in the movement of ions inside the root (Mohammed and Abu Dhahi, 2013). humidity levels of 25%, 50% and 75% Showed a high significant influence in abscisic acid concentration in leaves and an average of 0.139, 0.310, 0.472 mg .kg^{-1} respectively. These results are consistent with that of Saeedipour and Moradi (2012) an increase of the of ABA concentration multiple times in wheat plants under the influence of moisture tensile compared to wheat plants that do not suffer from the moisture tensile. Interference between spraying abscisic acid ABA2(20.0 mg.L^{-1}) and potassium K1(5000 mg.L^{-1}) shows insignificant effect on the ABA concentration 0.676 mg .kg^{-1} in leaves, the lowest average of ABA concentration 0.119 mg .kg^{-1} at a level of potassium spraying K3(6000 mg.L^{-1}) and in ABA0 (0 mg.L^{-1}). We note from the Table 2 significant effect of interference between the level of moisture W3 (75%) and potassium spraying K1(5000 mg.L^{-1}) as it recorded the highest average ABA concentration 0.679 mg .Kg^{-1} in leaves and the lowest average of ABA concentration 0.101mg .Kg^{-1} at the level of moisture W1(25%) and potassium spraying K3(6000 mg.L^{-1}). Interference between the moisture level W3(75%) and ABA at a level ABA2(20 mg.L^{-1}) shows insignificant effect on the first level of moisture W1(25%) and a level of ABA0 (0.0 mg.L^{-1}). The results showed the existence of three-overlapping between the study factors in this Characteristic, potassium spraying at a level K1 (5000 mg.L^{-1}) and ABA at a level ABA2(20 mg.L^{-1}) and a moisture level W3 (75%) gave the highest average 0.980 mg .Kg^{-1} of ABA, where the potassium spraying treatment K3(6000 mg.L^{-1}) and ABA0(0.0 mg.L^{-1}) and a moisture at a level W1(25%) gave the lowest average of ABA concentration0.036 mg .Kg^{-1}.

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Table 2. Effect of Potassium, abscisic acid and moisture levels in abscisic acid concentration in leaves (mg .kg⁻¹)

Potassium (K) mg. L^{-1}	Abscisic acid (ABA) mg. L^{-1}	Moisture 25%(W1) %	50% (W2)	75% (W3)	K* ABA
5000 (K1)	0.0 (ABA0)	0.058	0.156	0.250	0.154
	10.0 (ABA1)	0.240	0.467	0.808	0.505
	20.0 (ABA2)	0.341	0.709	0.980	0.676
5500 (K2)	0.0 (ABA0)	0.040	0.132	0.231	0.134
	10.0 (ABA1)	0.098	0.306	0.478	0.294
	20.0 (ABA2)	0.172	0.422	0.551	0.381
6000 (K3)	0.0 (ABA0)	0.036	0.103	0.219	0.119
	10.0 (ABA1)	0.079	0.188	0.308	0.192
	20.0 (ABA2)	0.190	0.309	0.430	0.310
LSD 0.05	0.230				0.153
					K average
K*W	K1	0.213	0.444	0.679	0.445
	K2	0.103	0.286	0.420	0.269
	K3	0.101	0.200	0.319	0.206
LSD 0.05	0.251				0.160
					ABA average
ABA*W	ABA0	0.044	0.130	0.233	0.135
	ABA1	0.139	0.174	0.531	0.281
	ABA2	0.234	0.480	0.653	0.455
LSD 0.05	0.209				0.160
W average		0.139	0.310	0.472	
LSD 0.05	0.160				

Proline acid concentration in leaves

The results in the table (3) indicate to superiority of significant effect K3 on the levels K1 and K2 by a percentage 46.36% and 33.58% under different moisture levels, spraying potassium be necessary for plants Faba bean, because bilateral monocots plants be less portability of mono monocots plants on potassium absorption from the soil because of the root hairs and the contact between the roots and soil, the portability grasses to absorption potassium from the soil be higher than in the Leguminosae (Fabaceae), proline concentration is increasing in leaves with increasing add ABA as the ABA2 (20 mg.L^{-1}) level shows significantly superiority 15.12% and 6.81% compared to the ABA0 (0 mg.L^{-1}) and ABA1 (10 mg.L^{-1}) level. the positive

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impact of ABA is characterized by its ability to stimulate the plant to produce proline acid that leads to increase the concentration of the cytoplasm and that leads to stimulate the process of water absorption and raising the plant portability to resistant droughts, Bano and Yasmieen (2010) found that ABA sprayed on the Wheat plants under moisture stress led to the lack of leaf area and raising the plant content of proline .Results showed increase in the proline concentration in leaves with a reduction in moisture content of the soil if the level W3 excellence on level W1 or W2 , these results are consistent with that of (Al-Mentafji, 2011) increase in proline content of the exhibition plant for tensile moisture where proline collect increasing because of the inability of the plant to biosynthesis of protein, which leads to increase the amount of amino acids within the plant, including the proline acid which is considered one of the defensive means to reduce the harmful impact of the drought, Drought stress Leads to stimulate the enzymes of the decomposition proteins and the production of amino acids, including a proline acid that works osmotic maintain, the role of proline in the stability and steadiness of cell membranes, to increase the ability of cells to absorb water, and nutrients dissolved in water from the growth medium (Mohammed, 2013). The results in the table (3) appear a significant overlap between potassium concentration and the concentration of ABA acid, the highest proline concentration of 9.38 mg .g^{-1} at K3 + ABA2, and the lowest proline concentration of 5.55 mg .g^{-1} at K1 + ABA0 with a significant increase of 69%.Table 3 also points to the existence of a significant overlap between moisture levels and levels of potassium spray, in the proline concentration in the leaves, as it gave the highest average 12.70 mg .g^{-1} at W3 + K3, and the lowest average 2.72 mg .g^{-1} at 1W + K1.Increased spraying potassium lead to reduces the negative impact of low humidity on the proline concentration where the overlap level W3 + K3 The excellence on the overlap level W3 + K1 and W3 + K2 with significant increased 30.65% 17.48%. overlap between moisture and ABA showed a significant excellence where the W3 + A2 treatment given the highest average of prolin 11.64 mg .g^{-1} compared with the rest of treatments and the lowest average 3.63 mg .g^{-1} in W1+A0 treatment, and the overlap between W3 + A2 excellence on the overlap W3 + A0 by a significant increase of 10.85%, any increase in the amount of proline in leaves when increased ABA spraying at low moisture levels. The results showed the existence of three-overlap between study factors in the concentration of proline in leaves, where the treatment ABA2 + K3 in W3 given the highest average 13.25 mg .g^{-1} proline, while the ABA 0 + K1 treatment at W1 has given the lowest average 2.11 mg .g^{-1}, and when comparing the spraying of Potassium and abscisic acid with low moisture levels Significantly excellence in the W3 + A2 + K3 on W3 + A0 + K1 illustrates increase of 42.01%, significantly overlap indicates to the Potassium and abscisic acid working to improve the Proline concentration in leaves , increased water stress lead to increasing the production of (Oxygen Species Reactive) and which causes oxidation of lipids in the cell membrane, low protein synthesis and increased proteolysis, superoxide roots interacts with proteins containing on gatherings S-Fe or Heam aggregates or sulfuric bonds, and it works on oxidation, and superoxide roots affecting in the transfer of electrons during the process of photosynthesis and in stroma enzymes in chloroplasts (AL-Hayani , 2015).

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increased proline lead to the lack of initial water potentials of the cell, and increase absorption of water from the roots (Kapoor et al., 2015), for this reason proline works to grab these roots or discarded, the accumulation of proline is considered the evidence of the extent of increasing concentrations of antioxidants, anti-free radicals (Gupta, 2011).

Table 3. Effect of Potassium, abscisic acid and moisture levels in proline acid concentration in leaves (mg .g⁻¹)

Potassium (K) mg. L^{-1}	Abscisic acid (ABA) mg. L^{-1}	Moisture 25%(W1) %	50% (W2)	75% (W3)	K *ABA
5000 (K1)	0.0 (ABA0)	2.11	5.22	9.33	5.55
	10.0 (ABA1)	2.65	5.75	9.79	6.06
	20.0 (ABA2)	3.40	6.33	10.05	6.59
5500 (K2)	0.0 (ABA0)	3.88	6.87	10.20	6.98
	10.0 (ABA1)	4.67	7.08	10.61	7.45
	20.0 (ABA2)	4.85	7.54	11.62	8.00
6000 K3)	0.0 (ABA0)	4.90	7.98	11.97	8.28
	10.0 (ABA1)	5.34	8.64	12.89	8.95
	20.0 (ABA2)	5.97	8.92	13.25	9.38
LSD 0.05			1.3		0.92
					K average
K*W	K1	2.72	5.76	9.72	6.06
	K2	4.46	7.16	10.81	6.64
	K3	5.40	8.51	12.70	8.87
LSD 0.05			1.7		0.8
					ABA average
ABA*W	ABA0	3.63	6.69	10.5	6.94
	ABA1	4.22	7.15	11.09	7.48
	ABA2	4.74	7.59	11.64	7.99
LSD 0.05			1.0		0.8
W average		4.19	7.14	11.07	
LSD 0.05			0.8		

The total concentration of chlorophyll

The results in table 4 indicated to the existence of a significant increase in the average concentration of chlorophyll by increasing the concentration of potassium, where the level of K3 excellence with an increase of 21.01%, 13.64% Compared to the level K1, K2. If increases photosynthesis and transmission their products by increasing of potassium concentration in leaves(Lateef, 2015). That good and balanced nutrition in terms of quantity and quality of nutrients and a date adding them and appropriateness with physiology age and stages of plant growth that can be secured with adding nutrients on the right time and in the critical stages of plant growth ensure access to good vegetative growth and then increase the efficiency of the process of photosynthesis in the plant leaves this leads to the increase of the chlorophyll content

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in leaves, and thus obtaining a good specifications plant can resist the extremist environmental conditions(Mahdi and Mohammed, 2009). from table 4 we also note that spraying in the ABA lead to reduce the concentration of chlorophyll in the plant leaves, where the ABA works to close the stomata and thus lower of the plant photosynthesis and transmission its products. The level W1 showed a significant excellence on the level W2 and W3 with an increase 20%, 37.98% respectively, the reason for the reduction of the amount of chlorophyll in the leaves by diminishing amounts of irrigation water to reduction average growth of leaves and reduction in the average division and cell elongation a result of increased initial water potentials of leaves thus reducing photosynthesis as a result of the reduction of open stomata, and initial water potentials is also operates on the reduction of the production of plant pigments including chlorophyll (Sarhan, 2014).Chlorophyll products shattering by Chlorophyllase and remove Mg molecules by Mg-dechelatase, it is believed that the digestion of proteins because of drought lead to the liberation of ammonia leading to the aging of leaves and Fallen (Verma and Verma.2010).spraying level ABA0 + K3 gave a highest average of chlorophyll concentration in plant leaves 880 µg $.g^{-1}$ and the lowest average 530 µg $.g^{-1}$ at level A2 + K1, significant overlap between two factors indicates to a reversal effect of potassium only to the improvement of this character.W1+K3 treatment Characterized by a significant excellence to the other treatment and with an average 886 µg $.g^{-1}$, and the lowest average concentration of chlorophyll 520 µg $.g^{-1}$ at treatment W3 + K1. when comparing low moisture levels with spraying potassium we note a significant excellence of the overlap of W3 + K3 level on the level K1 and a level W3with an increase of 26.92%.Record the highest average 933 µg $.g^{-1}$, at the overlap between moisture levels and spraying ABA levels at the level of W1 + A0, and the lowest average 500 µg $.g^{-1}$ at the level W3 + A2.The significant impact of triple overlap W, ABA, K on the concentration of chlorophyll in plant leaves if the highest average 1040 µg $.g^{-1}$ at the level of W1 + A0 + K3and the lowest average 420 µg $.g^{-1}$ at the level W3 + A2 + K1.

Table4. Effect of Potassium, abscisic acid and moisture levels in chlorophyll concentration in leaves (µg $.g^{-1}$)

Potassium (K) mg. L^{-1}	Abscisic acid (ABA) mg. L^{-1}	Moisture 25%(W1) %	50% (W2)	75% (W3)	K* ABA
5000 (K1)	0.0 (ABA0)	840	760	680	760
	10.0 (ABA1)	760	590	480	610
	20.0 (ABA2)	680	490	420	530
5500 (K2)	0.0 (ABA0)	920	790	710	806
	10.0 (ABA1)	750	670	530	650
	20.0 (ABA2)	690	520	490	566
6000(K3)	0.0 (ABA0)	1040	870	730	880
	10.0 (ABA1)	880	760	660	766
	20.0 (ABA2)	740	630	590	653
LSD 0.05	12.46				10.16
					K average
K*W	K1	760	613	520	633
	K2	786	660	576	674

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	K3	886	753	660	766
LSD 0.05	11.8				12.04
					ABA average
ABA*W	ABA0	933	806	706	815
	ABA1	796	673	556	675
	ABA2	703	546	500	583
LSD 0.05	2.8				12.75
W average		810	675	587	
LSD 0.05	12.75				

The percentage of malic acid in leaves

Table 5 shows the a significant effect of potassium spraying with increase in the percentage of malic acid in the leaves, as it was the highest increased of 1.60% at the level of K3. The appropriate potassium levels have great importance in the organization of the work of enzymes Including Malic dehydrogenase enzyme in Krebs cycle (Al-Desoki 0.2008).The results show increase in percentage of the malic acid in the leaves with a low amount of ABA spraying if the highest percentage of malic acid 2.34% at the level ABA0 and the lowest percentage of malic acid 0.77% at the level ABA2,Nambara and Marion-Poll (2005) indicate to ABA produces a response to all stress posed to plant whether it stresses water or saline or thermal, as the ABA works to prevent the transformation of starch into sugar, where the increase in the ABA concentration with drought in the leaves leads to exit potassium ions from the guardian cells to adjacent cells which leads to exit for water with potassium, and formation acidic medium in the Guardian cells, that leads to prevent acid formation in leaves (Taiz and Zeiger ,2010) .Table 5 also shows a significant decrease in percentage of the malic acid when low moisture content of the soil, If the highest average of 1.70% of malic acid at the level of W1 and the lowest average of %1.02 at the level of W3, the reason for this is to a decline in the vital activities in the vegetative part of the plant and obtain a defect in functional operations such as photosynthesis, respiration, transpiration, water and nutrient absorption. The overlap between K3+ ABA0 shows the highest average of malic acid 2.96% and the lowest average 0.73% at the level of K1 + ABA2,and these results indicate to the role of potassium increasing percentage of the malic acid. Table 5 also indicates also to the existence of a significant overlap between the humidity and potassium levels in increasing the percentage of the malic acid with the highest average 1.97% in leaves when the treatment is W1 + K3 and the lowest average 0.82% when the treatment W3 + K1. when comparing between the low level of moisture and potassium levels we note superiority of treatment W3 + K3 increased by 48.78% on the treatment W3 + K1.The superiority of overlap W1 + ABA0 significantly on the other levels of overlap it registered the highest percentage of malic acid 3.01% in leaves and the lowest average at the level of ABA2 + W3 0.65%, the reason may be due to the ABA accumulation and the inhibition of the growth of the apical meristem and decrease vegetative growth and defoliation which leads to a lack of access nutrients and metabolites from the leaves to the roots and other plant parts (Sathyamoorthi et. al.,2008).

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The overlap between the three factors, the study shows significant effect on percentage of the malic acid in leaves if it gave the highest average of malic acid 3.73% at the overlap W1 + ABA0 + K3, and the lowest average 0.61% At the overlap W3 + ABA2 + K1.

Table5. Effect of Potassium, abscisic acid and moisture levels in percentage of malic acid in leaves (%)

Potassium (K) mg. L^{-1}	Abscisic acid (ABA) mg. L^{-1}	Moisture 25%(W1) %	50% (W2)	75% (W3)	K* ABA
5000 (K1)	0.0 (ABA0)	2.40	2.11	1.02	1.84
	10.0 (ABA1)	1.21	0.96	0.84	1.00
	20.0 (ABA2)	0.81	0.77	0.61	0.73
5500 (K2)	0.0 (ABA0)	2.91	2.25	1.56	2.24
	10.0 (ABA1)	1.23	1.02	0.89	1.04
	20.0 (ABA2)	0.85	0.79	0.67	0.77
6000(K3)	0.0 (ABA0)	3.73	3.04	2.11	2.96
	10.0 (ABA1)	1.25	0.96	0.89	1.03
	20.0 (ABA2)	0.94	0.86	0.68	0.82
LSD 0.05	0.43				0.40
					K average
K*W	K1	1.47	1.28	0.82	1.19
	K2	1.66	1.35	1.04	1.35
	K3	1.97	1.62	1.22	1.60
LSD 0.05	0.30				0.36
					ABA average
ABA*W	ABAO	3.01	2.46	1.56	2.34
	ABA1	1.23	0.98	0.87	1.02
	ABA2	0.86	0.80	0.65	0.77
LSD 0.05	0.51				0.55
W average		1.70	1.41	1.02	
LSD 0.05	0.55				

Potassium concentration in leaves

Results in Table 6 shown K3 level excellence on the levels K1 and K2 and increased by 17.5%,7.6% under different moisture levels respectively, it is natural to increase the potassium amount in leaves increasing the spraying. Observed from Table also decrease potassium concentration in leaves by increased addition of ABA. These results are consistent with that of Bano and Yasmieen (2010) that the ABA is inhibiting the absorption of potassium in the Guardian cells. The results showed that the increase in the soil moisture lead to a significant increase in the potassium concentration in leaves it was the highest average of 47.3 mg .g^{-1} dry matter at the level of W1and the lowest average 25.5 mg .g^{-1} dry matter at the level of W3, lack of water lead to the acceleration of the rate of physiological processes, as a result of high temperature of the plant as well as the aging of leaves, drought stress also leads to the

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intercellular spaces in mesophyll become small this leads to a significant reduction in water conductivity of the tissue, as well as the loss of plastids Capacity and the inhibition of interactions of light for photosynthesis and reducing the activity of photosystem (PS II) (Sarhan, 2014).The drought stress have a negative impact in the presence of nutrients in the leaves including potassium. The overlap between the spraying potassium and abscisic acid shows significant effect in the potassium concentration in the leaves, and the superiority of treatment K3 + ABA0 the treatment ABA2 + K1 increased by71.4% the different levels of moisture. As for the effect of overlap between moisture levels and potassium levels, where the treatment W1 + K3 gave the highest average 52.2 mg .g^{-1} of potassium and the lowest average 23.7 mg .g^{-1} in the treatment W3 + K1.When comparing the potassium spraying levels with the level W3 there were significant differences at the increase in potassium spraying as the W3 + K3 level excellence on the W3+K1 level by 15.1%, the low of potassium concentration in leaves at the lower levels of moisture may be due to the general decline in the vegetative part because of the lack of water for a long time lead to a decline in the concentration of Cytokinins the plant would then resorted into a Eco dormancy phenomenon and reduced the elements absorption, while providing water to restoring growth and absorption (Lateef , 2015).significant superiority of W3 + ABA0 level on the W3 + ABA2 level by 47.5% this indicates increasing the potassium concentration in leaves with a decline of the ABA concentration. The results indicated that there were significant differences Between the three study factors in Potassium concentration if treatment ABA0 + K3 gave The best average 70.3 mg .g^{-1} at the W1 level, and the lowest average 19.0 mg .g^{-1} at the ABA2 +K1and W3 level with a significant superiority when compared between the Potassium and abscisic acid at the level of W3 where the results indicates to superiority of the level W3 + ABA0 + K3 on the level W3 + ABA2 + K1 increased by 71.5%, open and the closure process of the stomata with water and potassium absorption process this is because the pumping potassium ion(K^+) to outside the guard cells Lead to the water goes from the Guardian cells to the adjacent cell, and then closing the stomata to keep water which makes them resistant to drought, The existence of ABA increases the enter of water and absorption, and then maintains the plant from wilting and raising its efficiency in resisting the drought conditions (Taiz and Zeiger.2010).Some studies indicate that the ABA is responsible for the transmission of potassium ion across the plasma membrane to the guardian cells or outside, this results in opening and closing of stomata (Mohammed, 2013). (Gupta , 2011) Confirms that the ABA accumulation because of the drought stress leads to closing the stomata and leakage of potassium ions to the outside the guardian cells.

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Table 6. Effect of Potassium, abscisic acid and moisture levels in potassium concentration in leaves (mg .g-1 dry matter)

Potassium (K) mg. L-1	Abscisic acid (ABA) mg. L-1	Moisture 25%(W1) %	50% (W2)	75% (W3)	K ABA
5000 (K1)	0.0 (ABA0)	47.1	39.2	28.6	38.3
	10.0 (ABA1)	43.3	34.5	23.2	33.6
	20.0 (ABA2)	37.2	30.1	19.0	28.7
5500 (K2)	0.0 (ABA0)	56.2	41.6	30.2	42.6
	10.0 (ABA1)	45.6	38.0	25.8	36.4
	20.0 (ABA2)	39.8	32.6	21.2	31.2
6000(K3)	0.0 (ABA0)	70.3	44.9	32.6	49.2
	10.0 (ABA1)	45.8	39.7	27.5	37.6
	20.0 (ABA2)	40.7	32.9	21.8	31.8
LSD 0.05	9.0				11.5
					K average
K*W	K1	42.5	34.6	23.7	33.6
	K2	47.2	37.4	25.7	36.7
	K3	52.2	39.1	27.3	39.5
LSD 0.05	5.5				3.0
					ABA average
ABA*W	ABAO	57.8	41.9	30.4	43.3
	ABA1	44.9	37.4	25.5	35.9
	ABA2	39.2	31.8	20.6	30.5
LSD 0.05	4.2				6.3
W average		47.3	37.0	25.5	
LSD 0.05	6.0				

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