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Effect of some herbicides on licorice control

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Abstract:*A field experiment was conducted at the experiment field in Crop Science Department – College of Agriculture – Univ. of Baghdad in AL-Jadiryaduring the spring seasonof 2017 to identify the effect of the herbicides: 2,4-d with three concentrations (150 gm.activeingredient/ donum^{-1} , 200 gm.active ingredient/donum^{-1} and 250 gm.active ingredient/ donum^{-1}) , Glyphosate with three concentrations also (0.50 Lt.active ingredient/donum^{-1} , 1 Lt. active ingredient/donum^{-1} and 1.50 Lt.active ingredient/donum^{-1})on the control of settled licorice plant in the agricultural fields. The experiment was applied by randomized completely blocked design (RCBD) with three replications. The results showed that 2,4-d at concentration of 150 gm.donum^{-1} was advanced in the characters of dry weight, percentage of control and percentage of inhibitiondry weight with no significant differences from other concentrations of the same herbicide, the results indicated also that glyphosate in concentration of 1 L .donum^{-1}showed good effectiveness on licorice control and reducing its growth , but the herbicide 2,4-d was more exceeded in all concentrations that reflected the effectiveness of 2,4-d on licorice control and preventing it from growing again after spraying with herbicide compared with comparison treatment in which licorice continued growing.*

Keywords:*licorice, 2,4-d, Glyphosate*

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I. Introduction

Licorice (*Glycyrrhizaglobara* L.) is one of the legume family weeds that is a perennial weed which is reproducing with seeds and the root nodes, there are30 species of this weed in the world but the specie *Glycyrrhizaglobara*L. is the more common in Iraq , its height reached 3-7 feet, its roots grow vertically to depth of 4 feet and spread horizontally more than 8 feet. This weed exists mostly in middle east regions and the Mediterranean (Chakavarty, 1976).

This weed considered one of the most dangerous and disturbingherbicides competing crops on necessary growth requirements causing losses in crop which reached sometimes to 80% (Gianessi, 2009) in addition it causes regression in product quality and view distortion of the fields in which it exists, in addition to that it causes reduction in agricultural fields prices . The spread of such weeds without control causes high economic losses reached about 35 million dollar in Nebraska (Klein,2012) . The chemical herbicides control by using herbicides has become an effective application in weeds control increasing crop productivity using about three million tons of herbicides in the world to control such weeds and reduces its spread (Stephenson, 2000). 2,4-d herbicide is one of the widely used herbicides all over the world and considered the 3rd most important herbicide used in north America (Lerda and Rizzi, 2009) that controls broad leave weeds after spraying on vegetative growths or after germination (Al-Baldawi and Al-Naqib , 2011 and Kumar and Singh, 2010), Glyphosate is also used widely and considered one of the non-electoral herbicides that kills most plants preventing them from forming proteins they need in growth. It also stops a specific enzyme pathway, the shikimic acid pathway which causes plants death shortly after spraying (Henderson et al. 2010).

In order to control and reduce spread of licorice plant in experimental fields at the college of Agriculture/ Baghdad University in Al-Jadirya , the experiment was carried out using the herbicides 2,4-d and glyphosate.

II. Materials and Methods

After making a survey to the experimental fields of Field Crop Sciences department, the experiment was conducted at the mostmatching and intensive site in plant age. The experiment was carried out at the experimental field (botanic garden) in the spring season of 2017 by using the two herbicides 2,4-d and glyphosate with three concentrations for each herbicide as follows:

2,4-D (150 gm active ingredient / donum^{-1}, 200 gm active ingredient /donum^{-1} and 250 gm active ingredient / donum^{-1})Glyphosate also (0.50 Lt. active ingredient/ donum^{-1}, 1 Lt. active ingredient/donum^{-1} and 1.50 Lt. active ingredient /donum^{-1})

The experiment was applied by randomized completely blocked design (RCBD) with three replications .Licorice plants sprayed with herbicides when the plants reached a height of (20-25 cm) 6 leaves (Veisi, 2015). A sixteenth liter sprayerwas used and has been calibrated based on the use of 400 Lt. of water.Ha^{-1}.

The land was divided into experimental units of one square meter. The experimental unit included 12-19 plants of licorice. The herbicides were sprayed in the morning on 1/4/2017.

The characters studied:

1- % frequency = number of specie appearance / number of squares studied × 100

2- %Abundance= number of individuals in specie/number of individuals in all species in studies sample × 100

3- Plant density = number of individuals in specie /plant area .m^2

4-dry weight of vegetative parts (g): vegetative growths were cut from a square meter area and put in perforated paper bags , dried in electrical oven at 80°c for 24 hours and then their dry weight was measured .

5- % inhibition = $100 - \frac{A}{B} \times 100$

That is :

A= dry weight of weeds in weed control treatment

B= dry weight of weeds in weedy treatment (comparison)

6. control percentage :

$$\% \text{ control} = \frac{\text{Number of weeds in comparison treatment} - \text{number of weeds in control treatment}}{\text{Number of weeds in comparison treatment}} \times 100$$

(Ciba-Giegy,1977).

Regrowth of vegetative parts:

In order to estimate the percentage of dry matter accumulation in the new vegetative parts that grow again affected by different treatments, after cutting vegetative parts and measuring the dry weight the plants were left to grow and after one month from cutting the new germinations were cut from one square meter and put in perforated bags and dried in electrical oven on 80 °c for 24 hours, then the ratio of recovering was measured and compared with comparison treatments which recovered completely 100% (Weerasinghe and Chandrasena 1994).

8. Statistical analysis:

The data were statistically analyzed by usingGenstate according to RCBD program, and mean coefficients of the treatments were compared by using low significant difference taste (L.S.D.) at a significant level of 0.05 (Steel and Torri, 1980).

Table (1) shows the names of chemical herbicide as commonly used

Trade name	Common name	Chemical name
Hedonal , trinoxol	2,4-D	C8H6CL2O3
Round up	Glyphosate	$C_3H_8NO_5P$

III. Results and Discussion

First: the percentage of frequency, percentage of Abundance and plant density

The results of Table (2) showed significant differences in the percentage of frequency of licorice emergence in the experimental units. Treatment T6 gave highest frequency percentage of 93.6% compared to T2 treatment which gave lowest percentage of 54.0 % in square meter, whileT7 gave frequency percentage of 90.5% compared with other species of weeds , the same table showed also that T6 gave highest Abundance percentage in licorice weeds of 125.6% compared to T1 which gave lowest percentage Abundance of 121.5 and 121.4 respectively.

The same table showed that T6 gave highest plant density in licorice/m^2 of 19.67 plant/m^2 compared with T2 which gave lowest plant density of 11.3 plant/m^{2}this due to that T6 gave highest frequency percentage of licorice and T2 gave the lowest frequency percentage of licorice which reflected highest and lowest plant density for the same weed by the two treatments.

Table (2) shows averages of frequency ,Abundance and density (plant.m^{-1}) on weeds before spraying herbicides

Treatments /before praying	Frequency%	% Abundance	Plant density
T1	74.5	73.9	15.67
T2	54.0	121.5	11.33
T3	79.4	85.0	16.67
T4	79.4	98.5	16.67
T5	88.9	110.8	18.67
T6	93.6	125.6	19.67
T7	90.5	121.4	19.00
L.S.D 5%	10.03	15.10	2.10

Second: the effect of different herbicides concentration on dry weight of weeds (gm.m^{-1}) and percentage of inhibition and control .

The results of Table (3) showed significant differences in the effect of different types of herbicides and their different concentrations in the control percentage . 2,4-d treatment (150g.d) T4 and T5 (200 g.d) gave highest control percentage of 96.82% 95.30% compared with comparison treatment T7 and T1 (Glyphosate 0.50 L.D) and T3 (Glyphosate 1.50 L.D.)which gave lowest control percentage of 0.0 , 53.36% and 56.55% respectively.

The same table showed that T6 2,4-D (250 g.d) gave control percentage of 91.78% , this is due to its effectiveness in broad leaves weeds control including licorice, this result agreed with the results of Al-Baldawi and Al-Naqeeb(2011) and Kumar and Singh(2010) who found high effectiveness of 2,4-d in broad leaves weeds control. The table showed significant differences in the effect of types and concentrations of herbicides in weeds dry weight (gm.m^{-1}) when T4 (2,4-d 150 g.d) gave the lowest dry weight in licorice weed of 89.0 gm which was not significantly different from T5 (2,4-d 200 g.d) , T6 (2,4-d 250g.d) and T2 (1 L.dGl-) which gave dry weight of 90.70 , 90.95 and 95.90 gm.m^{-1} respectively compared with comparison treatment which gave highest dry weight of 227.0 gm.m^{-1}. The reduction on dry weight of licorice weeds was due to the high ratio control of this weed in the same treatments (table 3) in which dry weight was decreased that confirms the effectiveness of 2,4-d herbicide in controlling and reducing growth of vegetative parts of this weed and the reflection of high control ratio in its dry weight.

The table also indicates significant differences between different treatments in inhibition ratio of dry weight as T4 (2,4-d 150 g.d) gave highest inhibition ratio of 60.81% which did not differ significantly from T5 (2,4-d 200 g.d) , T6 (2,4-d 250 g.d) and T2 (1L.d Gl-) that gave inhibition ratio of 60.09% , 57.85% and 57.77% respectively compared with comparison treatment T7 in which weeds growth continued without any inhibition on dry weight. The high rate of inhibition on dry weight is only a reflection to control ratio and dry weight which is directly proportional to the inhibition ratio.

It is generally observed from the tables that treatment with 2,4-d in concentration of 150 g.d gave better results in increasing control percentage and inhibition ratio on dry weight and reducing dry weights of weeds despite increasing in frequency ratio, Abundance and weed density in the same treatment (table 3). Treatment with 2,4-d in concentration of 150 g.d did not much differ from other concentrations of herbicide indicating that 2,4-d showed effectiveness and killed weeds vegetative germinations.also Its noted that the highest concentration of glyphosate herbicide showed effectiveness in control but 2,4-d exceeded in most studied characters.

Table (3) shows the effect of different treatments on dry weight and percentage of inhibition and control

Treatments	Dry weight of weeds (gm.m^{-1})	Percentage of inhibition %	Percentage of control %
(T1)Glyphosate 0.50 L.a.i/D^{-1}	121.50	46.48	53.36
(GlyphosateT2) 1 L.a.i/D^{-1}	95.90	57.77	64.95
(T3)Glyphosate 1.50 L.a.i./D^{-1}	106.00	53.33	56.55
(T4)2,4-D 150 gm.a.i./D-1	89.00	60.81	96.82
(T5)2,4-D 200 gm.a.i./D-1	90.70	60.09	95.30
(T6)2,4-D 250 gm.a.i./D-1	95.70	57.85	91.78
(T7)Control (Weedy)	227.00	0.00	0.00
L.S.D 5%	8.69	3.77	4.59

Third: growth restoration

Table (4) showed significant difference between different treatments in growth restoration character and activity of vegetative germinations cut from the soil surface as the comparison treatment T7 exceeded in giving highest ratio in growth restoration of 100% whereas T5 (2,4-d 150 $g.d^{-1}$) and T6 (2,4-d 200 $g.d^{-1}$) did not give any vegetative growth after cutting vegetative parts which indicated the efficiency of herbicide 2,4-d by the two concentrations above in completely killing the plant (table 3) and fully eliminating its growth.

As noted by the table, the rest herbicides treatments were somewhat effective in preventing growth restoration by vegetative parts which may indicates that the herbicides were effective not only on vegetative germination but also on the ground parts of the plant which have the ability to supply the plant with vegetative germinations even after cutting the vegetative part from soil surface and this due to the systemic nature of the two herbicides.

Table (4) shows the effect of different treatments in growth restoration of vegetative parts

Treatments	% growth restoration
(T1)Glyphosate 0.50 L.a.i./D^{-1}	41.70
(GlyphosateT2) 1L.a.i./D^{-1}	33.30
(T3)Glyphosate 1.50 L.a.i./D^{-1}	25.00
(T4)2,4-D 150 gm.a.i./.D-1	0.00
(T5)2,4-D 200 gm.a.i./D-1	0.00
(T6)2,4-D 250 gm.a.i./D-1	11.7
(T7)Control (Weedy)	100.00
L.S.D 5%	13.91

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