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Effect of sowing date and herbicides on Chickpea (*Cicer arietinum* L.) growth, yield, yield components and companion weeds under rain-fed conditions at Duhok governorate.

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Abstract

This experiment was carried out at the research farm of Field Crops Department, Agricultural College, University of Duhok, Kurdistan Region-Iraq during spring season 2015-2016. The experiment comprised of three sowing date (15 February, 1 March and 15 March) and four herbicide treatments (Propyzamide, Haloxyfop, Trifluraline and weedy Check). The experiment laid out in a split plot design based on the randomized complete block design (RCBD) with three replications assigning sowing dates in the main plots and herbicide treatments in the sub-plots. Results revealed that the Haloxyfop had good effect on reducing the number of narrow leaved weeds per m^2 followed by Trifluraline which recorded 0.44 and 8.00 respectively. The application of Trifluraline herbicide at 15-February sowing date gave lowest dry weight of broad leaved weeds 86.80 g/m^2 , maximum plant height (48.33 cm) , 100-seed weight (30.50 g) , harvest index (34.17%) and the highest seed yield 2499.52 kg ha^{-1} which cause to increasing yield 120.37% compare to weedy check at the same date of sowing.

Keywords: *Cicer arietinum* L., Sowing date, Haloxyfop, Trifluraline, Propyzamide.

Introduction

Chickpea(*Cicer arietinum* L.) is considered as one of the most important grain legumes all over the world. It is used widely in public foods, and in various commodities and recipes. Chickpea has great nutritive value as it contains a high percentage of protein. In Iraq, it ranks as a second grain legume after faba bean. Its cultivation is concentrated in the northern governorates including Sulaymania, Duhok, Erbil and Ninevah, covering an area of 14,000 ha with average yield of 0.74 t ha^{-1} (1). Chickpea is the third major legume crop in the world after dry bean at 19 million tons (MT) and field pea at 10.3 MT (6). Chickpea, however, is a poor competitor to weeds because of slow growth rate and limited leaf area development at early stages of crop growth and establishment (2). Nevertheless, almost all values reflect the seriousness of the weed problem. Yield losses were observed to vary between 40 to 94% in the Indian subcontinent. Post emergent applications need great care with respect to stage of growth and air temperature to avoid phytotoxicity (3). Weeds infestations also deteriorate the quality of seed which create storage problem and also effect market rate of the product. Saxena(32) reported 30-50% annual loss due to weeds.

The problem of weeds in chickpea is so severe due to lack of suitable weed control measures. Current chickpea weed control strategies include crop rotations, mechanical practices, hand weeding and mostly application of pre emergence herbicides usually farmers go for manual weeding under such situation. However, availability of labour and cost involved make them to seek for other cheaper alternatives for weed control. The use of post emergence herbicides for season long weed control is thus, preferred over early use of herbicides (14). Since work on post emergence herbicides especially in chickpea is meager,

an attempt has been made to evaluate the efficacy of post emergence herbicides for effective control of weeds in chickpea (11).

Among the various agronomic practices, sowing time is single most important factor influencing the yield of chickpea. Optimum sowing time of chickpea may vary from one variety to another and also from one region to another due to variation of agro-ecological conditions (37). Ozdemir and Karadavut(23) reported a 102% yield increase in autumn sowing over spring sowing. Date of sowing plays an important role in yield and yield attributes of chickpea (35 and 30). Delayed sowing reduces growing period, hastens maturity and ultimately reduces yield. The purpose of this experiment was to identify the problem of weed species in chickpea crop in the Kurdistan region- Duhok to evaluate several herbicides for selective weed control and to find out the suitable sowing date of chickpea.

Material and Methods

Site description and experimental design:

This experiment was conducted at the research farm of Field Crops Department, Agricultural College, University of Duhok, Sumail County, Kurdistan Region- Iraq during spring season 2015-2016. The site is located at

latitude 36° 51 38́ N, longitude 42° 52́ E, altitude 473 m above sea level. The soil was clay with (pH 7.8, O.M. 2.56%, E.c. 1.02 ds^{-1}, N 28.89% and P 0.0294%). The agro-meteorological station on the experimental site recorded monthly minimum, maximum and average temperature, relative humidity and rainfall that presented in (Table 1). Total Rainfall total in experimental site was 468.1 mm and rainfall distribution were 44.26 % in fall, 46.46 % in winter and 9.27 % in spring. The experiment comprised of three sowing date (15 February, 1 March and 15 March) and four herbicides Propyzamide,

Haloxyfop, Trifluraline and weedy Check (Table 2). The experiment laid out in a randomized complete block design (RCBD) as a split plot arrangement with three replications assigning sowing dates in the main plots and herbicide treatments in the sub-plots. Each sub-plot consisted of 4 rows 3m long, 0.25 m row spacing, 0.15 m plant distance and 0.5 m space which was intended between any 2 neighboring plots. Replications were spaced apart 2 m from each other. The seeds of local variety were sown by hand and placed at 5 cm deep.

Measurement of traits and Statistical analysis:

Weed sampling: The weed biomass was identified by experts of plant taxonomy in the College of Agriculture and then classified to narrow and broad leaved. Quadrate samples for each group were counted in an area of 1.0 m^2. Dry weight was obtained after 48 hours of oven-drying weed plants at 70ºc for the two groups of weeds. Also the number and dry weight of narrow and broad leaved were recorded (Table 3).

- Crop: Ten plants from each plot were used to measure yield components and morphological characters of plant. Measurement characters included plant height (cm), height of the lowest pod from soil surface (cm), number of primary branches / plant, number of pods per plant, number of seeds per plant, weight of 100 seed (g), biological yield (g $plant^{-1}$), harvest index (%) and seed yield (kg ha^{-1}). The recorded data was statistically analyzed with analysis of variance according to RCBD design using statistical analysis system (SAS, 2001), and the significant differences among the means were tested by DMRT at probability 0.05 (5).

Results and Discussion

Tables 4 and 5, represented non-significant differences among sowing dates on number of narrow leaved weeds, but regarding the

Table 1: Average values of Maximum and Minimum Temperature (ºC), Relative Humidity of Air(%) rainfall (mm) during the season of study in 2016 at Sumail Location*

Month	Monthly absolute minimum temperature C	Monthly absolute maximum temperature C	Average temp. C	Relative humidity %	Precipitation mm
September 2015	19.50	39.01	29.25	28.00	20.0
October	16.20	29.34	22.77	50.60	41.8
November	06.88	18.72	12.80	73.20	58.4
December	01.27	13.52	07.39	74.00	87.0
January 2016	01.40	10.60	06.00	78.40	90.5
February	04.50	16.83	10.66	74.80	39.0
March	06.57	18.81	12.69	70.40	88.0
April	11.01	25.69	18.35	56.70	40.6
May	14.90	31.56	23.23	41.40	02.8
					468.1

***** Source: Agro-Meteorological Station of Agricultural College, 2016.

Table 2: Some information of herbicide used in the experiment

Common Name	**Trade Name**	**Formulation**	**Application rate (kg a.i. ha^{-1})**	**Time of application**
propyzamide	Kerb	50% W.P.	1.5	Post emergence (3-4 leaf stage of crop)
Haloxyfop - methyl	Gallant Super	10.8% E.C.	0.108	Post emergence (3 leaf stage of narrow leaved weeds)
Trifluraline	Treflan	48% E.C.	1.152	Pre-plant soil incorporated

W.P.: Wettable powder, E.C.: Emulsifiable Concentrate.

number of broad leaved weeds was significant. However the highest number was recorded for delay sowing date (15-March). Among herbicide treatments , the Haloxyfop had good effect on reducing the number of narrow leaved weeds followed by Trifluraline which recorded 0.44 and 8.00 respectively, while Trifluraline followed by Propyzamide recorded lowest number of broad leaved weeds 14.66 and 16.88 respectively. Also the same trend was shown about dry weight of narrow and broad leaved weeds which Haloxyfop recorded lowest dry weight of narrow leaved weeds 2.40 g/m^2 but

Table 3: Common weeds accompanied with chickpea field during the spring season 2016.

	Scientific name	Family name
Narrow leaved weeds		
1	*Phalaris minor* Retz.	Poaceae
2	*Hordeum glaucum* Steud.	Poaceae
3	*Cyperus rotundus* L.	Cyperaceae
4	*Cynodon dactylon* (L.)Pers.	Poaceae
5	*Avena fatua* L.	Poaceae
6	*Sorghum halepense* (L.)Pers.	Poaceae
Broad leaved weeds		
7	*Malva sylvestris* L.	Malvaceae
8	*Convolvulus arvensis* L.	Convolvulaceae
9	*Polygonum aviculare* L.	Polygonaceae
10	*Euphorbia helioscopia* L.	Euphorbiaceae
11	*Hypericum perforatum* L.	Hypericaceae
12	*Vaccaria pyramidata* Medik.	Caryophyllaceae

13	*Sinapis arvensis* L.	Brassicaceae
14	*Trifolium campestre* Scherb.	Fabaceae
15	*Lactuca serriola* L.	Asteraceae
16	*Cichorium intybus* L.	Asteraceae
17	*Centaurea iberica* Trevir. Spreng.	Asteraceae
18	*Sonchus oleraceus* L.	Asteraceae
19	*Xanthium strumarium* L.	Asteraceae
20	*Silybum marianum* (L.) Gaertn	Asteraceae
21	*Carthamus oxycantha* Bieb.	Asteraceae

highest weight was 237.70 and 227.55 g/m^2 for weedy check

treatments of narrow and broad leaved weeds respectively.

This result supported by Yasin *et.al*.(38) and Gollojeh *et. al*.(9) who reported the efficient control of grass weeds by selective herbicides. Also the results were agreement with findings by Yousefi *et. al*.(39) who observed the Trifluraline application cause to increase the control of weeds in chickpea field due to inhibition action of that herbicide in seed germination of weeds.

Concerning the interaction of sowing dates with herbicide treatments, the lowest number and dry weight of narrow leaved weeds was shown at Haloxyfop herbicide application at first and third sowing dates which was zero and the highest value related to check. The lowest number of broad leaved

Table 4: Analysis of variance on different traits of chickpea and companion weeds.

Source	Degree of freedom d.f.	Number of narrow leaved weeds m^{-2}	Number of broad leaved weeds m^{-2}	Dry weight of narrow leaved weeds $g\ m^{-2}$	Dry weight of broad leaved weeds $g\ m^{-2}$	Plant height (cm)	Lowest pod height (cm)	Number of primary branches $plant^{-1}$	Number of pods $plant^{-1}$	Number of seeds $plant^{-1}$	100-seed weight (g)	Biological yield (g $plant^{-1}$)	Harvest index (%)	Seed yield (kg ha^{-1})
Block	2	17.33	12.44	94.4	370	0.861	6.583	0.11111	0.67	0.443	0.1108	0.03	0.139	204
SD (Sowing date)	2	57.33 n.s.	283.11	11628.6	8108.1	51.194	35.583	0.36111 n.s.	86.163	62.103	18.0758	48.094	29.956	191960
Error a	4	36.67	13.78	507	127.4	0.444	1.542	0.06944	1.173	1.487	0.7942	2.828	5.976	1356
H (Herbicide	3	996.74	150.96	89144	27412.5	125.361	48.769	0.2222 n.s.	288.339	358.2	43.162	165.515	177.101	617072

s)														
D*H	6	54.96 n.s.	60.3 *	13760	1711.3	10.861 *	6.435 *	0.1389 n.s.	7.43	3.342 n.s.	1.444 *	1.325 n.s.	8.691 *	11952 *
Error b	18	24.8888	21.6294	674.888	267.172	3.6944	1.8518	0.1944	1.56411	1.7388	0.4871	0.6422	2.7918	3002.88
Error	22	27.03	20.2	644	241.8	3.104	1.795	0.1717	1.493	1.693	0.543	1.04		2704
Total	35													

n.s.,* represented non-significant, significant at 0.05 level respectively.

Table 5: Effect of sowing dates, herbicides and their interaction on number and dry weight of narrow and broad leaved weeds.

Herbicides	Number of narrow leaved weeds m^{-2}				Number of broad leaved weeds m^{-2}				Dry weight of narrow leaved weeds ($g\ m^{-2}$)				Dry weight of broad leaved weeds ($g\ m^{-2}$)			
	Sowing date (15-February)	**Sowing date (1-March)**	**Sowing date (15-March)**	**Mean of herbicides**	**Sowing date (15-February)**	**Sowing date (1-March)**	**Sowing date (15-March)**	**Mean of herbicides**	**Sowing date (15-February)**	**Sowing date (1-March)**	**Sowing date (15-March)**	**Mean of herbicides**	**Sowing date (15-February)**	**Sowing date (1-March)**	**Sowing date (15-March)**	**Mean of herbicides**
Propyzamide	12.00 cd	9.33 De	21.33 B	14.22 b	13.33 B	16.00 b	21.33 b	16.88 B	78.93 de	103.07 D	100.27 d	94.10 b	104.67 de	95.20 e	140.67 c	113.51 b
Haloxyf	0.00	1.33	0.00	0.44	16.00	20.0	30.6	22.22	0.00	7.20	0.00	2.40	105.20	141.	131.	126.13

op	e	E	E	d	B	0 b	6 a	A	F	F	f	d	de	3 c	87 cd	b
Triflura line	9.33 de	9.33 De	5.33 De	8.00 c	14.66 B	16.00 b	13.33 b	14.66 B	28.40 F	121.20 Cd	46.67 ef	65.40 c	86.80 e	124.80 cd	129.73 cd	113.77 b
Check	25.33 ab	20.00 Bc	30.66 A	25.33 a	17.33 B	18.66 b	33.33 a	23.11 A	169.87 B	164.00 Bc	379.20 a	237.70 a	188.80 b	204.40 b	289.47 a	227.55 a
Mean of sowing dates	11.66	10.00	14.33		15.33 B	17.66 b	24.66 a		69.30 C	98.86 B	131.53 a		121.36 c	141.43 b	172.93 a	

Values within each set of means followed by the same letter are not significantly different at p=0.05 according to Duncan's M.R.T., 1

Table 6: Effect of sowing dates, herbicides and their interaction on plant height, lowest pod and number of primary branches of chickpea.

Herbicides	Plant Height (cm)				Lowest pod height (cm)				Number of primary branches plant $^{-1}$			
	Sowing date (15-February)	**Sowing date (1-March)**	**Sowing date (15-March)**	**Mean of herbicides**	**Sowing date (15-February)**	**Sowing date (1-March)**	**Sowing date (15-March)**	**Mean of herbicides**	**Sowing date (15-February)**	**Sowing date (1-March)**	**Sowing date (15-March)**	**Mean of herbicides**
Propyzamide	44.00 b	43.66 b	42.00 bc	43.22 a	23.66 bc	22.00 cd	21.00 D	22.22 a	3.33	3.33	3.00	3.22
Haloxyfop	47.00 a	42.33 bc	41.33 bc	43.55 a	26.33 a	23.66 bc	20.00 De	23.33 a	3.66	3.33	3.00	3.33
Trifluraline	48.33 a	43.33 b	40.00 c	43.88 a	26.00 ab	22.00 cd	21.33 Cd	23.11 a	3.66	3.00	3.33	3.33

Check	36.33 d	36.00 d	36.00 d	36.11 b	18.33 e	18.33 e	18.33 E	18.33 b	3.00	3.00	3.00	3.00
Mean of sowing dates	43.91 a	41.33 b	39.83 b		23.58 a	21.50 b	20.16 B		3.41	3.16	3.08	

Values within each set of means followed by the same letter are not significantly different at p=0.05 according to Duncan's M.R.T., 1955.

weeds was shown in Propyzamide application at February15 sowing date (13.33) and the same value was recorded for Trifluraline application at March15 sowing date. But the lowest dry weight of broad leaved weeds was for Trifluraline application at first sowing date 86.80 g/m^2. These results were in accordance with those

achieved by Ala and Mazid (24) and Sarparast and Sheikh (31) that reported the application of Propyzamide admixture with Terbutyn compare to weedy check gave good result in controlling of weeds. Also Majnon Hosseini, 1994 (17) indicated that the Trifluraline application for controlling of chickpea weeds was more effective in reducing of competition effects.

Data from Tables 4 and 6 indicated significant differences among sowing dates in plant height and lowest pod height. The greater height was recorded at early date of sowing 43.91 cm and 23.58 cm for plant and lowest pod height traits respectively. Ozdemir and Karadavut(23) and Valimohammadi *et. al*.(37) represented that plant height influenced by sowing time. Also,

according to Rahemi and Soltani (28) and Shamsi(33), the height of the first pod from soil surface increases with earlier planting dates. Regarding to herbicide treatments the maximum plant height was recorded at Trifluraline treatment (43.88cm) which was no-significant with other studied herbicides. This result is in agreement with Marwat *et al*.(18) and Larik *et al*(15).

The interaction of sowing dates with herbicide treatments represented that maximum plant height was recorded for February15 sowing date with Trifluraline followed by Haloxyfop application at the same date of sowing 48..33 and 47 cm respectively, also the same trend was shown for the lowest pod

height trait. However, the minimum height for plant and lowest pod height was recorded for weedy check treatments at different sowing dates.

Concerning the number of primary branches per plant, non-significant differences were recorded for sowing times, herbicide treatments and their interaction. This trait

not affected with request period for its formation and also was the genetic trait that less affected with environment. The reason for superiority of first sowing date to others may be attributed to greater opportunity for plant using stored moisture in soil that cause more branching per plant (Table 1). The same results was reported by Shamsi(33) who confirmed present results.

The results from Tables 4 and 7 indicated that early sowing date gave greater ability for plant in pod formation which surpassed the February15 date on other sowing dates and recorded 27.96 pod and seeds plant^{-1}. So that delay in sowing was reduced 15.95% the number of seeds per plant. It seems that delayed planting due to encounter the reproductive growth with the higher temperature inoculation is less than the number of flowers and will lead to a reduction in the number of seeds per plant (21). These results supported by findings of Mishra *et. al*.(19) and Turk *et. al*.(36) who reported that the delay in sowing time reduced number of seeds per plant. Also the present results were agree with those reported by Johnson and Major(13) and also Singh *et al* (34) who found that number of pods per plant was decreased with delay in sowing time.

Significant effects was found among herbicide treatments, the Trifluraline scored highest number of pods plant^{-1} (29.06) followed by Haloxyfop application 28.68 pods and the same trend reflected on number of seeds plant $^{-1}$. The interaction of sowing dates with herbicide treatments represented

that the highest number of pods plant $^{-1}$ was recorded for first sowing date with Haloxyfop application (33.73) and the minimum 14.86 pods plant^{-1} related to weedy check at the third sowing date. Similar trend was observed by Pooniya et.al (27), Ratnam *et. al*.(29) and Gore *et. al*. (10).

From the same Table, different sowing dates gave significant effect in 100-seed weight trait. Delay in sowing date cause to reduce in 100-seed weight. Increasing weight of 100-seed in the first date of sowing may be due to availability of longer growth duration that cause increased more population production and resulting increase in pod formation and seed filling (34). Also lower 100-seed weight in chickpea and soya bean was reported due to shorter period for using of resources by plant (8) and (12). The effect of herbicides on 100-seed weight was significant and greater weight of 100-seed was recorded in Trifluraline (28.45 g) followed by Haloxyfop (26.42 g). The current study revealed that the interaction of different sowing dates and herbicides had significant effect on 100-seed weight. The maximum weight (30.50 g) was recorded in February15 sowing date with Trifluraline

application followed by Haloxyfop at the same sowing date (28.30 g), while the lowest weight of 100-seed was shown among weedy check treatments at March sowing dates. Some researchers reported that the chickpea seed weight was sensitive to sowing dates and delay in sowing dates cause to formation of smaller seeds (40).

Tables 4 and 8 represented the significant effects among sowing dates, herbicides and their interactions on biological yield, harvest index and seed yield per hectare. The highest biological yield was recorded in date 15-February (26.87 g/plant) but lowest value (22.90 g/plant) was found in third sowing date. Some

Table 7: Effect of sowing dates, herbicides and their interaction on number of pods, seeds per plant and 100-seed weight of chickpea.

Herbicides	Number of pods plant $^{-1}$				Number of seeds plant $^{-1}$				100-seed weight (g)			
	Sowing date (15-February)	**Sowing date (1-March)**	**Sowing date (15-March)**	**Mean of herbicides**	**Sowing date (15-February)**	**Sowing date (1-March)**	**Sowing date (15-March)**	**Mean of herbicides**	**Sowing date (15-February)**	**Sowing date (1-March)**	**Sowing date (15-March)**	**Mean of herbicides**
Propyzamide	28.66 C	24.60 d	23.00 d	25.42 b	30.73 ab	25.40 c	24.73 c	26.95 B	26.76 c	25.23 d	25.00 D	25.66 C
Haloxyfop	33.73 A	27.73 c	24.60 d	28.68 a	31.53 a	28.93 b	26.13 c	28.86 A	28.30 b	25.66 cd	25.30 D	26.42 B
Trifluraline	30.86 B	27.86 c	28.46 c	29.06 a	31.60 a	29.13 b	29.00 b	29.91 A	30.50 a	28.17 b	26.7 C	28.45 A
Check	18.60	17.20	14.86	16.88	18.00	16.46	14.13	16.20	23.66	22.93	22.86	23.15

	E	e	f	c	d	d	e	c	e	e	E	D
Mean of sowing dates	27.96 A	24.35 b	22.73 c		27.96 a	24.98 b	23.50 c		27.30 a	25.50 b	24.96 B	

Values within each set of means followed by the same letter are not significantly different at p=0.05 according to Duncan's M.R.T., 1955.

Table 8: Effect of sowing dates, herbicides and their interaction on biological yield, harvest index and seed yield of chickpea.

Herbicides	Biological yield (g plant $^{-1}$)				Harvest index (%)				Seed yield (Kg ha^{-1})			
	Sowing date (15-February)	**Sowing date (1-March)**	**Sowing date (15-March)**	**Mean of herbicides**	**Sowing date (15-February)**	**Sowing date (1-March)**	**Sowing date (15-March)**	**Mean of herbicides**	**Sowing date (15-February)**	**Sowing date (1-March)**	**Sowing date (15-March)**	**Mean of herbicides**
Propyzamide	28.30 b	27.08 b	25.05 cd	26.81 b	29.88 b	27.16 bc	28.91 b	28.65 b	2254.2 b	1959.08 C	1930.64 cd	2074.96 a
Haloxyfop	30.59 a	27.71 b	26.62 bc	28.31 a	29.20 b	26.79 bc	24.77 c	26.92 c	2378.64 ab	1978.64 C	1758.2 d	2038.48 a
Trifluraline	27.42	24.32	24.00	25.24	34.17	29.39	27.50	30.35	2499.52	1905.76	1758.16	2054.48

	b	d	d	c	a	b	bc	a	a	Cd	d	a
Check	21.16 e	18.67 f	15.92 g	18.58 d	20.10 d	20.17 d	20.39 d	20.22 d	1134.2 e	1004.4 Ef	860.4 f	999.68 b
Mean of sowing dates	26.87 a	24.44 b	22.90 b		28.34 a	25.88 ab	25.39 b		2066.6 a	1711.96 B	1576.84 c	

Values within each set of means followed by the same letter are not significantly different at p=0.05 according to Duncan's M.R.T., 1955.

researchers Naseri *et.al.* (25), Imam and Niknejad(12), Lopez-Billido *et.al*.(16) and Naseri *et.al*. (22) regarded the similar results about soya bean and other crops and reported that the longer growing period was the main reason for greater biomass.

The Haloxyfop application recorded maximum yield 28.31 g/plant which was increased 52.36 % compared to weedy check. Among interaction of sowing dates with herbicides, the application of Haloxyfop at first sowing date gave maximum biological yield (30.59 g/plant) followed by Propyzamide (28.30 g/plant) at the same sowing date which cause to increase 44.56 % and 33.74 % compared to check at the same sowing date.

The highest harvest index 28.34% was recorded at the first sowing date while about the herbicide effects, the Trifluraline recorded 30.4% which cause to increase 10.13% compare to check. The interaction of sowing dates with herbicides indicated that the highest harvest index was recorded for early date sowing when treated with Trifluraline (34.17%). These results confirm the findings by

Pooniya *et.al.* (27), Rahemi *et.al*.(29) and Gore *et.al*. (10).

Finally, the seed yield was determined on the basis of single plant yield (g) conversion to kg ha^{-1}. The same Table clearly showed that the sowing at February15 gave maximum yield (2066.6Kg. ha^{-1}) that increased 489.76 kg from the third sowing date. Many researchers agree that, early planting dates have higher yields (26), (7) and (20). The lower yield in delay time of sowing attributed to low plant height, less plant branches and shorter growing period (21).

The all studied herbicides had good effects on controlling of weeds that ultimately reflected on increasing seed yield. There were no significant differences among herbicide treatments. However, the

highest yield was recorded at Trifluraline application treatment (2054.48 kg ha^{-1}) which causes to increase in yield 105.5 % compare to weedy check. This result

supported by researchers Chaib and Forster, (4) who reported that the Trifluraline application cause to increase yield by 80% compare to weedy check. Among the interaction of sowing dates with herbicides , the maximum yield (2499.52 kg ha^{-1}) was shown in February15 sowing date with Trifluraline application followed by Haloxyfop at the same sowing date (2378.64 kg ha^{-1}) and cause to increase yield 120.37% and 109.71% respectively compare to weedy check at the same date of sowing. The results were in accordance with those achieved by Yasin, *et al* (38) and Gollojeh *et al*,(9) who reported the efficient control of grass weeds cause to yield improving in both chickpea and lentil.

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تأثير مواعيد زراعية و بعض مبيدات الأدغال في صفات نمو و حاصل الحمص ومكوناته و الأدغال المرافقة له تحت الظروف المطرية في محافظة دهوك.

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المستخلص

أجريت التجربة في حقل البحوث العائد لقسم المحاصيل الحقلية ،كلية الزراعة، جامعة دهوك، إقليم كردستان-العراق خلال الموسم الربيعي 2015-2016، باستعمال تصميم القطاعات الكاملة المعشاة و بترتيب الألواح المنشقة ، اشتملت على ثلاث مواعيد للزراعة (15 شباط و1 آذار و15 آذار) في الألواح الرئيسية و ثلاث مبيدات للأدغال (بروبيزاميد،هالوكسي فوب، ترفلان) فضلا عن معاملة بدون مكافحة (مقارنة) في الألواح الثانوية. دلت النتائج بأن مبيد هالوكسي فوب كان له تأثير جيد في تقليل عدد الأدغال الرفيعة الأوراق تلاه مبيد ترفلان اذ قلل العدد الى 0.44 و 8 دغل للمبيدين بالتتابع مقارنة بعدم إضافة المبيدات. أعطت المعاملة بمبيد الترفلان و التي زرعت في 15-شباط اقل وزن جاف للأدغال عريضة الأوراق 86.80 غم. م-^{2} ، أعلى ارتفاع نبات 48.33 سم ، وزن 100- بذرة (30.5 غم) ، دليل الحصاد (34.17%) و أعلى حاصل للبذور (2499.52 كغم/ هكتار) و بزيادة بلغت نسبتها 120.37% عن معاملة المقارنة.

كلمات مفتاحية: الحمص، موعد الزراعة، بروبيزاميد ،هالوكسي فوب، ترفلان.