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Response of three corn *(Zea maize L.)* hybrids to Perfect herbicide

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Abstract:

A field experiment was carried out in the field of Agriculture College , University of Duhok during the spring season 2016 to study the effect of three doses of perfect herbicides(Nicosulfuron 75%WG) (30, 50 , 70 g la^{-}) on weeds, yield and yield components of three hybrid maize (IK8xHs), (OH40x HS) and (Un44052 x IK8) by using split plot design, the perfect doses in main plot and hybrids in sub plot with three replications. The results revealed that the perfect doses were significant effect on number and dry weight of broad leave weeds, plant height and ear and days to 75 % tasseling , No. of kernels row^{-1} and yield per plant and not significant for other traits (leaf area , days to 75%, silking , No. row ear^{-1} and 300 kernel weight) while the maize hybrids were influenced significantly on all the traits except No. and dry weight of broad leave weeds, and day to 75% silking. For the interaction between perfect doses and maize hybrids, the results exhibited significant effect for all traits except No. and dry weight of broad leaves weed and No. rows ear^{-1}. The hybrid (OH40 x IK8) was superior among the hybrids in No. rows ear^{-1}, No. kernels row^{-1}, 300 kernel weight and total kernel yield and recorded 19.0, 34, 43.71. 43 and 8847.99 kg ha^{-1}, respectively.

The kernel yield plant^{-1} had significant positive relationship with No. kernels row^{-1}, No, rows ear^{-1}, and 300-kernel weight with the value of 0.732, 0.86 and 0.470, while the No. of brood leave weeds was significantly positive correlated with dry weight of broad leave weeds.

Keywors: Maize hybrids, perfect herbicide, yield component

Introduction:

Maize is the third most important cereal crops of the world after wheat and rice. There are many Socio – economical, physical and biological factors that limit the productivity of maize crop in the world and Iraq. One of the major problems is posed by weeds. which have shown to reduce the productivity 25-50%. Rutta *et al* (19) indicated that weeds compete with the crop plants for space, light, moisture, nutrients and carbon dioxides, which reduced not only the yield, grain quality and hinder harvest operations but also increase the cost of production to minimize the weed losses several method are variable such as mechanical, cultural, biological and chemical control methods. Chemical weed control is a best method, fast effective and labor saving method than others. Many researcher like Correa *et. al*(5) and Owen *et. al*(17)using the chemical weed control method and Hoverstsd *et. al*.(9), Johnson *et. al*.(12), Khan and Haq(14), Juhl(13), Toloraya *et.al*.(22) indicated that the success of weeds control method depends upon several factors; however the weed emergence pattern, application timing and stage of crop are very important in chemical control . Also Vandini *et al* (24) exhibited that the time of herbicides is very important for proper controlling of weeds and effectiveness of herbicide can be increased. Dalley *et. al*.(6) and John and Michel(11), revealed that as glyphosate post emergence herbicide timing was delayed that the number of kernels rows^{-1} and the kernels number plant^{-1} and all decreased. Therefore, this study was carried out to evaluate the effect of different doses of perfect herbicide (Nicosulfuron 75y.WG) on weed, yield and components of maize hybrids.

Materials and Methods:

The experiment was carried out in the field of College of Agriculture,

Duhok University during spring 2016. The trial was laid out in split plot design with three replications, the main plots were herbicide doses and subplot were maize hybrids namely (Ik8×Hs), (OH40×IK8) and (Un44052×IK8). Selection of herbicides doses was base on the manufacturers recommended use rates at the time of the study was initiated. Treatments consisted of non treated control and three doses of perfect herbicide (Nicosulfuron 75%WG) (30, 50 and 70 gm ha^{-1}). The plots were 2.25 × 2.5 m, the analysis of the soil and weather properties indicated in table 1. Maize hybrids were sown 24/3/2016 with single row.2-3 seeds per hole were sown in a row 2.5m levant, 0.75 m, between rows and 0.25 m between plants and the plants were thinning to one plant in hole at an early growth stage. Field fertilized with (N.P.K; 27. 27. 0) at rate 400 kg ha^{-1}. As first doses, in the days to 75% silking and No. of row ear^{-1}, while the maize hybrids planting date and 200kg ha^{-1} of urea (46%) were added. Herbicides were applied at 9/4/2016 after sowing as post-emergence.

Data regarding on weeds density and dry weight from an area of $1m^2$ from two randomly selected areas taken at 23/5/2016. Five randomly plants were selected from each plot to record plant and ear height (cm), leaf area cm^2,date to 75% tasseling and silking , No. rows ear^{-1}, No. kernels row^{-1} ,300 – kernel weight and kernel yield $plant^{-1}$. The data on weed an crop parameters was analyzed statistically by using Minitab software package (16) subsequently. Tukeys was used to compare between means at 0.05 probability level.

Results and Discussion:

The results showed (Table 3)that the perfect doses had a significant effect on all studied traits except

exhibited highly significant effect on all traits except No. and dry

weight of broad leaves weed and days to 75% silking, whereas the interaction between perfect doses and maize hybrids revealed that the interaction had a significant effect on plant and ear height, leaf area, days to 75% tasseling and silking 300-kernel weight and kernel yield plant^{-1} ,while the other traits showed non significant effect. This result was in agreement with those pindings reported by Roy *et al* (18), Shoko and Zivanovic (20) reported that there was a significant difference in weed density of various weed control practices and negatively affected the weed growth.

Table 1. Soil and weather properties

Weather properties					soil properties				
Month	Ave. Daily max.tem c^0	Ave. Daily min..tem c^0	Seasonal Relative Humidity RH %	Seasonal Rainfall mm	Depth (cm)	Soil texture class	PSD %		
							sand	Silt	clay
March	18.81	6.57	70.4	88					
April	25.69	12.24	56.7	40.6					
May	31.56	14.9	41.4	2.8	0-30	SIC	4.48	51.52	44.00
June	34.23	16.08	32.5	00	30-60	SIC	5.23	46.81	47.96

The Table 4 showed the effect of different doses of perfect doss on maize traits, the data revealed that the total weed density in m^2 after spray was significantly affected by all the weed control treatments

The maximum (8.2m^2) total weed density was recorded in weedy

check, the reduction in weed No. of broad leaves weeds in the different doses was no significantly different and recorded 5.7, 5.4 and 5.0 receptively, while the dry weight of broad leaves weed, showed the control retested the high dry weight and the doses 70 g ha^{-1} exhibited the lower dry weight for this trait. Data regarding to plant was given in the same table represented that plant height was significantly affected by various doses of perfect herbicide and the maximum plant height (180 cm) was recorded with dose 70 g ha^{-1} while the dose 30 g ha^{-1} was exhibited the minimum plant height 170.6. The variation in plant height of maize in all weed control treatment could be attributed to varying effect of weed competition duration for available resources offered by different weed densities in different weed control practices. Researchers such as Akhtar *et al* (1), and Hussian *et al* (10), reported that the plant height was more affected by density of weed. For ear height the data in the same table showed that the maximum ear height of 92.93 cm was recorded in dose 30 g ha^{-1} and the maximum ear height of 78.6 was that measured in weedy check, this results main the ear height was reduced in this treatment because weed competition with maize plant . Regarding of leaf area (cm^2), the results should not be effected by different levels of perfect doses, also the result indicate that the minimum days to 75% tasseling and silking recorded by perfect dose 50 g ha^{-1} with value 79.22 and 85.22, respectively and maximum value for these traits were obtained by weedy check and the value was 80.78 and 87.33. For No. of rows ear^{-1}, the different doses of perfect were not effect significantly when compare with weedy check, while the No. of kernels row^{-1} was significantly affect by perfect dose and maximum value was recorded by dose 70 g ha^{-1} (31.04) and the minimum value (28.12) was obtained by weed check, highest

value of 300-kernel weight was resisted by dose 70 g ha^{-1} with value 72.93 whereas the minimum value was 63.02. Regarding the kernel yield $plant^{-1}$, the maximum value was recorded by doses 70 g ha^{-1} and the value was 138.6, while the minimum value obtained by weedy check and the value reached 12.4, this results showed that the kernel yield plants was more affected by the yield components such as No. of rows ear^{-1} and no. of kernels row^{-1}. form the results above the perfect dose 70 g ha^{-1} was more effective for controlling

Table (2) list of broad and narrow leaf weeds in experimental site.

Broad leaf weeds		
Common name	Scientific name	Family name
milk thistle	*Silybum marianum*	Compositae
wild radish	*Raphanus raphanistrum*	Brassicaceae
wild mustard	*Sinapis arvensis*	Brassicaceae
sea beet,	*Beta vulgaris*	Amaranthaceae
bindweed	*Convolvulus arvensis*	Convolvulacea
Egyptian mallow	*Malva parviflora*	Malvacea
Hoary Cress	*Cardaria draba*	Brassicaceae
lady's lace	*Ammi majus*	Umbiliferae
Safflower	*Carthamus tinctorius*	Asteraceae
large cocklebur	*Xanthium strumarium*	Asteraceae
sweet peas	*Lathyrus annuus*	Fabaceae
red star-thistle	*Centaurea pallescens*	Asteraceae
knotweed	*Polygonum multiflorum*	Polygonaceae
saltbush	*Atriplex belangeri*	Amaranthaceae

Note: narrow leaf weeds were not presented in the experimental units.

the weed in the experiment plots. Similar results were recognized by Vandini *et al* (24), Vanbiljon *et al* (23) and Haruna (8), who reported that the used the herbicide is more effective by using appropriate doses of herbicide. Data presented in Tables 3, 4, 5 and 6 revealed the effect of maize hybrids on studied traits, the hybrid maize had no significant effect on No. and dry weight of broad leaves weed, while it had a significant effect on plant height (cm). The hybrid (IK8 x HS) had the maximum plant height 178.4 cm, whereas the minimum plant height was recorded by (OH40 x IK8) with the value 172.1 cm. Concerning the ear height, the maximum ear height was observed in the hybrid (Un4052 x IK8) with (95.32cm) and the minimum ear height was 84.63 by hybrid (IK8 x HS). For days to 75% tasseling and silking the hybrid (Un44052 x IK8) was the earliest for days to 75% tasseling with 79.32 day, while the hybrid (OH40 x IK8) took the longest period for the same trait with 80.75 days. In the same table, the difference between the three hybrids had no significant effect on days to 75% silking. The case of earliness and lateness in due to the parents which involved in the hybrid.

Table 5 showed that the largest leaf area was exhibited by hybrid(IK8x Hs) with 703.7 cm^2, where as the smallest value 647.1cm^2 was recorded by hybrid (OH40 x IK8) and the increase in leaf area was due to the parents which had involved in the hybrid. The hybrid (OH40 x IK8) was superior for No. of rows ear^{-1}, No. of kernels row^{-1}, 300-kernel weight and kernel yield $plant^{-1}$, while the hybrid (IK8xHs) recorded the lowest value for these traits with 17.71, 25.17, 60.89 and 113.5 respectively.

From the above results the components appeared the important role for increase the kernel yield $plant^{-1}$ in the hybrid, Amanulah *et al* (3) and Geier *et al* (7)submitted similar results. The

Table3. Mean square of variance analysis for maize traits during spring season 2016.

S.O.V.	Ms											
	d.f	No. of broad leave weeds	Dry weight of broad leave weeds (g)	plant height (cm)	Ear height (cm)	leaf area (cm^2)	Days to 75% tasseling	Days to 75% silking	No. rows ear^{-1}	No. kernels $lrow^{-1}$	300-kernel Weight (g)	kernel yield $plant^{-1}$
Blocks	2	0.25	1.05	131.94	24.51	55	2.11	10.1	0.27	5.75	111.86	12
Herbicide does	3	** 18.99	** 403.67	* 587.36	** 411	N.S 1212	** 4.07	N.S 7.4	N.S 0.15	* 19.23	N.S 173.45	** 237.83
Error a	6	1.40	26.22	233.38	30.39	1125	0.40	2.3	0.08	4.28	81.82	16.42
Hybrids Maize	2	NS 0.58	NS 3.22	** 200.17	** 406.67	** 9891	** 6.86	N.S 5.0	** 3.71	** 180.15	** 299.79	** 5665.5

Herbicide doses * Hybrids	6	NS 0.43	NS 8.63	** 1089.6	** 129.3	** 9618	** 5.05	* 5.9	N.S 0.22	N.S 9.52	** 16.7	** 57.24
Error b	16	2.31	84.44	13.44	13.09	1126.43	0.79	1.99	0.47	4.36	34.41	10.67
Total	35											

***** and ** indicating significant difference at 0. 05 and 0.01 probability level

Table 4. Effect of perfect doses on studied maize traits during spring season 2016.

Maize traits	Perfect doses (g ha^{-1})			
	0	30	50	70
No. of broad leave weeds	8.2 a	5.7 b	5.4 b	5.0 b
Dry weight of broad leave weeds (g)	27.8 a	22.91 b	18.55 c	12.03c d
plant height (cm)	172.1 bc	170.6 c	177.3 ab	180.7 a
Ear height (cm)	78.6 b	92.93 a	92.31 a	90.71 a
leaf area (cm^2)	674.7 a	663.5 a	690.1 a	684.0 a
Days to75% tasseling	80.78 a	80 ab	79.22 b	79.56 b
Day to % the silking	87.33 a	85.67 ab	85.22 b	86.00 ab
No. rows ear^{-1}	18.33 a	18.14 a	18.11 a	18.37 a
No. kernels row^{-1}	28.12 b	28.48 ab	30.54 ab	31.04
300- kernel weight (g)	63.02 b	64.48 ab	72.93 a	65.97 ab
kernels yield plant $^{-1}$(g)	126.4 c	135.0 ab	133.7 b	138.6 a

Means followed by same letter for each column has no significant differences.

data in Table 6 showed the interaction effect of perfect doses and maize hybrids on the studied traits, the results exhibited that the No. and dry weight broad leaves weed were not significantly effect by the interaction perfect doses and hybrids.

Table 5. Effect of maize hybrids on studied traits during spring season 2016.

Maize traits	Maize hybrids		
	Ik8*Hs	OH40*IK8	Un44052*IK8
No. of broad leave weeds	6.2 a	6.3 a	5.8 a
Dry weight of broad leave weeds (g)	20.44 a	20.61a	19.91a
plant height (cm)	178.4 a	172.8 b	174.4 ab
Ear height (cm)	84.63 b	85.97 b	95.32 a
leaf area (cm^2)	703.7 a	647.1 b	683.5 a
Days to75% tasseling	79.58 b	80.75 a	79.33 b
Day to 75%silking	86.25 a	85.33 a	86.58 a
No. rows ear-1	17.71 b	18.82 a	18.19 b
No. kernels row^{-1}	25.17 b	32.52 a	30.95 a
300- kernel weight (g)	60.89 b	70.19 a	68.72 a
kernels yield plant $^{-1}$(g)	113.5 c	156.6 a	130.1 b

Means followed by same letter for each column has no significant differences.

For plant height , the maximum value of 191.3 cm was recorded by hybrid (IK8x Hs) with70 g ha^{-1} dose; while the minimum value of 15.8.8 was obtained by hybrid (OH40 X IK8) with 30 g ha^{-1} dose, hybrids responded differently at different perfect doses The data showed that the hybrid (oH40 x IK8) gave the lower value for ear height than other at weedy check, this probably resulted from

competition between the weeds and hybrids plant, for light and aerial resources, but the hybrid (Un44052x IK8) recorded the highest ear height 104.53 cm at 50 g ha^{-1} perfect dose. The leaf area was influenced significantly by the interaction of hybrid and perfect dose, as the hybrids (OH40 x IK8) and (IK8 x Hs) gave the highest leaf area 736.9 cm^2 and 736.4 at doses 70 g ha^{-1} and 30 g ha^{-1} respectively, but the lowest leaf area 564.4 cm^2 was recorded by hybrid (OH40xIK8) at 30 g ha^{-1} dose. Regarding for days to 75% tasseling , the results indicated that the hybrid (Un44052 x IK) was the earliest for these traits with 78.67 days at weedy check while the hybrid (OH40 x IK8) took the longest period for this trait at weedy check. In the same table the hybrid (Un44052x IK8) exhibited the minimum value of 85 days to 75% silking at 30 g ha^{-1} perfect dose and the hybrid (OH40 x Ik8) gave the maximum value of 84.67 days to 75% silking and weedy check. The no. of rows ear^{-1} and 300-kernel weight were not significantly effect by the interaction hybrids and perfect doses.

Data in the Table 6 revealed that there were significant difference in the interaction between hybrids and perfect doses on No. of kernels row^{-1} and kernel yield $plant^{-1}$, the hybrid (OH40 x IK8) at 70 g ha^{-1} perfect dose gave the highest value for traits and recorded 34.43 and 165.9g respectively. This increase in yield may due to the increase of no. of kernels in row^{-1} in this hybrid, whereas the lowest value of this traits was shown in hybrid (IK8x Hs) and obtained 23.13 and 105.0 g respectively. The final conclusion of this table is that the dose 70g ha^{-1} was more effective and necessary for controlling weeds and highest kernel yields. These results were in line with Soltani *et al* (21) and Ali *et al* (2).

Table 6. Interaction effect between perfect doses and maize hybrids on studied traits during spring season 2016.

Perfect doses (g ha^{-1})	Maize hybrids	No. of broad leave weeds	Dry weight of broad leave weeds (g)	plant height (cm)	Ear height (cm)	leaf area (cm^2)	Days to 75% tasseling	Day to 75% silking	No. rows ear^{-1}	No. kernels row^{-1}	300-kernel weight (g)	kernels yield kg ha^{-1}
0	Ik8*Hs	8.7 a	27.58 ab	171.0 bc	76.8 de	682.9 ab	80.67 abc	88.00 ab	17.90 a	23.13 f	56.73 a	5600
	OH40*IK8	8.3 a	28.31a	175.3 b	68.7 e	652.3 abc	83.00 a	84.67 b	18.90 a	31.90 abcd	67.73 a	8032 b
	Un44052*IK8	7.7 a	27.52 ab	170.0 bc	90.3 bc	688.8 ab	78.67 c	89.33 a	18.20 a	29.33 abcd	64.60 a	6587 def
30	Ik8*Hs	6.0 a	23.34 ab	175.4 b	87.07 bcd	736.4 a	79.00 c	86.00 ab	17.97 a	26.43 cdef	57.20 a	6085 fg
	OH40*IK8	5.7 a	23.4 ab	158.8 c	96.00 ab	564.4 c	81.67 ab	86.00 ab	18.47 a	31.33 abc	68.53 a	8453 ab

	Un44052*IK8	5.3 a	22.01abc	177.7 b	95.73 abc	689.7 ab	79.33 bc	85.00 b	18.00 a	27.67 bcdef	67.70 a	7056 cd
50	Ik8*Hs	5.0 a	17.84 bcd	175.8 b	83.43 cd	725.0 ab	79.33 bc	86.00 ab	17.43 a	25.10 ef	70.43 a	6101 fg
	OH40*IK8	6.0 a	19.12 abcd	177.7 b	88.97 bcd	634.6 bc	79.33 bc	84.67 b	18.90 a	32.43 abc	73.07 a	8075 b
	Un44052*IK8	5.3 a	18.69 abcd	178.3 ab	104.53 a	710.7 ab	79.00 c	85.00 b	18.00 a	34.10 a	75.30 a	7216 c
70	Ik8*Hs	5.0 a	13.01cd	191.3 a	91.23 bc	670.6 ab	79.33 bc	85.00 b	17.53 a	26.00 def	59.20 a	6427 ef
	OH40*IK8	5.0 a	11.63 d	179.2 ab	90.2 bc	736.9 a	79.00 c	86.00 ab	19.00 a	34.43 a	71.43 a	8848 a
	Un44052*IK8	5.0 a	11.44 d	171.6 bc	90.7 bc	644.6 abc	80.33 bc	87.00 ab	18.57 a	32.70 ab	67.27 a	6901 cde

Means followed by same letter for each column has no significant differences.

Table 7. Simple correlation between yield and other maize traits.

	Days to 75% tesseling	plant height (cm)	leaf area (cm^2)	Ear height (cm)	No. kernels row^{-1}	No. rows ear^{-1}	300-kernel weight (g)	kernels yield $plant^{-1}$	Day to 75%the silking	Dry weight of broad leave weeds
plant height (cm)	-0.34*									
leaf area (cm^2)	-0.48**	0.38*								
Ear height (cm)	-0.47**	0.11	0.01							
No. kernels row^{-1}	0.11	-0.13	-0.19	0.27						
No. rows ear^{-1}	0.22	-0.07	-0.16	-0.12	0.41*					

300- kernel weight	-0.09	0.04	0.10	0.31	0.35*	0.35*				
kernels yield plant^{-1}	0.26	-0.14	-0.36*	0.16	0.73**	0.56**	0.47**			
Day to75% the silking	0.02	-0.38*	0.12	-0.13	-0.12	-0.12	-0.37*	-0.32		
Dry weight of broad leave weeds (g)	0.35*	-0.37*	-0.09	-0.33	-0.32	0.04	S0.11	-0.17	0.22	
No. of broad leave weeds	0.18	-0.14	-0.07	-0.48**	-0.26	0.19	-0.17	-0.15	0.10	0.67**

*, **, significant difference at 0. 05 and 0.01 probability level.

The results related to correlation studies Table 7 revealed that kernel yield plant^{-1} had a significant relationship with kernels row^{-1}, no. rows ear^{-1} and 300-kernel weight with values 0.732, 0.560 and 0.470, respectively , while the same trait related negative correlation with leaf area and the dry weight of broad leave weeds was significantly positive correlated with days to 75% tasseling and significantly negative correlated with plant height and the value were 0.352 and 0.367, respectively. From the same table, the No. of broad leave weeds was significantly positive correlated with dry weight of broad leave weeds. The same results were rcported by Anshuman *et al* (4), Kumar and Kumar (15), Mohammed and Zakia (16).

Conclusion:

The data presented here suggest that growers need to be repeated the experiment using the same herbicides with high doses such as 100, 120, 140 g ha^{-1}.

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استجابة ثلاثة هجن من الذرة الصفراء *Zea maize* L لمبيد Perfect

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المستخلص

طبقت تجربة حقلية في حقل كلية الزراعة / جامعة دهوك للوسم الربيعي 2016 لدراسة تأثير التراكيز 30 ، 50، 70 غم / هكتار من مبيد Perfect (Nicosulfuron 75y.WG) في حقل ثلاث هجن من الذرة الصفراء (Ikg x Hs) و (OH40 X IK8) و(UN44052 X IK8)) بأستعمال تصميم اللواح المشتقة. وضعت التراكيز في الالواح الرئيسية و الهجن في الالواح المنشقة وبثلاث مكررات. اظهرت النتائج ان تراكيز المبيد أثرت معنويا في عدد و وزن الادغال عريضة الأوراق و ارتفاع النبات و العرنوص و عدد الأيام ألى 75% تزهير ذكري و عدد البذور في الصف و حاصل النبات في حين اظهرت المساحة الورقية و 75% تزهير انثوي و عدد الصفوف في العرنوص و وزن 300 حبة تأثيرا غير معنويا اما الهجن فأثرت تأثيرا معنويا على جميع الصفات بأستثناء عدد و وزن الأدغال عريضة ألأوراق و عدد ألأيام ألى 75% تزهير أنثوي وكان التداخل بين تراكيز المبيد والهجن معنويا لجميع الصفات بأستثناء عدد و وزن ألأدغال عريضة ألأوراق و عدد ألصفوف عرنوص. تفوق الهجين (OH40 X IK8) على بقية الهجن في عدد الصفوف عرنوص و عدد الحبوب في الصف و وزن 300 حبة وحاصل النبات حيث بلغت القيم 19.0 و 34.43 و 71.43 و 8847.99 كغم هكتار، أضهر حاصل ألنبات أرتباطا معنويا و موجبا مع عدد البذور في الصف (0.73) و عدد الصفوف في العرنوص (0.56) و وزن 300 حبة (0.47) كما ارتبطت عدد ألأدغال عريضة ألأوراق أرتباطا معنويا و موجبا مع ألوزن ألجاف للأدغال عريضة ألأوراق.

كلمات مفتاحيه: هجن الذرة الصفراء، مبيد ، الحاصل ومكونات.