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STUDY OF SOME FACTORS EFFECTING WEEDS CONTROL UNDER DRY LAND CONDITION

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Abstract

The research was carried out during spring season 2018 in the College of Agriculture and Forestry fields at Mosul University. Three control machines (Rotavator, Mower, and Sprayer), were used as the first factor in four levels (Rotavator, Mower, Spray, Mower + Spray). In addition, weed control dates were adopted as the second factor in two levels, at the beginning of March and beginning of April. The effecting of these factors were studied on slippage percentage, coefficient of working width exploitation, no. weeds/m^2, less dry weight of weeds g/m^2, and weed control percentage. The results showed that the treatment (Mower + Spray) recorded the best results for all parameters, which did not differ significantly from Spray treatment at both dates. While the treatment of Mower recorded the highest slippage percentage and the lowest coefficient of working width exploitation at both dates. Also, the treatment of Mower recorded the highest value of weeds plants 696, 996.7 no. weeds/m^2 and the highest less dry weight of weeds 667.1, 220.9 g/m^2 and the lowest weed control percent in both weed control dates 41.30, 44.14 %. The impact of mechanical and chemical weed control and date for weed control application is clear in terms of reducing weed plants.

Key words: Chemical herbicides, Rotavator, Mower, Chemical sprayer, Mechanical weed control, Tillage.

Introduction

The weeds are plants compete with cultivated crops for water, light and other nutrients (Al-Jawadi, 1999). Weeds also vary in their competitive abilities according to land conditions and season (Al-Allaaf, 2006). Weeds can also host pests and diseases that can spread to cultivated crops. the weed control through either mechanical control or of chemical herbicides is common used (Monaco *et al.,* 2002). Moreover, the use of herbicides and mechanical control weed is the most effective and efficient and less costly and faster performance. Also, it is necessary to pay attention to the weed control process, which causes the loss rate (25-40%) in Iraq due to weeds (Khattab and Mohamed, 2017). Anter and Al-Badr (2012) indicate in there study to compare the weed control methods using primary tillage with herbicide and zero tillage with (as plantation systems), they observed that is no differences between systems and both systems are effective to reduce weight and numbers of weed plants in the field. Khattab and Mohamed (2017) observed in there research when studying the effect of mechanical and chemical control in some hits of the yields of different genotypes of maize *Zea mays* L. That the process of cultivator was very effective in the fight against the annual weeds, especially in the case of repeated hoeing more than two times to complete extermination of these plants and this led to a significant increase in the qualities of the grain yield of maize, the treatment of herbicide significantly superior in the control of annual and perennial weeds, and reduce their dry weights with the increase in grain yield. In addition, both mechanical and chemical weed control is necessary to get a good yield of crops by eliminating weed plant effect (Mekky *et al.,* 2007). Arvidsson *et al.,* (2004) Found that the increased slipping of agricultural tractor wheels is due to increasing soil resistance when soil depth is increased, and they also found that each type of soil equipment has a different effect on the slipping of agricultural tractor wheels during work. Sultan and Anter (2008) Show that the herbicide Glyphosate is used to control weeds, especially annual broadleaf or thin leaves weeds that compete with crops, whether superficial or deep-rooted and has been shown to be highly effective in controlling these weeds, especially when used after

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ploughing.

Materials and Methods

Field research was carried out at the Agriculture and Forestry college farm located in the northwest of the Mosul city in the season (2018-2019). The soil was clay-silt, see table 1.

Table 1: Soil Texture

Soil	Value	Unit
sand	18.3	%
silt	36.7	%
clay	45.00	%
Soil bulk density	1.43	(Mg/m^3)
Soil moisture	15.4	%

The tractor model that used in the search was Goldoni 2WD, see table 2.

The data were statistically analysed according to Randomized Complete Block Design (RCBD) and results tested by Duncan multiple-range test. Where the first factor is application dates of weed control which was the beginning of March and April. While the second factor was the weed control machines with four-level (Rotovator, Mower, Spray, Mower + Spray and control treatment). Mower width working 120 cm and Rotavators width working 85 cm and Sprayer width working 85 cm, see Fig. 1.

Use in the experiment Glyphosate herbicide is a broad-spectrum systemic herbicide and crop desiccant, it is used to kill weeds, especially annual broadleaf weeds and grasses that compete with crops, the common name of the compound N-(phosphonomethyl) and an organophosphorus compound, specifically aphosphonate, which acts by inhibiting the plant enzyme 5-enolpyruvylshikimate-3-phosphate synthase. Which belonged to the chemical group (Aliphatics) and the product under the brand names (Roundup, Glyphosate) (Monaco *et al.,* 2002).

Table 2: Technical specification for the tractor used.

Type	Goldoni 10s
Model	Professional two-wheeled tractor 3200
Rated power	6.4 KW/ 8.5 HP
Number of cylinders	1
Nominal rate	3600 rpm
Cooling system	Air
Gear	4 normal, 4 low
Length (front bumper / rear handle bar)	1795 mm
Weight with wheels and rotary cultivator	153 Kg
Set of wheels 5.00x10" on adjustable disc	Obtainable widths: 533mm - 553mm - 621mm - 661mm
Transmission	Mechanical traction, with endless screw and oil bath gears

The data of the studied properties were calculated through the following laws:

1- The less dry weight of the weeds (g/m^2) and the number of weed (no. weeds/m^2)

Use a wooden frame (0.25 m^2) to determine the dry weight of the weed in each experimental unit, then multiply the number 4 to the square meter and according to the method used by (Al-Jawadi, 1999).

2- Weed control percent (%):

Weed control percentage was determined at the end of the season using the following equation and according to the method used by (Al-Jawadi, 1999).

Weed control percentage =

Fig. 1: Tractor (Goldoni) and control machines.

$$\frac{Weight\ of\ untreated\ weeds(g/m^2) - Weight\ of\ treated\ weeds(g/m^2)}{Weight\ of\ untreated\ weeds\ (g/m^2)} \times 100$$

3- Coefficient of working width exploitation:

The operable exploitation factor is determined using the following formula (Dahham, 2012).

Weed control percentage =

$$\frac{Actual\ working\ width(m)}{theoretical\ work\ width(m)} \times 100$$

4- Wheel Slippage percent (%):

Slippage percentage is calculated using the following equation (Al-Jawadi, 1999):

$$\frac{Vt - Va}{Vt} \times 100$$

Where :

S = Slippage percentage (%), Vt = Tractor unloaded (m/s) and Va = Tractor loaded (m/s).

Results and Discussion

Effect of the type of machine on the studied characteristics:

The treatment using Rotavators recorded the highest wheel slippage percentage 9.01 %, while the treatment (Mower + Spray) achieved the lowest slippage percentage 1.51% which did not differ significantly from the treatment using Spray which reached 2.04 %, while the treatment using Mower recorded 5.07 %, which differed significantly from the rest of the treatments, see Fig. 2. This may be due to the fact that Spray is directly affected by the spraying process (spraying of the herbicide on the weed), While in Rotavators the process is by dealing with the soil directly and raised, which is a stressful process for the tractor because of soil resistance and sudden obstacles, which increases slippage percentage, this is consistent with (Arvidsson *et al.,* 2004).

Fig. 3 observed that the Spray treatment achieved the highest coefficient of working width exploitation view where it recorded 1.05 %, which did not differ significantly from both treatments (Mower + Spray) and Mower,

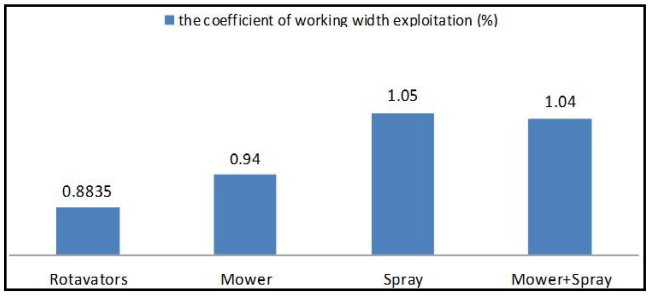

Fig. 3: Effect of the type of machine on the coefficient of working width exploitation (%).

where the results were 1.04 and 0.94 % respectively, while Rotavators was recorded the lowest coefficient of working width exploitation 0.88 %, which was not significantly different from the treatment using Mower 0.94 %. This may be due to the difference in the design work of the equipment.

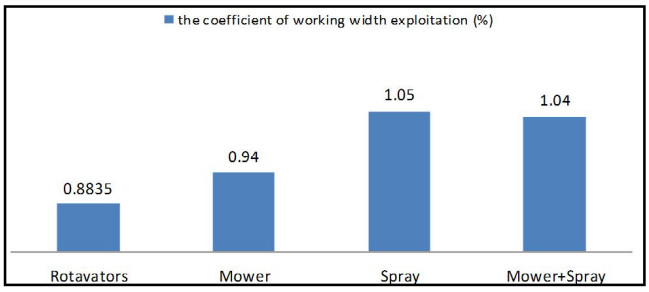

Fig. 2: Effect of the type of machine on slippage percentage (%).

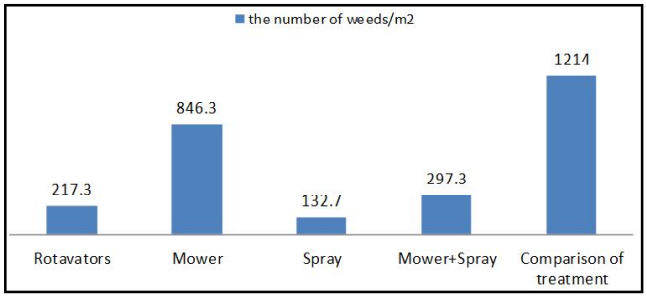

Fig. 4: Effect of the type of machine on the number of weeds/ m^2.

Table 3: shows the significant differences between weed control treatments.

Weed control treatments	Slippage percent%*	Coefficient of working width exploitation %	Number of weed/m²*	Less dry weight g/m²*	Weed control percent %
Rotavators	9.0133 a	0.88350 b	217.3 b	73.2 bc	88.960 a
Mower	5.0767 b	0.94500 ab	846.3 a	444.0 b	42.720 b
Spray	2.0417 c	1.05167 a	132.7 b	12.5 c	97.342 a
Mower+Spray	1.5150 c	1.04167 a	297.3 b	58.7 bc	91.223 a
Control treatment			1214.0 a	933.6 a	

The values that get the same letters are not significant at $P \leq 0.05$.
* The less value is the best.

Fig. 4 shows the significant superiority of the treatments (Mower + Spray), Rotavators and Spray on the comparison treatment where the results were 297.3, 217.3 and 132.7 no. weeds/m^2 respectively, while treatment using Mower which did not differ significantly from the comparison treatment were 846.3 and 1214 no. weeds/m^2 respectively, which may be due to the fact that the weed in the soil is in difficult places to reach by Mower, which leads the control process through cutting the plant at a specified height without access to the weed which is at a lower level. While other transactions have access to the weed that is in difficult places such as having access weeds developing inside small grooves, which act as an impediment and guard her or be partially harmed.

Fig. 5 shows that all control treatments were Significantly surpassed comparison treatment, recording the highest dry weight of the weeds were 933.6 g/m^2, whereas the treatment using Spray recording the lowest dry weight of the weeds was 12.5 g/m^2 which did not differ significantly from both treatment (Mower + Spray) and Rotavators the results were 73.2 and 58.7 g/m^2

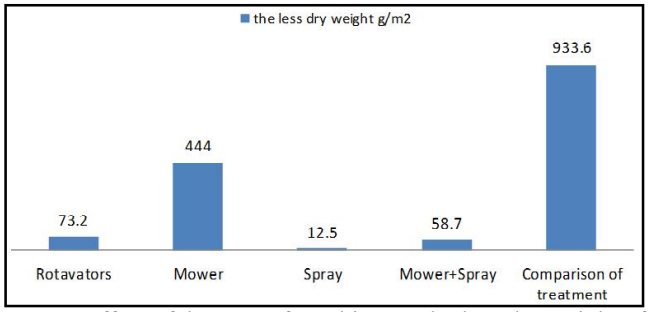

Fig. 5: Effect of the type of machine on the less dry weight of weeds g/m^2.

respectively .while the treatment using Mower recording the highest dry weight of the weeds were 444 g/m^2. This confirms what was stated in the previous paragraph Mower complete the work control through cutting the plant at a specified height without access to the weed which is at a lower level. While other transactions have access to the weed that is in difficult places such as having access weeds developing inside small grooves, which act as an impediment and guard her or be partially harmed.

Fig. 6 illustrates that all Spray, Mower + spray and Rotavators recorded the highest values of the weed

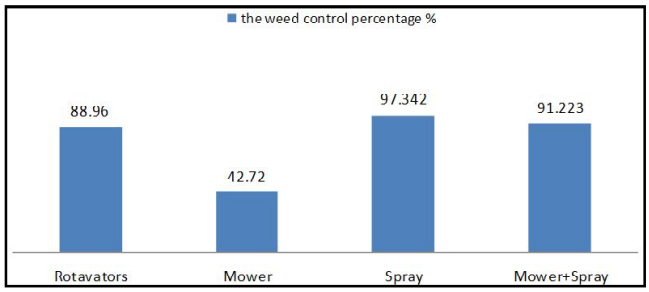

Fig. 6: Effect of the type of machine on the weed control percentage%.

control percentage where the results were 97.342, 91.223, and 88.960 % respectively, while the treatment of Mower was recording lower weed control percentage 42.720 % which differed significantly from the rest of the treatments.

Effect of the dates on the studied characteristics:

Table 3 shows that there is no significant effect of control dates on each of the following characteristics (slippage percentage, coefficient of working width exploitation, number of weed /m^2, weed control percentage %). Which confirms the inability to adopt the number weeds, to know treatment efficiency in control because of variation weeds growth, and therefore the difference in the competitive effect of the crop is based on the less dry weight, which expresses the representative efficiency of plant growth (Sultan and Al-allaaf, 2010). While there was a significant effect of control dates in the lowest dry weight of the weed g/m^2, the beginning of April recorded the lowest dry weight of the weed the results were 151.6 and 457.2 g/m^2, respectively. This agrees with what Boström and Fogelfors (1999) referred to that it is important to select the control date so that it can affect the existing weed to get for good control.

Effect of the interaction between the type of machine and dates on the studied characteristics:

Table 4 indicates the superiority of the treatment using (Mower + Spray) with both dates in giving the lowest values slippage percentage of 1.45 % and 1.57 % respectively, which did not differ significantly from the treatment using Spray at both dates were 2.05 and 2.03 % respectively, as also noticed that the treatment using

Table 3: shows the significant differences between weed control treatments.

Date of Weed control application	Slippage percent%*	Coefficient of working width exploitation %	Number of weed/m^2*	Less dry weight g/m^2*	Weed control percent %
Beginning of March	4.65 a	1.00 a	473.1 a	457.2 a	80.725 a
Beginning of April	4.16 a	0.95 a	610.0 a	151.6 b	79.398 a

The values that get the same letters are not significant at $P \leq 0.05$.
* The less value is the best.

Table 3: shows the significant differences between weed control treatments.

Date of Weed control application	Weed Control treatment	Slippage percent%*	Coefficient of working width exploitation %	Number of weed/m²*	Less dry weight g/m²*	Weed control percent %
Beginning of March	Rotavators	9.31 a	0.96 ab	162.7 c	93.9 bc	90.84 a
	Mower	5.81 b	0.94 ab	696 abc	667.1 b	41.30 b
	Spray	2.05 cd	1.05 a	149.3 c	11.8 c	98.66 a
	Mower+Spray	1.45 d	1.04 a	286.7 bc	86 bc	92.10 a
	Control treatment		1070.7 a	1427.1 a		
Beginning of April	Rotavators	8.71 a	0.80 b	272 bc	52.5 bc	87.08 a
	Mower	4.34 bc	0.94 ab	996.7 ab	220.9 bc	44.14 b
	Spray	2.03 cd	1.04 a	116 c	13.2 c	96.03 a
	Mower+Spray	1.57 d	1.04 a	308 bc	31.3 c	90.34 a
	Control treatment		1357.3 a	440.1	bc	

The values that get the same letters are not significant at $P \leq 0.05$

* The less value is the best.

Rotavators differed significantly from both treatments using (Mower + Spray) and Spray on the second date, where the lowest coefficient of working width exploitation was 0.80 %, Either the rest of the treatments did not show a significant difference between them in both dates. Either for the number of weeds/m², all the treatments were excelled significantly on comparison treatment in both dates recorded the lowest number of weeds/m², Except for the treatment using Mower which did not differ significantly from the comparison treatment at both dates where the treatment using Spray recorded the lowest number of weed/m² in the two dates 149.3 and 116 no. weeds/m² respectively. The table also shows the superiority of all the treatments of Rotavators, Mower, Spray and (Mower + Spray) with the first date on the treatment of the comparison in their recording the lowest dry weight of the weed g/m² where the results were 93.9, 667.1, 11.8 and 86 g/m² respectively, While there was no significant difference between all treatments with the comparison treatment on the second date. The table also indicates that the treatment of mower recorded the lowest value of the weed control percentage in the first and second dates where the results were 41.30 and 44.14 % respectively which differed significantly from the rest of the treatments in both dates, While the rest of the treatments did not differ significantly in terms of weed control percentage on both dates.

Conclusion

According to the statistical analysis it is clear that Rotovator record high value of slippage. Soil tillage equipment causes an increase in wheel slippage due to soil resistance to penetration during tillage. The coefficient of working width exploitation clarify that the high value was illustrated with Spray treatment. Furthermore, this is because some of the pesticide spray is fly by the pressure of the pesticide spray itself, which in turn increases the width of the spray treatment. Through the results both variables which are number of weed plants/ m² and less dry weight of weed plants g/m², are similar for both application dates of weed control and weed control machines. The best results can be seen with Spray treatment, Mower + Spray and Rotovator as well. While the Mowing treatment record low values for weed control machines at the both application dates of weed control. The resone is that the Mowing process did not kill the weeds plants in good way. Moreover, the weed plants were able to resume growth even when it get some damage. Thus it is necessary to uproot, cut or overturn the weeds to ensure its elimination.

Recommendation

Authors' recommend to do more tests in another two season to establish the results of these weed control machines at different application dates for weed control. In addition, adopt more field experiments in the presence of an economic crop to see the impact of both the applied weed control dates and weed control machines on the final yield.

References

Al-Allaaf, K.E.A.K. (2006). Comparison Performance of Different Systems of Mechanization for Weed Control Under Fallow Area. University of Mosul.

Al-Jawadi, R.A.M.N. (1999). Effect of different plowing systems on fuel consumption and weed control in dry land farming. University of Mosul.

Anter, S.H. and M.S.J.A.B. (2012). Effect of Tillage systems and Chemical herbicides on the Control of weeds in Wheat Crop. *Journal of Kirkuk University of Agricultural Sciences*, **3(2):** 89–110.

Arvidsson, J.T.K.K.G. (2004). Specific draught for mouldboard

plough, chisel plough and disc harrow at different water contents. *Soil and Tillage Research*, **79(2SPEC.ISS.):** 221–231. https://doi.org/10.1016/j.still.2004.07.010.

Boström, U.H.F. (1999). Type and time of autumn tillage with and without herbicides at reduced rates in southern Sweden. 2. Weed flora and diversity. *Soil and Tillage Research*, **50(3–4):** 283–293. https://doi.org/10.1016/S0167-1987(99)00017-3.

Dahham, G.A. (2012). Evaluation of the field performance for locally made moldboard plow shares. https://doi.org/10.13140/RG2.2.21423.59046.

Khattab, T.A. and Z.M.M. (2017). Effect of mechanical and chemical control in some traits of the yields of different Genotypes of Maize *Zea mays* L. *Journal of Kirkuk University for Agricultural Sciences*, **8(Appendix):** 131–145.

Mekky, M.S., M.A.A. and S.A.E. (2007). Effect of mechanical tillage system, wheat varieties and weed control treatments on weeds and wheat (*Triticum Aestivum* L.) Productivity. *Misr. J. Ag. Eng.*, **24(1):** 18–41.

Monaco, J.T.S.C.W. and F.M.A. (2002). *Weed science: Principles and practices, fourth ed*. https://doi.org/10.1111/j.1438-8677.2012.00585.x.

Sultan, A.M. and K.E.A.A. (2010). Efficiency of Plowing Systems on Weeds Density and Growth in Bare Fallow under Dry Land Farming in Northern Iraq. *Mesopotamia Journal of Agriculture*, **38(4):** 1–9.

Sultan, A.M. and S.H.A. (2008). Effect of Some Herbicides on Weed Control in Broadbean (*Vicia Faba* L.) Under Dry Land Farming in Northern Iraq. *Mesopotamia Journal of Agriculture*, **36(3):** 1–6.