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INCREASING BARLEY (*HORDEUM VULGARE* L.) COMPETITIVE ABILITY TO COLLATERAL WEEDS BY DIFFERENT SEED RATING AND SOME HERBICIDES

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Abstract

A field experiment was carried out in Musaib, Babylon, Iraq in the winter season of 2018 and 2019 to find out the effect of seed rating (100,150 and 200 Kg/ha). and a combination of Topic and Logran herbicides as follow: 1- Control/spray with distilled water. 2- ½ of the recommended conc. (i.e. 125 gm/ha Topic + 250 gm/ha Logran). 3- The recommended conc. (i.e. 250 gm/ha Topic + 500 gm/ha Logran). As an integrated management for controlling weed populations grown with barley CV.IPA.99. and the effect of these factors on barley yield and yield components and its growth and development, in a split in RCBD with 3 replicates. Results indicated that the higher seeding rate (200 Kg/ha) recorded higher means of plant height, leaf No./stem, tillers No./m^2, spike No./m^2, grain No./spike, 1000 grain weight (gm) and grain yield ton/ha (120.53 cm, 7.66 leaf/stem, 514.95 tillers/m^2, 438.11 spike/m^2, 49.15 grain/spike, 44.33 gm and 2.26 ton/ha respectively. While the recommended conc. of herbicides recorded the higher means of plant height, leaf No./stem, tillers No./m^2, spike No./m^2, grain No/spike, 1000 grain weight (gm), grain yield ton/ha and weeds dry weight gm/m^2 (116.30 cm, 7.00 leaf/stem, 461.57 tillers/m^2, 401.39 spike/m^2, 45.48 grain/spike, 42.83 gm, 2.26 ton/ha and 11.51 gm/m^2) respectively. Whereas, the interaction between the factors of the trial (i.e. 200 Kg/ha of seeding rate) and the recommended of the two herbicides gave the highest means of the characters studied. This interaction, therefore, can be recommended in barley farms to achieve reduction in weed growth and harmful effect of them and boosting barley plantations productivity as well.

Keywords **:** Barley, Collateral weeds, Coldinafop-methyl, Triasulfuron, Terbutryn, Seeding Rates.

Introduction

To counteract the population explosion and the increasing demand for food in the world, it is necessary to pay a great attention and improve the cultivation and productivity of strategic crops using the available scientific methods as cheap as possible. Barley (*Hordeum vulgare* L.) occupies an important position among all crops of greatest importance to mankind. It comes in the 3rd place after wheat and rice worldwide. Barley enters human food in many world countries, in addition to its using in many industries of interest to humans and animals. (Al-Mishhadani *et al.*, 1991). The success of barley cultivation faces many serious problems that reduce productivity of the unit area. Weeds are one of the most serious factors that causes a sever shortage in barley production qualitatively and quantitatively and cause a great losses as a result of the efforts and money used to confront this vital scourge. The importance of the seed rating has been proven by early workers in this field as an important and vital efficient tool in facing and mitigating the risk of weeds. (Kadhim and Shati, 2010; Lark *et al.*, 2008). It has also been proven that by following and tackling seed rating techniques in barley farms had a positive impact on curbing the growth of weed plantation accompanying field crops and thereby, raising the ability of the economic plants to compete with weed populations on different growth factors. (i.e. water, nutrients, sun, aeration, …. etc) and cause a significant increase in barley productivity. (Paynter and Hill, 2009). The use of the traditional mean to combat weed has a positive effect in reducing the damages of weed population and improve agronomic outcome. Although it may cause a slight harm to the nature and plant, but utilizing herbicides led to reduce the harmful effect of the weed plants in the agronomy fields. That seed rating reduces significantly the dry matter of the weed plants growth with barley has been confirmed by (Khan, 1999). (Chaubey *et al.*, 2014) reported also that elevated seed rating increases barley plant height, flag leaf area, tillering etc. and thereby boosted barley yield. The increase in barley yield and yield components (spike/m^2, seed No/spike, 1000 grain weight and yield) was reported by (Lousaert and Ellis, 1993). The effect of herbicides in improving barley productivity occupies a good area in the literature. (Chaudhary *et al.*, 2016). (Kaur *et al.*, 2018) show that using (Topic + Logran) in barley fields, reduced dry matter of the collateral weeds in barley farms and causes a significant reduction in weed population ability to compete with barley plants, and ultimately improved barley performance. There are also many works proved that herbicides, were good tool for weed control. (Chaubey *et al.*, 2014) reported a significant increase in growth parameters (plant height, flag leaf area, leaf No./stem, tillers/m^2) by increasing concentration of (Topic + Logran) herbicides. Using (Topic + Logran) in barley farms decreases significantly weed plants activities and augmented yield and yield components of barley plants (Kumari *et al.*, 2013). In the light of the above facts, this work was designed to study the effect of seed rating and (Topic + Logran) herbicides and decreasing weed population in barley plants trying to boost barley competition ability for earning divergent growth requisites in order to achieve good level of growth and development.

Material and Methods

A field experiment was conducted in Musaib/ Babylon/Iraq during winter season of 2018/2019 to find out the effect of seeding rate (100, 150 and 200 kg/ha) and a combination of (Logran + Topic) herbicides (control, ½ the recommended concentration of each and the recommended dosage of each) on the populations of weed growing with barley (cv. IPA 99) and the impact of that on some vegetative qualities and yield and yield components. Experiment design

was split in RCBD with three replicates. Main plots were seeding rates while herbicides occupied the sub-plots. In table -1- commercial and common names of the herbicides used in this work. Back mounted sprinkler used for applying the herbicides. Treatment of these herbicides were done at 2-4 leaf age of the weeds (Hamda *et al.*, 2013). Data were analyzed using ANOVA test and means were compared at 5% level of probability (Al-Sahooky and Whaeeb, 1990). Data were collected in the end of growing season and the parameters measured were dry matter of the weed populations, barley plant's height, leaf No./stem, tillering No./M^2, flag leaf area and yield and its components.

Table 1 : Chemical name, commercial and common name for the herbicides were used in the experiment

Commercial name	Common name	Chemical name
Topic looEC	Clodinafop-methyl	(R)-2-[4-(5-chloro-3floro-2-pyridyloxy)phenoxy] propionic acid
Logran	Triasulfuron	3-(6-methoxy-4-methyl-1,2,5-triazine-2-2)-1-(2-[2-chloroethoxyl-phenyl sulfony]-urea)
	Terbutryn	2-tert-butylamino-4-ethylamino-6-methyl-s-triazine

Table 2 : Weed population densities with barley crop

Density	Scientific Name	English Name
	Weeds Broad leaves	
Very dense	*Beta vulgaris L.*	Wild beets
Dense	*Silybum marianum L.*	Milk thistle
Medium dense	*Malva praviflora*	Dwarf mallow
Rare	*Ammi majus*	Common bishops weed
Rare	*Sonchus oleraceus*	Common sow
Rare	*Raphanus rapanistrum L.*	Wild radish
Medium	*Convolvulus arvensis L.*	Field bindweed
Rare	*Chenopodium murale L.*	Sow bane
Rare	*Medicago hispida Gaertn*	Toothed medic
Very rare	*Melilotus indicus L.*	Melilot
Very rare	*Polygonum avicularo L.*	Prostrate lanot
Rare	*Trifolium resupinotum L.*	Persian clover
Rare	*Cyperus rotundus*	Nutgrass
Rare	*Cardoria draba L.*	Hoary
Rare	*Rumer dentatus L.*	Curled dock
Rare	*Brassica nigra*	Wild mustard
	Grassy	
Very dense	*Avena fatua L.*	Wild oat
Dense	*Lolium rigidum Gaud*	Rigid rye grass
Medium	*Lolium temulentum L.*	Annual darnel
Medium	*Phalaris minor Retz*	Lesser canary

Very dense = 80-100 % of the weed population in the plot.
Dense = 60 – 79% of the weed population in the plot.
Medium = 40 – 59% of the weed population in the plot.
Low = 20 – 39% of the weed population in the plot.
Rare = 19 – 0% of the weed population in the plot.

Results and Discussion

Data in table -3- shows a significant differences in plant's height due to seeding rate and herbicides and their interaction. The recommended dosage of the two herbicides in combination gave the highest mean of plant's height (116.30 cm) while control recorded the lowest mean (96.10cm). This may be due to the effect of these chemicals in reducing weed plants number and inhibits their growth and dry matter which gives the barley plants chance to grow naturally without the harmful competition of the weeds by utilizing growth factor at upper levels to get efficient photosynthetic process and the other bio-activities (Suresha *et al.*, 2015). High seeding rate resulted in higher plant's length (120.53 cm) and the lowest mean (95.12 cm) resulted by the control treatment. This may be attributed to that increase in seeding rate resulted in more plants in unit area and boost the barley plant competitive ability to the weeds for growth requisites, this however, causes elongation of stems to get sun ray. Shading between plants causes reduced red light in comparing to far red light, which is responsible for increasing stem length in order to enhance gibberellin production which increases stem elongation (Ateya and Gadoa, 1990). This interaction of the experiment factors (the recommended dosage of the herbicides and the higher seeding rate) gave higher mean of plant's height (125.05cm) while control treatment and the lowest seeding rate recorded the lower means (82.79 cm). These findings are in agreement with those reported by (Chaubey *et al.*, 2014; Paynter and Hill, 2009). Data in the same table replay also that the recommended concentration of the two herbicides (Logran + Topic) gave (7.00 leaf/stem) in a significant variation with the other levels of this factor (i.e. ½ the recommended and the control) which resulted in (6.82 and 6.02 leaf/stem)

respectively. High seeding rate gave significantly higher mean of this trait (7.66 leaf/stem) while 100 and 150 kg/ha. Seed rating recorded (5.32 and 6.87 leaf/stem), interaction between experiment's factors recorded (8.41 leaf/stem) for recommended herbicides and high seeding rat, while the recommended dosage and lowest seeding rate treatment of interaction gave (5.07 leaf/stem). Seeding rate and herbicides treatments affected significantly the tillering number/m^2. Higher mean of this trait (461.57 tiller/M^2) was recorded by the recommended dosage of the herbicides combination, and the control gave the lowest mean (408.05 teller/M^2). This can be attributed to the fact that herbicides retarded weed growth and therefore, a suitable conditions to the barley plant to grow healthy. A significant increase in teller/M^2 was given by the highest seeding rate as compared to the control treatment. Tillering is an important parameter and physiological process in the vegetative growth stages for wheat and barley. On the other hand, soil and crop agronomic practices like fertilization, weed control and the planting density provide a good opportunity for growth and increasing tillerings that has a firm relation the yield and its component. These results are in agreement with the results reported by (Shati, 2006; Patrick *et al.*, 2009) and disagreed with those given by (Kirkland, 1993). Interaction of the study factors had also a significant influence on this quality. The recommended dosage of the herbicides with the higher seeding rate resulted in high mean (538.55 tiller/M^2). Control, with 100 kg/ha seeding rate, gave the lowest mean of tillering (328.04 tiller/M^2). This result indicate that high seed rating means high spike number in unit area which is one of yield components. The data also indicates that mixing the herbicides in the recommended dosage and in ½ of it increased significantly flag leaf area, they gave (18.52 and 18.36cm^2) respectively with no significant difference among them, yet, differ significantly with the control treatment that gave (17.99 cm^2).

Table 3 : Effect of seeding Rate and herbicides on barley yield and its components, vegetative, characteristic and weed dry weight for growing season 2018/2019

Seeding Rate gm/ha	Herbicides gm/ha	Plant height/ha	Leaf No./stem	Tillering No./m^2	Flag leaf area/m^2	Spike No./m^2	Grain No./spike	1000 grain weight/gm	Grain yield ton/ha	Dry matter weight gm/m^2
100		82.79	5.37	328.04	17.25	343.84	48.28	39.12	0.75	26.62
150	Control	92.16	6.40	424.01	18.18	346.12	44.01	40.13	1.35	25.01
200		113.36	6.31	472.11	18.55	425.15	36.54	43.17	1.72	22.91
100	Topic 125	99.33	5.53	346.07	17.52	340.11	48.86	41.67	1.20	18.37
150	+	120.44	6.68	442.01	18.68	361.39	45.04	41.65	1.70	16.80
200	Logran 250	123.18	8.26	534.20	18.89	436.63	37.22	45.00	2.27	16.66
100	Topic 250	103.24	5.07	403.08	17.62	366.14	50.31	41.26	1.63	11.74
150	+	120.63	7.54	443.08	18.48	384.59	46.94	42.42	2.35	11.45
200	Logran 500	125.05	8.41	538.55	19.47	453.46	39.17	44.82	2.80	11.36
L.S.D		2.24	0.21	14.36	0.35	6.33	0.90	1.12	0.06	1.01
Seeding Rate	100	95.12	5.32	359.06	17.46	350.03	49.15	40.68	1.19	18.91
	150	111.07	6.87	436.36	18.44	364.03	45.33	41.40	1.80	17.75
	200	120.53	7.66	514.95	18.97	438.41	37.65	44.33	2.26	16.97
L.S.D		2.24	0.12	11.71	0.25	5.81	0.80	1.14	0.02	0.54
Herbicides	Control	96.10	6.02	408.05	17.99	371.70	42.94	40.80	1.27	24.84
	Topic 125 + Logran 250	114.31	6.82	440.76	18.36	379.37	43.70	42.77	1.72	17.27
	Topic 250 + Logran 500	116.30	7.00	461.57	18.52	401.39	45.48	42.83	2.26	11.51
L.S.D		0.83	0.13	8.04	0.19	3.06	0.45	0.32	0.04	0.66

Same trend recorded with the seeding rate. The treatments 150 and 200 kg/ha resulted in (18.44 and 18.97 cm^2) of flag leaf area with no significant difference among them but differ significantly with the lowest seeding rate treatment that recorded (17.46 cm^2). Interaction between recommended herbicides with the highest seeding rate gave the higher means (19.47cm^2), recommended dosage of the Logran + Topic herbicides resulted a high mean of spike number/square matter (401.39 spike/M^2) as compared to the control treatment (371.70 spike/M^2). The reason at this outcome may be due to the killing effect of the herbicides on the weed plants leaving barley plantation grow without any competition harm effect. These findings are with the same trand with those given by (Kumari *et al.*, 2013). Spike number increased with the increase of seeding rate, this definitely due to the increase of tillering with the increment of seeding rate in unit area. Previously recommended dosage of Logran and Topic with higher seeding rate gave higher spike number (453.46 spike/M^2) comparing to the control treatment with the lowest seeding rate. These results show that seeding rate had a strong influence in increasing spike number in unit area via increasing plant number per unit area. Results of (Lousaert and Ellis, 1993) came in agreement with results of our work. They reported a linear relationship between spike number and plantation density by using MCPA in weed elimination. A significant impact also obvious on grain number/spike by both seeding rate and herbicides. Combination of the two herbicides used in the recommended concentration gave the highest mean up this trait (45.48 grain/spike) as compared to the control treatment

which recorded (42.94 grain/spike). Reduction of weed plants number in addition to inhibit their growth which resulted in lower dry matter of the weeds gave to the crop an easy opportunity to grow without the stress of the weeds, and thereby, high bio-activities in utilizing growth factors (i.e. water, nutrients, sun, …. etc.) in their growth, development, formation and filling of the grain easily. The results agreed with (Al-Sultani, 2000) findings and disagreed with those reported by (Martin *et al.*, 1990) that herbicides led to reduction in grain number per spike. Higher seeding rate (200 kg/ha) gave lower mean of spike's grain number (37.65 grain/spike), while control treatment gave the highest mean (49.15 grain/spike), this may be attributed to the fact that, an increase in seeding rate lead to increase in plantation density. This increases the competition between barley plants and weeds in the other side. This competition is at maximum rate during the initiation of seeds leading to reduction, therefore, correlated to the plant ability to compete with other individuals around him during plant development. There is a sever competition on nutrients among yield components. It is well known that efficient tillering number are formed firstly utilizing most of the nutrient available and filling stage comes after this process, and the number of tillerings is affected by what nutrient available. The interaction of the experiment factors had also significant influence on grain number/spike. High mean of this trait is recorded by the recommended dosages of the two combined herbicides with the lowest seeding rate, that is (50.31 grain/spike). On the other hand, the control with the highest seeding rate recorded the lowest mean of this quality (36.54 grain/spike). It is clear from the data that spike grain number for the control treatment with the lower seeding rate reached (36.54 grain/spike), while this figure in the same treatment with the highest seeding rate is (48.28 grain/spike), this indicates that there is an inverse relationship between seeding rate and grain number in the spike.

This may be due to the definite competition between the plants with high seeding rate treatment which causes reduction in the outcome of the source and less flow to the sink and ultimately reduction in grain number per spike, besides the increase in one of yield component may cause decrease of the other one. Grain weight was also influenced by herbicides. The recommended dosage of the herbicides used gave higher mean of 1000 grain weight (42.83 gm) comparing to the control (which gave the lowest mean 40.80 gm). Reason of this may be due to the absence of the competition and more photosynthetic production leading to increase in grain weight. These findings agreed with what reported by (Al-Chalabi, 2003) and disagreed with those of (Harrison and Beuerlein, 1989) where they confirmed no significant effect of herbicides on grain weight. The higher seeding rate recorded higher mean of grain weight (44.33 gm) as compared to the lowest seeding rate. The interaction of herbicides and seeding rate show variant means. Treatment where the recommended dosage of the herbicides with the higher seeding rate gave (44.82 gm) while it was (39.12 gm) given by the control and lowest seeding rate. Grain yield also was influenced by the factors of the investigation. Using the herbicides in the recommended dosage recorded high mean of grain yield (2.26 Ton/ha) as compared to the control (1.27 Ton/ha). Using high seeding rate also gave higher means of grain's yield (2.26 Ton/ha), while the lower seeding rate gave lower mean of this quality (1.19 Ton/ha). The interaction treatment where high seeding rate with the recommended dosage of the herbicides combination recorded high mean (2.80 Ton/ha) whereas low seeding rate with the control gave (0.75 Ton/ha). This may be attributed to the fact that weed elimination led to high flag leaf exposure the sun. This leaf contribute more than 85% of its photosynthesize and other growing factors, to the nearest spike and ultimately increasing yield and its components like grain's weight. This lead to comprehend that utilizing the competition (i.e. boost the competition efficiency of the crop) is an effective tool to get a clear result in reducing weed effect on crop production. Topic herbicides has an obvious influence on narrow leaf weed plant. It inhibits stem growth, root growth, Acetolactate synthase activity and disturb weed plants' growth and then causes a death to them. Logran herbicides, hence, has an influence on wide leaf weeds by inhibiting cell division and enlargement, Acetolactate synthase enzyme activity and on photosynthesis process and finally eliminate them (Khan *et al.,* 1999). The recommended dosage of the herbicides influenced strongly the dry weight of the weed plants, it gave the lowest means (11.51 gm/M^2), while the higher seeding rate gave (16.97 gm/M^2). This could mean that herbicides and increasing seeding rates reduced the weed population density and their dry matter. This augmented the opportunity to the crops to utilize whatever available growth requisites to involve them in their growth and development and increasing grain yield, this interaction of high seeding rate and the recommended dose of the herbicides resulted in (11.36 gm/M^2), while control with low seeding rate resulted in (26.62 gm/M^2).

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