Revista Mexicana de Ciencias Agrícolas

DOI: https://doi.org/10.29312/remexca.v15i6.3105

Article

Narrow- and broadleaf weed control in wheat

Tomás Medina-Cázares[1]
Ernesto Solís-Moya[1]
Oscar Arath Grageda-Cabrera[1]
Sarahyt Santamaría González-Figueroa[1,§]

1 Campo Experimental Bajío-INIFAP. Carretera Celaya-San Miguel de Allende km 6.5, Celaya, Guanajuato, México. CP. 38010. (medina.tomas@inifap.gob.mx; solis.ernesto@inifap.gob.mx; grageda.oscar@inifap.gob.mx).

Autora para correspondencia: gonzalez.sarahyt@inifap.gob.mx.

Abstract

Long-term use of herbicides leads to resistance problems; therefore, the biological effectiveness of new treatments needs to be determined. This study aimed to determine the effectiveness of herbicides applied postemergence on weeds [*Avena fatua* L., *Phalaris* spp., *Brassica nigra* (L.) W. D. J. Koch and *Chenopodium album* L.]; for this, a trial was established in the autumn-winter 2019-2020 cycle, using the experimental design of randomized complete blocks with four replications. Five herbicide treatments (T2: mesosulfuron-methyl 1%/iodosulfuron-methyl-sodium 0.2%; T3: iodosulfuron-methyl-sodium 0.9%/mesosulfuron-methyl 4.5%/thiencarbazone-methyl 2.25%/mefenpyr-diethyl 13.5% + methylated vegetable oil; T4: flucarbazone sodium 70% + clodinafop-propargil 0.8%; T5: tralkoxydim 25%; T6: pinoxaden 0.5% + rapeseed oil 45%) and a control without application (T1) were evaluated. The variables evaluated were phytotoxicity to the crop, population and weed control. At harvest, the following were determined: plant height, spike length, yield, the weight of 1 000 grains, and the hectoliter weight of wheat. The T2 and T3 treatments controlled *A. fatua* and *Phalaris* spp. to a lesser extent and *B. nigra* and *C. album* to a greater extent in addition to causing a higher degree of phytotoxicity; T6 and T4 better controlled the populations of *A. fatua* and *Phalaris* spp., with an intermediate performance for broadleaf weeds; T5 showed poor control for both narrow- and broadleaf weeds. The herbicides that controlled weed populations and increased yield were T2 and T3, controlling broadleaf species, and T4 and T6, controlling narrow- and broadleaf weeds.

Keywords:

Triticum aestivum L., herbicides, resistance.

DOI: https://doi.org/10.29312/remexca.v15i6.3105

Introduction

The Bajío Guanajuatense is an intensive agricultural area with two annual sowing cycles; during the autumn-winter cycle, the wheat crop ranks first in planted area and adapts to the rotation system with sorghum or corn. In 2021, 50 741.5 ha were sown and 339 437.39 t were produced (SIAP, 2022). This production is destined for the pasta and bread industry (USDA, 2021); this sector has very defined grain quality standards that are related to the flour extraction capacity, and among the most prominent factors is the weight of 1 000 grains and the hectoliter weight (Buendía-Ayala *et al*., 2019).

In the wheat production system, weed control is essential, as poor or no control causes losses in grain yield (Abouziena *et al*., 2008). In the state of Guanajuato, (Medina and Rosales, 2014) reported that if weed is not controlled during the first 50 days of wheat development, losses amount to 19%, and if free competition is allowed throughout the cycle, losses can reach 59%. In addition to affecting yield, competition affects the quality of the grain, both intrinsically and due to the impurities generated during harvest.

According to an analysis of the diversity of weed species in the wheat-producing area in El Bajío, the most frequently occurring weed species are wild oats (*A. fatua*), which occur in 51.43% of the sampled points, alpistillos: *P. minor* Retz. in 48.92% and *P. paradox* L. in 31.52%, mostacillas (*Brassica* spp.) in 8.71%, and quelite cenizo (*C. album*) in 5.76% (Delgado, 2006).

The populations of these species tend to increase, and the use of herbicides is the primary tool used by farmers to control them, but the poor management of these agrochemicals is causing problems of resistance to the herbicides that are used continuously; when analyzing specific points of this agricultural area. Torres-García *et al*. (2018a and 2018b) reported resistance in the populations of *P. minor* and *A. fatua*; for the above reason, it is necessary to evaluate the herbicides available on the market to know their behavior and look for alternatives to integrate them into an integrated weed management (IWM) plan.

Wheat production in El Bajío must have the capacity to compete with imported wheat in quality and price, so it is necessary to evaluate the chemical weed control options available in the area, which can contribute to achieving good yields and grain quality. Several studies that evaluate the effect of different herbicides on wheat have been carried out, but they only focus on the development and yield of the crop, so it is necessary to characterize the effect they have on its industrial quality, which was done in the present work.

This study aimed to determine the effect of herbicides applied postemergence on narrowleaf weeds (*A. fatua* and *Phalaris* spp.) and broadleaf weeds (*B. nigra* and *C. album*) in wheat in the Bajío Guanajuatense region and their influence on grain yield and quality.

Materials and methods

In the autumn-winter 2019-2020 cycle, an experiment was established in the Bajío Experimental Field of the National Institute of Forestry, Agricultural and Livestock Research (INIFAP), for its acronym in Spanish in Celaya, Guanajuato (20.586652209878732-100.8264054867971). The wheat variety used was Cisne F2016, with a sowing density of 150 kg ha^{-1}; this variety is semi-dwarf, 98 cm tall, and its vegetative cycle is early, with 76 days to flowering and 132 days to physiological maturity (Solís *et al*., 2017).

The fertilization of 240-46-00 (N-P-K), recommended by INIFAP, was used, applying all the phosphorus and half of the nitrogen at sowing and the rest of the nitrogen before the first supplemental irrigation 40 days after sowing. The experimental design used was randomized complete blocks with four replications was used. The experimental plot consisted of six furrows 6 m long and 0.75 m apart occupying an area of 27 m^2.

The treatments evaluated were: T1) no application of herbicides; T2) mesosulfuron-methyl 1%/iodosulfuron-methyl-sodium 0.2% (15/3 g ai. ha^{-1}); T3) iodosulfuron-methyl-sodium 0.9%/ mesosulfuron-methyl 4.5%/thiencarbazone-methyl 2.25%/mefenpyr-diethyl 13.5% (2.9/45/15/7.5 +

Revista Mexicana de Ciencias Agrícolas
REMEXCA
DOI: https://doi.org/10.29312/remexca.v15i6.3105

915 g ai. ha^{-1}); T4) flucarbazone sodium 70% + clodinafop-propargil 0.8% (28 + 8 g ai. ha^{-1}); T5) Tralkoxydim 25% (375 g ai. ha^{-1}); T6) pinoxaden 0.5% + rapeseed oil 45% (60 + 411.7 g ai. ha^{-1}). When two or more active ingredients are separated by "/", it represents a factory-formulated mixture; when they are separated by "+", it represents a tank mixture.

Herbicides were applied postemergence when the crop was in the Zadok 2.3 developmental stage (this stage is characterized by the production of nodes on the main stem and the establishment of flowers), the species of *A. fatua* with two to three tillers, *Phalaris* spp. with two to three leaves without tillers, broad leaves with a height of less than 10 cm. A Robin RSO3 motorized backpack sprayer was used, to which a wand with six 8003 nozzles was adapted, with a pressure of 40 PSI, which provided a spray volume equivalent to 300 L ha^{-1}.

In the control plots without the application of herbicides (T1), weeds were allowed to develop freely throughout the experiment. The variables evaluated were: 1) weed population density at the time of application of the treatments and 30 days after application (daa), using a quadrant of 1 m^2, the weed contained within the quadrants was identified and quantified; 2) phytotoxicity to the crop at 15 daa, modifying the scale used by Yanniccari *et al*. (2017) of 0 to 100%, where 0 meant no damage was observed, and 100% death of the crop was observed; 3) weed control by species at 30 and 60 daa for *B. nigra* and *C. album* and *A. fatua* and *Phalaris* spp. were also evaluated at harvest. The first two were not evaluated at harvest because they did not represent a contamination problem in the grain reception due to their seed size and tendency to dehiscence. The effect of herbicides in the entirety of each experimental plot was visually evaluated, for which the percentage scale (0-100%) was used, where 0 meant that the weed was not affected and 100, that it was completely eliminated; and 4) at the time of harvest, the height and size of the wheat spike and the number of spikes of *A. fatua* and *Phalaris* spp. were determined; finally, yield variables and those related to grain quality (weight of 1 000 grains and hectoliter weight) were quantified.

The data were analyzed using the SAS 9.3 software, subjecting them to individual analysis of variance for each of the main weeds present and for the variable of toxicity caused by herbicides to the crop, when the F test was significant (HSD with *p*# 0.05), the means were compared using Tukey's mean test. To homogenize the variances, the percentage data were transformed to the arcsine value of the root of the percentage; however, for reasons of clarity, untransformed data are presented in results and discussion (SAS Institute, 2014).

Results and discussion

Four annual weed species belonging to the following three botanical families dominated the experimental site: Poaceae (*A. fatua* and *Phalaris* spp.), Chenopodiaceae (*C. album*), and Brassicaceae (*B. nigra*). At the time of the application of the post-emergent treatments, the total weed population was 2 817 000 plants ha^{-1}, while at 30 daa, there was a reduction, obtaining an average population of 1 252 000 plants ha^{-1}.

The dominant species were *A. fatua* for narrowleaf and *B. nigra* for broadleaf, representing 44.3% and 19.9% of the total population, respectively. The analysis of variance for populations showed highly significant differences for treatments and weeds. For the individual analysis corresponding to *A. fatua*, all the variables showed highly significant differences, except for the initial count variable, showing the homogeneity of the populations present in the different experimental plots.

Table 1 shows the mean comparisons of the variables evaluated; in the count at 30 days, decreases were observed in all treatments where herbicide was applied. The treatments with the highest population of *A. fatua* were T1 (control without herbicide application) and T5 (tralkoxydim), with 138 and 84 *A. fatua* plants m^{-2}, respectively. In turn, the treatments with the lowest population of *A. fatua* were T3 and T6, with 28 and 22 plants m^{-2}, respectively.

DOI: https://doi.org/10.29312/remexca.v15i6.3105

Table 1. Population and control of *Avena fatua* in different stages of development of wheat crops with the applicati on of different herbicides. A-W 2019-2020 cycle.

Treatment	Initial count (p m^{-2})	Count 30 daa (p m^{-2})	Control 30 daa (%)	Control 60 daa (%)	At harvest	
					Control 120 daa (%)	(s m^{-2})
1	138	142 a*	0 d	0 d	0 d	66 a
2	138	42 b	77 b	81 b	86 b	12 b
3	108	28 b	83 ab	86 ab	91 ab	12 b
4	126	42 b	74 b	79 b	89 ab	12 b
5	116	84 b	17 c	12 c	12 c	58 a
6	126	22 c	90 a	90 a	94 a	8 b
CV (%)	29.17	46.19	7.1	5.42	4.58	56.1

* = values with the same letter within each column are statistically equal (Tukey$p$< 0.05); daa= days after application; (p m^{-2})= plants m^{-2}; (s m^{-2})= spikes m^{-2}.

Regarding the control percentage at 30, 60, and 120 daa, it was observed that the best treatments were T6, T3, and T4, which increased their effectiveness in each evaluation due to the residual activity of their active ingredients (Palmieri *et al*., 2022), which agrees with Balassone and Puricelli (2020), who carried out an evaluation with various herbicides belonging to the group of inhibitors of the acetolactate synthase enzyme; among them, iodosulfuron-methyl-sodium, flucarbazone sodium and pinoxaden were determined to have an effect on the emergence of seedlings over time; this was also indicated by Shoeran *et al*. (2013) in wheat crops.

On the other hand, T5 (tralkoxydim) obtained control values of 12%; based on the scale for the evaluation of weed control proposed by the European Weed Research Society (EWRS) (Urzúa, 2001), it is considered a very poor control, since for a product to be classified as acceptable control, it must present values higher than 87.5%. In relation to the number of spikes m^{-2} of *A. fatua* at harvest, the same trend was observed as for the control percentage; it should be noted that the lower the number of spikes of *A. fatua*, the lower the percentage of weed seed contamination in the grain.

The analysis of the number of plants, percentage of control, and spikes of *Phalaris* spp. per m^{2} at harvest at different stages of the development of the wheat crop (Table 2); the initial count of plants does not show statistical differences in the different plots with the treatments, while in the count performed at 30 daa, T1 showed the highest populations and the lowest populations were observed at T3 and T6.

Table 2. Population and control of *Phalaris* spp. in different stages of development of wheat crops with the applicati on of different herbicides. A-W 2019-2020 cycle.

Treatment	Initial count (p m^{-2})	Count 30 daa (p m^{-2})	Control 30 daa (%)	Control 60 daa (%)	At harvest	
					Control 120 daa (%)	(e m^{-2})
1	88	96 a*	0 d	0 d	0 d	54 a
2	62	14 b	78 b	82 b	87 b	4 bc
3	48	10 b	86 ab	88 a	89 b	2 c
4	78	16 b	76 b	81 b	88 b	4 bc
5	56	24 b	41 c	44 c	39 c	16 b
6	58	10 b	88 a	89 a	93 a	0 c
CV (%)	39.6	44.61	5.67	3.6	3.28	39.49

* = values with the same letter within each column are statistically equal (Tukey p< 0.05); daa= days after application; (p m^{-2})= plants m^{-2}; (s m^{-2})= spikes m^{-2}.

DOI: https://doi.org/10.29312/remexca.v15i6.3105

Regarding the percentage of control, in the evaluations carried out at 30 and 60 daa and at harvest, the treatments that showed the highest percentages in the first two evaluations were T3, T6, T2, and T4.

In the harvest evaluation, the T3, T4, and T6 treatments presented controls above 87.5%, which is the minimum required by the EWRS to be classified as an acceptable control. The number of spikes m^{-2} of *Phalaris* spp. at harvest also presents a statistical difference between treatments, with those with the lowest number of spikes presenting the best control percentages, which were statistically different from the other treatments.

Table 3 shows the number of plants m^{-2} and the percentage of control of *B. nigra*; the treatments that presented the highest population of plants of this species m^{-2} were T1, T5, and T6, with 44, 44, and 50 plants, respectively. Regarding the control percentage, in the evaluations carried out at 30 days, the T2 and T3 treatments obtained values greater than 87.5% and at 60 daa, T2, T3, and T4; therefore, according to the EWRS, they can be classified as acceptable control.

Table 3. Population and control of *Brassica nigra* in different stages of development of wheat crops with the application of different herbicides. A-W 2019-2020 cycle.

Treatment	Initial count (p m^{-2})	Count 30 daa (p m^{-2})	Control 30 daa (%)	Control 60 daa (%)
1	40	44 a*	0 c	0 c
2	85	10 b	95 a	99 a
3	40	2 b	95 a	99 a
4	64	2 b	83 c	88 b
5	56	44 a	0 c	0 c
6	52	50 a	0 c	0 c
CV (%)	91.9	93.2	2.43	2.12

* = values with the same letter within each column are statistically equal (Tukey $p< 0.05$); daa= days after application; (p m^{-2})= plants m^{-2}.

The number of plants m^{-2} of *C. album* showed statistically equal values in the initial counts, but at 30 daa, T2 and T3 completely controlled the population of this weed. The same trend was observed regarding the control percentage at 30 and 60 daa, with T2 and T3 being the treatments that showed values greater than 95% (Table 4).

Table 4. Population and control of *Chenopodium album* in different stages of development of wheat crops with the application of different herbicides. A-W 2019-2020 cycle.

Treatment	Initial count (p m^{-2})	Count 30 daa (p m^{-2})	Control 30 daa (%)	Control 60 daa (%)
1	36	30 a*	0 b	0 b
2	44	0 b	93 a	99 a
3	30	0 b	94 a	99 a
4	50	4 b	0 b	0 b
5	26	6 B	0 b	0 b
6	28	34 a	0 b	0 b
CV (%)	52.9	52.4	4.42	4.78

* = values with the same letter within each column are statistically equal (Tukey$p< 0.05$); daa= days after application; (p m^{-2})= plants m^{-2}.

DOI: https://doi.org/10.29312/remexca.v15i6.3105

Phytotoxicity was only observed in wheat plants treated with T2 and T3 treatments, which consisted of yellowing, chlorosis of young leaves, and height reduction, and to which a value of 12.5% was assigned in both cases (according to the EWRS, this percentage is classified as symptoms that are not reflected in the yield), being statistically superior to that of the other treatments. It is important to note that the damage gradually disappeared as time went by.

The variables of height, spike size, hectoliter weight, weight of 1 000 grains, and yield are shown in Table 5. Concerning wheat height, all treatments had the same statistical behavior except for T3, in which a decrease of approximately 5% was quantified. In terms of spike size, the analysis of variance showed no statistical differences between treatments.

Table 5. Yield and quality parameters of wheat crops with herbicide treatments. A-W 2019-2020 cycle.

Treatment	Height (cm)	Spike length (cm)	Hectoliter weight (kg hl^{-1})	Weight of 1 000 grains (g)	Yield at 13% moisture (kg ha^{-1})
1	97 a*	10.6	73.4 b	33.5 b	4 025 c
2	89.6 ab	10.5	79.2 a	40.5 a	7 272 ab
3	86.6 b	9.8	78.2 ab	41 a	6 714 ab
4	93.5 ab	10.2	78 ab	40.3 ab	7 590 a
5	96.6 a	10.6	79.2 a	36.8 ab	6 393 b
6	94.2 a	10.3	78.9 a	40 ab	6 264 b
CV (%)	3.5	3.46	2.7	7.63	7.63

* = values with the same letter within each column are statistically equal (Tukey $p< 0.05$).

For hectoliter weight, the only treatment that did not comply with the value of 76 kg hl^{-1}, which is a parameter required by the national milling industry (SE, 1996), was T1; this indicates that herbicide treatments had sufficient weed controls not to affect the optimal hectoliter weight for the wheat grain.

T2 showed the highest weight, with 79.2 kg hl^{-1}, close to the values requested by the United States of America, the main wheat exporter, which requires a hectoliter weight of 79.4 kg hl^{-1} (Martínez *et al*., 2017). Regarding the weight of 1 000 grains, the analysis of variance showed a statistical difference between treatments; only T3, T6, T2, and T4 complied with the Official Mexican Standard NOM-247-SSA1-2008 (SE, 2008) since their values are greater than 40 g. Concerning grain yield, the best treatments were T4, T2, and T3 with 7 590, 7 272, and 6 714 kg ha^{-1}, respectively, being statistically different from the control without application, the yield of which was 4 025 kg ha^{-1}, which represented a yield decrease of around 46.9%.

Conclusions

The most efficient herbicides for the control of narrowleaf weed species, *A. fatua* and *Phalaris* spp., in wheat crops were flucarbazone sodium 70% + clodinafop-propargil 0.8% and pinoxaden 0.5% + rapeseed oil 45% and for broadleaf species, *B. nigra* and *C. album*, they were mesosulfuron-methyl 1%/iodosulfuron-methyl-sodium 0.2% (T2) and iodosulfuron-methyl-sodium 0.9%/mesosulfuron-methyl 4.5%/thiencarbazone-methyl 2.25%/mefenpyr-diethyl 13.5% + methylated vegetable oil, both with values above 87.5%.

None of the herbicides evaluated showed phytotoxicity effects that adversely affected wheat crop yields. Concerning industrial grain quality, the lack of weed control had a negative impact on all the parameters evaluated. Nevertheless, T2 presented the highest hectoliter weight value and, therefore, the highest yield, making it the most feasible recommendation for weed control in wheat production in the El Bajío Guanajuatense region.

DOI: https://doi.org/10.29312/remexca.v15i6.3105

Bibliography

1 Abouziena, H. F.; Shararafaida, A. A. and El-Desoki, E. R. 2008. Efficacy of cultivar selectivity and weed control treatments on wheat yield and associated weeds in sandy soils. World J. Agric. Sci. 4(3):384-389.

2 Balassone, F. y Puricelli, E. 2020. Sensibilidad de biotipos de *Conyza sumatrensis* a glifosato y a inhibidores de ALS en dos estados de desarrollo. Agriscientia. 37(2):11-20. 10.31047/1668.298x.v37.n2.25404.

3 Buendía-Ayala, B.; Martínez-Cruz, E.; Villaseñor, M. H.; Hortelano, S. R.; Espitia-Rangel E. y Buendía-González, M. 2019. La incidencia de roya amarilla y la calidad industrial del grano y la masa en trigo harinero. Revista Mexicana de Ciencias Agrícolas 10(1):143-154. 10.29312/remexca.v10i1.1333.

4 Delgado, R. J. 2006. Rotación de cultivos en sistemas de labranza de conservación: Experiencias en el CIMMYT. *In*: memoria del primer foro de producción y comercialización de trigo en Guanajuato. Ed. INIFAP. Campo Experimental Bajío. Celaya, Guanajuato, México. 138-147 pp.

5 Martínez, C. E.; Espitia, R. E.; Villaseñor, M. H.; Hortelano, S. R.; Muñiz, R. E. y Zamudio, C. A. 2017. Calidad industrial del trigo harinero en función del número de riegos. Revista Méxicana de Ciencias Agrícolas. 8(7):1497-1508.

6 Medina, C. T. y Rosales, R. E. 2014. Capítulo 3. Manejo integrado de maleza. *In:* tecnología para la producción sustentable de trigo de riego en El Bajío. Libro técnico núm. 6. Instituto Nacional de Investigaciones Forestales, Agrícolas y pecuarias (INIFAP). 58-66 pp.

7 Palmieri, V. E.; Alvarez, C. E.; Permingeat, H. R.; and Perotti, V. E. 2022. A122S, A205V, D376E, W574L and S653N substitutions in acetolactate synthase (ALS) from *Amaranthus palmeri* show different functional impacts on herbicide resistance. Pest Manag. Sci. 78(2):749-757.

8 SAS Institute Inc. 2014. Base SAS® 9.3 Procedures guide. Cary, NC, USA.

9 SE. 2008. Secretaría de Economía. Norma Oficial Mexicana NOM-247-SSA1-2008. Productos y servicios. Cereales y sus productos. Cereales, harinas de cereales, sémolas o semolinas. Alimentos a base de: cereales, semillas comestibles, de harinas, sémolas o semolinas o sus mezclas. Productos de panificación. Dirección General de Normas Especificaciones y Métodos de Prueba.

10 Shoeran, S.; Punia, S. S.; Yadav, A. and Singh, S. 2013. Bioefficacy of pinoxaden in combination with other herbicides against complex weed flora in wheat. Indian J. Weed Sci. 45(2):90-92.

11 SIAP. 2022. Servicio de Información Agroalimentaria y Pesquera. Avance de siembras y cosechas. https://nube.siap.gob.mx/avance-agricola/.

12 Solís, M. E.; Huerta, E. J.; Pérez, H. P.; Villaseñor, M. H.; Ramírez, R. A. y Ledesma, R. L. 2017. Cisne F2016: nueva variedad de trigo harinero de gluten fuerte para El Bajío, México. Revista Mexicana de Ciencias Agrícolas 8(8):1911-1917.

13 Torres-García, J.; Segura-León, O.; Uscanga-Mortera, E.; Trejo, C.; Conde-Martínez, V.; Kohashi-Shibata, J. and Martínez-Moreno, D. 2018b. Evolution, growth and phenology of *Phalaris minor* L. biotypes resistant to ACCase inhibiting herbicides in Mexico. Bot. Sci. 96(1):95-102.

14 Torres-García, J.; Tafoya-Razo, J.; Velázquez-Márquez, S. and Tiessen, A. 2018a. Double herbicide-resistant biotypes of wild oat (*Avena fatua* L.) display characteristic metabolic fingerprints before and after applying ACCase and ALS-inhibitors. Acta Physiol. Plant. 40(119):1-12.

Revista Mexicana de Ciencias Agrícolas
REMEXCA
DOI: https://doi.org/10.29312/remexca.v15i6.3105

15 Urzúa, S. F. 2001. Estudios de efectividad biológica con herbicidas. *In*: bases para realizar estudios de efectividad biológica de plaguicidas. Ed. Colegio de Postgraduados. Montecillo, Estado de México. 85-94. pp.

16 USDA. 2021. United States Department of Agriculture. Grain and feed annu*al*. https://apps.fas.usda.gov/newgainapi/api/Report/.

17 Yanniccari, M. E.; Larsen, A. O. y Istilart, C. M. 2017. Evaluación de herbicidas post-emergentes en variedades de trigo Candeal. Instituto Nacional de Tecnología Agropecuaria. Actualización técnica en cultivos de cosecha fina 2016/17. http://hdl.handl.net/11336/80114.

Narrow- and broadleaf weed control in wheat

Journal Information
Journal ID (publisher-id): remexca
Title: Revista mexicana de ciencias agrícolas
Abbreviated Title: Rev. Mex. Cienc. Agríc
ISSN (print): 2007-0934
Publisher: Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias

Article/Issue Information
Date received: 01 May 2024
Date accepted: 01 August 2024
Publication date: 04 October 2024
Publication date: Aug-Sep 2024
Volume: 15
Issue: 6
Electronic Location Identifier: e3105
DOI: 10.29312/remexca.v15i6.3105

Categories

Subject: Articles

Keywords:

Keywords:

Triticum aestivum L.

herbicides

resistance

Counts

Figures: 0

Tables: 5

Equations: 0

References: 17

Pages: 0