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EFFECT OF CHEMICAL CONTROL OF WEED IN GROWTH AND YIELD OF FIVE VERITY OF *TRITICUM AESTIVUM* L. (WHEAT)

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Abstract

A field experiment was carried out at the farm of the Department of Field Crop Sciences College of Agriculture, Diyala University, during the season 2018-2019 with the aim of studying the efficiency and effectiveness of the chemical control of the companion weed for six varieties of wheat crop using combinations of three systemic herbicides (Clodinafop-propargyl + Tribenuron - methyl) and (2.4dichlorophenoxyacetic acid + Clodinafop-propargyl) for a narrow and broadleaf weed control. It was added in recommended concentrations in the form of combinations within two treatments with the comparison treatment without control and weed-free treatment and were distributed with three replicates using the randomized complete block design RCBD. The results showed the superiority of (Clodinafop-propargyl + Tribenuron - methyl) treatment over the treatment of (2.4 dichlorophenoxyacetic acid + Clodinafop-propargyl) and the weedy treatment, as it gave the lowest bush density, dry weight and the highest inhibition and control of (25.87 plant.m^{-2}, 36.70 g.m^{-2}, 75.93% and 997.70%), respectively. As for the varieties, the variety Sham 6 surpassed over the rest of varieties, as it recorded the lowest weed density 92.8 plant.m^{-2}, the variety Tamoz recorded the lowest dry weight 44.3 g.m^{-2}, the variety Smito recorded the highest inhibition percentage of 58.1% and the highest control percentage of 60.7%. Furthermore, the weedy treatment with all varieties recorded the highest dry weight and the lowest inhibition and control. As for the interaction between control treatments and varieties gave significant results in most of the studied traits and the variety Adna with (Clodinafop-propargyl + Tribenuron-methyl) achieved the lowest population density of weed was 9.2 plant.m^{-2}, the lowest dry weight was 11.2 g.m^{-2}. As well as, the variety Smito followed by Adna with the same two herbicides achieved the highest inhibition percentage of 99.33 and 99.74%, respectively. This confirms the complementarity between the varieties and herbicides factor in achieving the aim of reducing competition caused by the weed of wheat crop and the importance of these two factors in raising the yield.

Key words: Herbicides, Clodinafop-propargyl, Tribenuron - methyl, weed control, (*Triticum aestivum* L.).

Introduction

Wheat (*Triticum aestivum* L.) A strategic grain crop that is important locally and wold, where food is the staple of most of the world's population and has an important role play in food security and the most important crops in Iraq (Altay, 2012 and Asseng *et al.,* 2015). It ranks first in the area of Agriculture. but he is a weak competitor for weed compared Stages of growth, The weed is causing a loss of up to 45% Bond and Liefert (2017). If you compete with the wheat for growth requirements such as water, light and nutrients. The most widespread weed in Iraq growth with wheat (*Lolium rigidum, Lolium temulentum, Avena fatua, Raphanus raphanistrum, Silybum marianum* and *Malvapravi flora* (Al-Wagaa 2018), use the chemical control of Weed an important process to increase the yield and the methods its high efficiency, speed of effect, speed of application and low cost (Shehzad, *et al.,* 2012 and Cook, *et al.,* 2019) the Tribenuron-methyl systemic herbicides give a good control of broad weed Dong (2015) and Clodinafop- propargyl also gave good results in the control against the weed thin leaves accompaniment for wheat The 2.4-D herbicides also achieved good efficiency in high Control and reduced weed density (Abbas *et at.,* 2007 and Baghestan *et al.,* 2007). Varieties of wheat have differed in a resistance or competitiveness of weed that causes a difference in the qualities and quantity yields. Susceptibility of some wheat varieties to impede the growth of weed control great importance in the

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completion and integration of weed management in crop fields such as wheat (Alziadee, 2015). The aim study was to evaluate the activity of both the Tribenuron-methyl, Clodinafop-propargyl and 2.4-D weed control associated with five varieties wheat growth and yields cultivation in Iraq.

Materials and Methods

A field experiment was carried out at the farm of the Department of Field Crop Science- College of Agriculture - Diyala University, during the 2018-2019 season, with the aim of studying the effect of the knowing the effect of herbicides Clod inafop- propargyl and Tribenuron-methyl and 2. 4 d ichlorophenoxyacetic acid table 1 in the control weed accompaniment five cultivars of Bread wheat. Carried out in accordance with the experience of Randomized completely block design (R.C.B.D.) with three replications, the first factor treatments control (Weedy-check, weed free, Tribenuron-methyl + C lodinafop- propargyl and Clodinafop- propargy l + 2.4 dichlorophenoxyacetic), The second factor included six varieties of wheat (sham 6, smito, Tamuz, Fatah and IPA 99 and Adna). The field was well prepared from ploughing, smoothing, Experimental unit was 4 m^2 with dimensions 2×2 m rate of 45 $kg.ha^{-1}$ at planting Wheat was planted at a rate of 120 $kg.h^{-1}$ as lines (20 cm distance lines), physical and chemical properties table 2. Fertilizer phosphate 48% P_2O_5 was used before planting in one batch and urea fertilizer 46% N was used in four batches (Khalil *et al.,* 2019), they were added in different stages of crop growth. Herbicides were added during the tillering stage and with the recommended concentrations as shown in table 3 by a knapsack sprayer, the capacity of 20 liters calibrated on the basis of 400 $l.ha^{-1}$. The types of weed were identified in the experimental treatments table 4, and then the weed density was calculated per square meter before harvesting, then the plants were cut and air-dried to constant weight. The inhibition percentage was calculated based on the dry weight of the weed from the following equation:

$$\%Inhibition = 100 - \frac{A}{B} \times 100$$

Whereas A is the weed dry weight in the control treatment, and B the weed dry weight in the comparison treatment (weedy). (Steinsiek *et al.,* 1982; Al-Wagga and Al-Juboory 2013). As well as, the percentage of control was calculated from the following equation (Singh *et al.,* 2016).

Controll %

$$\frac{\text{The weed number in comparision treatment} - \text{the weed number in control treatment}}{\text{The weed number in comparsion treatment}}$$

The data were collected and analyzed statistically using the computer by adopting the SAS program according to the RCBD and use of the last significant

Table 1: The trade name and concentration and ingredient active and the type weed control.

Trade Name And Concentration	Ingredient Active	Weed Target
Granstar 75FD (15$g.ha^{-1}$)	Thifensulfuron-Methyl 75% + Tribenuronmetiel (sulfonielureum) 25%	Control narrow and Broad leaf weed
Topik 100 EC (400$ml.ha^{-1}$)	Clodinafop-Propargyl 75g + Cloquintocet-Mexyl 25g	Control narrow weed
2, 4-D Difor Amine 72 SL (1800$ml.ha^{-1}$)	2.4 dichlorophenoxyacetic acid	Control Broad leaf weed

Table 2: Some chemical and physical properties of the experiment soil before cultivation for the two seasons 2018-2019.

Property		Unit	2018-2019
Available nitrogen		$Mg.kg^{-1}$soil	77.8
Available phosphorous		$Mg.kg^{-1}$soil	12.53
Available potassium		$Mg.kg^{-1}$soil	187.3
Organic matter		$g.kg^{-1}$soil	13.1
Soil sepa- rates	Clay	$g.kg^{-1}$soil	381
	Silt	$g.kg^{-1}$soil	440
	Sand	$g.kg^{-1}$soil	179
	Texture		Silt clay loam soil

Table 3: Herbicide names, use rate, method, and the date of addition.

Treatment control	Use rate	Addition method	Addition date
Weed-chock	0.0	Without control	The weed growth throughout the season
Clodex 100EC + Spotlight WDG 75	60 $g.ha^{-1}$ + 80 $g.ha^{-1}$	Post-emergence	When the weed height 5 cm
Atlantis WG	80 $g.ha^{-1}$	Post -emergence	Wheat at age 5 leaves
Logran extra 64 WG + Topik plus	50 $g.ha^{-1}$ + 65 $g.ha^{-1}$	Post -emergence	Wheat at age 5-7 leaves
Chevalier 15 WG	320 $g.ha^{-1}$	Post -emergence	Wheat at age 5-7 leaves

Table 4: Family and Names of weed sparted in the field experiment.

Family	Narrow weed
Gramineae	*Phalaris minor* L.
Gramineae	*Lolium rigidum* Gaud.
Gramineae	*Avena fatua* L.
Family	Broad leaf weed
Brassicales	*Raphanusraphanistrum* L.
Leguminasea	*Melilotus indicus* L.
Malvaceae	*Malva rolundifolia* L.
Campositeae	*Lactuca serriola* L.
Chenopodiaceae	*Beta valgaris* L.
Campositeae	*Silybum marianum* L. Gaertn
Campositeae	*Sonchus oleraceus* L.

difference test (L.S.D) to compare arithmetic means of treatment at a level of probability (5%).

Results and Discussion

The experiment results showed that the types of narrow-leaf weed distributed in the field are *Lolium rigidum, Lolium temulentum, Avena fatua, Pharais minor*, and broadleaf weed are *Silybum marianum, lactuca virosa , Melilotus indica, Beta vulgaris, Raphanus raphanistrum* and *Sonchus oleraceus,* as shown in table 3.

Effect of weed herbicides and variety on the weed intensity.m^{-2} the results in table 5 showed that there were significant differences between the effect of control treatments, where the Granstar 75 FD + Topik 100 EC achieved the largest effect in reducing weed density compared to the 2.4-D Difor Amine + Topik 100 EC100 and the comparison treatment, as weed density reached 25.87, 172.05 and 284.38 plant.m^{-2}, respectively. This may be due to the nature of broadleaf weed distribution that showed superiority in terms of type's number and density, or the killer herbicide effect may be different depending on the nature of the chemical compound of the herbicide or the difference of the weed resistance to the herbicide effect (Barros *et al.,* 2007). Table 10 shows there were significant differences between the varieties in the companion weed density, as the variety Sham 6 achieved the lowest weed density of 92.8 plant.m^{-2} and IPA 99 gave the highest weed density of 139.1 plant.m^{-2}. The reason for the difference may be attributed to the nature of the growth of these varieties and their ability to compete with the weed and to inhibit their growth (Ashiq *et al.,* 2007). Table 3 showed there was a significant interaction between control treatments and varieties, as variety Tamoz with Clodinafop-propargyl + Tribenuron - methyl EC recorded the lowest weed density was 13.2 plant.m^{-2}, while the IPA 99 recorded the highest density with 2.4 dichlorophenoxyacetic acid + Clodinafop-propargyl at 225.6 plant.m^{-2}, compared to the comparison treatment. The reason may be attributed to the difference in the ability of the varieties to compete for the weed, and this is due to their variation in some morphological characteristics such as height, tillers number, growth rates, physiological factors, genetic factors and biochemical factors (Lemerle *et al.,* 2001).

The results in table 6 showed that there was a significant effect of control treatments in the weed dry weight, as the treatment of Clodinafop-propargyl + Tribenuron - methyl exceeded overall treatments in reducing the weed dry weight. It gave the lowest dry weight reached 36.70 g.m^{-2}, while the dry weight reached 62.43 g.m^{-2} for the treatment of 2.4 dichlorophenoxyacetic acids + Clodinafop-propargyl compared to the comparison treatment, which gave the highest dry weight of 121.88 g.m^{-2}. This shows the killing effect of herbicides on the weed, which caused the plants to stop growing, and caused a reduced in weed dry weight, this provides strength to the crop plants in overcoming and competition the weed (Shahid, 1994). The varieties also differed significantly among them in the effect on the characteristic of weed dry weight, as the lowest weed dry weight reached 44.3 g.m^{-2} with the variety Tamoz, while the highest weed dry weight reached 59.8 g.m^{-2} with the variety Fata. The reason may be attributed to the variety of varieties in its ability to compete for the weed, this is one of the most important criteria upon which to choose

Table 5: Effect of weed herbicides and variety on the weed intensity/m^{-2}.

Treatment	variety						Effect
	Sham6	Smito	Tamoz	Fatah	IPA 99	Adna	Treatment
Weedy check	0	0	0	0	0	0	0.00
Free weed	181.5	301.5	342.8	315.5	293.5	271.5	284.38
Clodinafop-propargyl + Tribenuron – methyl	21.2	41.2	13.2	33.2	37.2	9.2	25.87
2.4dichlorophenoxyacetic acid + Clodinafop-propargyl	168.3	123.6	125.6	183.6	225.6	205.6	172.05
Effect variety	92.8	116.6	120.4	133.1	139.1	121.6	
5%L.S.D	Herbicides 4.3		variety 11.32			Herbicides X variety 18.42	

Table 6: Effect of weed herbicides and variety on the dry wright weed g/m^{-2}.

Treatment	variety						Effect
	Sham6	**Smito**	**Tamoz**	**Fatah**	**IPA 99**	**Adna**	**Treatment**
Weedy check	119.5	153.5	114.5	102.8	125.5	115.5	121.88
Free weed	43.2	14.2	35.2	81.2	35.2	11.2	36.70
Clodinafop-propargyl+ Tribenuron – methyl	66.6	71.6	27.6	68.6	39.6	100.6	62.43
2.4dichlorophenoxyacetic acid+ Clodinafop-propargyl	0	0	0	0	0	0	0.00
Effect variety	57.3	59.8	44.3	63.2	50.1	56.8	
L.S.D 5%	Herbicides 5.55		variety 7.02			Herbicides X variety 14.04	

the suitable varieties for planting (Singh *et al.,* 1997).

Table 7 showed a significant effect between control treatments and varieties. The variety Adna with the treatment of Clodinafop-propargyl + Tribenuron - methyl achieved the lowest dry weight was 11.2 g.m^{-2}. While the variety Fatah with 2.4 dichlorophenoxyacetic acid + Clodinafop-propargyl recorded the highest weed dry weight of 68.6 g.m^{-2}, compared with the weedy treatment, which gave the highest dry weight with the variety Smito reached 153.5 g.m^{-2}. This variation in dry weights may be due to the direct effect of both herbicides and varieties, where herbicides affect the weed growth and inhibit their growth on one side, and the varieties affect their ability to compete for the weed on the other side (Korres and Frou 2002). The results in table 7 indicated that there were significant differences in the percentage of inhibition, where the treatment of Clodinafop-propargy + Tribenuron - methyl l exceeded in the inhabitation of the weed growth. As it recorded the highest percentage of inhibition amounted to 75.93% compared to the treatment of Mebidi 2.4 -dichlorophenoxyacetic acid + Clodinafop-propargyl that recorded the lowest percentage of inhibition amounted to 28.98% compared with the weed-free treatment that gave 100% inhibition. The reason for this may be due to the nature of the difference in the weed sensitivity or its resistance to herbicides that used in the experiment and to the nature or difference of the efficiency of the herbicide in its ability to affect the weed. These results were identical to what the dry weight characteristic showed in table 9, which reflected positively in this characteristic. It was observed from table 5 that there were a significant effect of the varieties on the percentage of inhibition characteristic, where the variety Smito recorded the highest percentage of inhibition amounted to 58.1%, followed by the variety Sham 6 with a percentage of inhibition of 58.0%, while the variety Fatah recorded the lowest inhibition percentage of 33.9%. This may explain the different susceptibility of these varieties in reducing dry weights and thus their competitiveness, which is one of the most important scientific methods used to control the companion weed the wheat crop (Kaut *et al.,* 2009). The Table also showed the presence of significant interaction between the varieties and herbicides in the inhibition percentage, as it is noted that the variety Adna and Smito gave the highest inhibition percentage with the Clodinafop-propargyl + Tribenuron - methyl reached 99.74 and 99.23%, respectively. Whereas, the two varieties, Adna and Sham6 with 2.4 dichloro-phenoxyacetic acid + Clodinafop-propargyl, recorded the lowest inhibition percentage was 8.2 and 21.88%, respectively. The reason for the variation in the inhibition percentage may be attributed to the combined effect of both the varieties and herbicides, where whenever the variety distinguished by good growth, suitable height, more tillers number, its competition was good for the weed. As for the effect of the herbicide, it may be due to the nature of the herbicide effect on the weed plants by inhibiting cell division or preventing the formation of amino acids, thereby the process of photosynthesis stopped, which causes a decrease in dry weight, and reflected positively

Table 7: Effect of weed herbicides and variety on the inhibition weed %.

Treatment	variety						Effect
	Sham6	**Smito**	**Tamoz**	**Fatah**	**IPA 99**	**Adna**	**Treatment**
Weedy check	0	0	0	0	0	0	0.00
Free weed	100	100	100	100	100	100	100.00
Clodinafop-propargyl+ Tribenuron – methyl	71.84	99.23	77.58	27.03	80.13	99.74	75.93
2.4dichlorophenoxyacetic acid+ Clodinafop-propargyl	21.88	32.99	54.6	8.47	47.75	8.2	28.98
Effect variety	48.4	58.1	58.0	33.9	57.0	52.0	0.00
L.S.D5%	Herbicides 4.05		variety 2.92			Herbicides X variety 6.31	

Table 8: Effect of weed herbicides and variety on the percentage weed control %.

Treatment	variety						Effect Treatment
	Sham6	**Smito**	**Tamoz**	**Fatah**	**IPA 99**	**Adna**	
Weedy check	-	-	-	-	-	-	0.00
Free weed	100	100	100	100	100	100	100.00
Clodinafop-propargyl+ Tribenuron – methyl	99.2	94.2	98.5	99.2	91.2	98.2	97.70
2.4dichlorophenoxyacetic acid+ Clodinafop-propargyl	11.6	35.6	41.6	25.6	15.6	10.6	23.43
Effect variety	52.7	57.5	60.7	56.2	51.7	53.0	
L.S.D5%	Herbicides 2.69		variety 3.11			Herbicides X variety 4.43	

in increasing the inhibition percentage (Baghestani *et al.,* 2008).

Table 8 showed that there were significant differences in the characteristic of control percentage between control treatments and varieties. The treatment of Clodinafop-propargyl + Tribenuron - methyl was superior by achieving the highest control percentage reached 97.70%, while the treatment of 2.4 dichlorophenoxyacetic acid + Clodinafop-propargyl gave a control percentage of 23.43% with the 2.4 dichlorophenoxyacetic acid + Clodinafop-propargyl. The increase in the control percentage may be attributed to the effect of this herbicide on reducing the weed population density and the dry weight due to the killer effect of the herbicide, in addition to the different chemical composition and thus this clear variance shows between the two herbicides in the control percentage (Fahad *et al.,* 2013). As for the varieties effect, the results in the same Table showed that the variety Tamoz exceeded and recorded the highest control percentage of 60.7%. Whereas the variety IPA 99 recorded the lowest control percentage of 51.7%, perhaps the reason for the difference in the control percentage is due to the variety susceptibility to compete for the weed through the morphological characteristics it possesses from rapid growth, height and tillers number. It also observed from the Table that there were a significant interaction between the varieties and control treatments, as the variety Sham 6 gave the highest control percentage with the Clodinafop-propargyl + Tribenuron-methyl treatment reached 99.2%, while the variety Adna with the 2.4 dichlorophenoxyacetic acid + Clodinafop-propargyl achieved the lowest percentage was 10.60%. This effect is due to the multiplier role of varieties with the used herbicides, which can be included in integrated crop management in order to obtain better yield and good quality by reducing the weed population density per unit area (Zand *et al.,* 2007).

References

Al-Wagga, A.H.A. and B.A. Al-Juboory (2013). Effects of additives, methods and number of application on activity of glyphosate controlling for Dichanthium annulatum (Forsk) stapf. growth in sugarcane fields. *Diyala Agricultural Sciences Journal*, **5(2)**

Abbas, G., M.A. Ali, Z. Abbas, M. Aslam and M. Akram (2009). Impact of different herbicides on broadleaf weeds and yield of wheat. *Pak. J. Weed Sci. Res.*, **15(1):** 1-10.

Al Ziadee, S.H.A. (2015). Critical duration in weeds control of wheat. *Euphrates J. of Agri. Sci.*, **7(1):** 143-151.

Altay, F. (2012). Yield stability of some Turkish winter wheat (*Triticum aestivum* L.) genotypes in the Western Transtional Zone of Turkey. *Turkish Journal of Field Crops*, **17(2):** 129-134.

Ashiq, Noor Muhammad and Noor Ahmad (2007). Comparative efficacy of different herbicides against broadleaved weeds in wheat. *Pakistan Journal of Weed Science Research,* **13(3-4):** 149-156.

Asseng, S., F. Ewert, P. Martre, R.P. Rötter, D.B. Lobell, D. Cammarano and M.P. Reynolds (2015). Rising temperatures reduce global wheat production. *Nature climate change*, **5(2):** 143.

Bagheri, H., S. Asgari and H. Piri-Moghadam (2014). On-line micro solid-phase extraction of clodinafop propargyl from water, soil and wheat samples using electrospun polyamide nanofibers. *Chromatographia*, **77(9-10):** 723-728.

Baghestani, M.A., E. Zand, S. Soufizadeh, M. Beheshtian, A. Haghighi, A. Barjasteh and R. Deihimfard (2008). Study on the efficacy of weed control in wheat (*Triticum aestivum* L.) with tank mixtures of grass herbicides with broadleaved herbicides. *Crop protection*, **27(1):** 104-111.

Baghestani, M.A., E. Zand, S. Soufizadeh, M. Mirvakili and N. Jaafarzadeh (2007). Response of winter wheat (Triticum aestivum L.) and weeds to tank mixtures of 2, 4 D plus MCPA with clodinafop propargyl. *Weed biology and management*, **7(4):** 209-218.

Barros, J.F., G. Basch and M. de Carvalho (2007). Effect of reduced doses of a post-emergence herbicide to control grass and broad-leaved weeds in no-till wheat under Mediterranean conditions. *Crop Protection*, **26(10):** 1538-1545.

Bond, J. and O. Liefert (2017). Wheat outlook. *USDA Economic*

Research Service, WHS-17b, 1-28.

Cook, S.K., L.R. Davies, F. Pickering, L.V. Tatnell, A. Huckle, S. Newman and P.E. Turnbull (2019). Research Review No. CP 182/1807258 Weed control options and future opportunities for UK crops.

Dong, B., W. Qian and J. Hu (2015). Dissipation kinetics and residues of florasulam and tribenuron-methyl in wheat ecosystem. *Chemosphere*, **120:** 486-491.

Fahad, S., L. Nie, A. Rahman, C. Chen, C. Wu, S. Saud and J. Huang (2013). Comparative efficacy of different herbicides for weed management and yield attributes in wheat.

Gomez, K.A. and A.A. Gomez (1984). Statistical procedures for agricultural research (2 ed.). John wiley and sons, NewYork, 680.

Heap, I. (2014). Herbicide resistant weeds. In *Integrated pest management* (pp. 281-301). Springer, Dordrecht.

Kaut, A.H.E.E., H.E. Mason, A. Navabi, J.T. O'donovan and D. Spaner (2009). Performance and stability of performance of spring wheat variety mixtures in organic and conventional management systems in western Canada. *The Journal of Agricultural Science*, **147(2):** 141-153.

Khalil, S.K., S. Khan, A. Rahman, A.Z. Khan, I.H. Khalil, S.W. Amanullah and A. Khan (2010). Seed priming and phosphorus application enhance phenology and dry matter production of wheat. *Pak. J. Bot*, **42(3):** 1849-1856.

Korres, N.E. and R.J. Froud Williams (2002). Effects of winter wheat cultivars and seed rate on the biological characteristics of naturally occurring weed flora. *Weed research*, **42(6):** 417-428.

Lemerle, D., B. Verbeek and B. Orchard (2001). Ranking the ability of wheat varieties to compete with Lolium rigidum. *Weed Research*, **41(3):** 197-209.

Shahid, (1994). Screening of different weed management practices for controlling weeds in wheat crop M.Sc. Thesis, Faculty of Agricultural. Gomal University 102-108.

Shehzad, M.A., M. Maqsood, M. Anwar-ul-Haq and A. Niaz (2012). Efficacy of various herbicides against weeds in wheat (*Triticum aestivum* L.). *African Journal of Biotechnology*, **11(4):** 791-799.

Shehzad, M.A., M. Maqsood, M. Anwar-ul-Haq and A. Niaz (2012). Efficacy of various herbicides against weeds in wheat (*Triticum aestivum* L.). *African Journal of Biotechnology*, **11(4):** 791-799.

Shehzad, M.A., M.A. Nadeem, M.A. Sarwar, G.M. Naseer-ud-Din and F. Ilahi (2012). Comparative efficacy of different post-emergence herbicides in wheat (*Triticum aestivum* L.). *Pak. J. Agri. Sci.*, **49(1):** 27-34.

Singh, R.K., D.K. Singh and R.P. Singh (1997). Weed-crop competition in wheat as affected by different weed species. *Indian Journal of weed science*, **29(3-4):** 199-199.

Singh, R.K., S.R.K. Singh and U.S. Gautam (2016). Weed control efficiency of herbicides in irrigated wheat (Triticum aestivum). *Indian Research Journal of Extension Education*, **13(1):** 126-128.

Stat, F.A.O. (2010). Statistical database. *Rome: Food and Agriculture Organization*.

Steinsiek, J.W., L.R. Oliver and F.C. Collins (1982). Allelopathic potential of wheat (Triticum aestivum) straw on selected weed species. *Weed science*, **30(5):** 495-497.

Zand, E., M.A. Baghestani, S. Soufizadeh, A. Eskandari, R. PourAzar, M. Veysi and A. Barjasteh (2007). Evaluation of some newly registered herbicides for weed control in wheat (*Triticum aestivum* L.) in Iran. *Crop Protection*, **26(9):** 1349-1358.

Zhang, D., H. Wang, X. Ji, K. Wang, D. Wang and K. Qiao (2017). Effect of abamectin on the cereal cyst nematode (CCN, Heterodera avenae) and wheat yield. *Plant disease*, **101(6):** 973-976.