Journal of Research in Ecology

An International Scientific Research Journal

ISSN No: Print: 2319 –1546; Online: 2319– 1554

Mini Review

Effect of weed competition in the characteristics of growth and yield and its components of wheat crop *Ttriticum aestivum* L.: A mini review

Authors:
Watheq Falhi Hammood and Suhad Mathkoor Safi A

Institution:
College of Agriculture, University of Baghdad, Iraq.

Corresponding author:
Watheq Falhi Hammood

ABSTRACT:

The variation of wheat varieties in most vegetative traits such as plant height, number of tillers and leaf area may be one of the criteria in determining the variability of these varieties in their ability to compete with the weeds in general. It is reflected in the difference in the percentage of loss to the final crop, as the competition of the weeds for wheat crop has a clear impact. The growth rate of the crop is a determinant factor for the growth, development and production of the crop in later stages. Many researchers have pointed out that the decline of the biological record in the presence of the weeds may be due to the competition of the broad leaf weeds rather than the narrow leaf. This may also be due to the low density of the narrow leaf weeds compared to the broad leaf and low dry weights, which contributed to increase the height of the plant and the number of tillers and dry weight of plants and thus increase the biological yield. The yield of cereals in the transactions were after 4-7 weeks from the emergence of the crop and greatly depend on the absence of weeds.

Keywords:

Ttriticum aestivum, Wheat crop, *Lolium rigidum* L.

Article Citation:
Watheq Falhi Hammood and Suhad Mathkoor Safi A
Effect of weed competition in the characteristics of growth and yield and its components of wheat crop *Triticum aestivum* L.: A mini review
Journal of Research in Ecology (2018) 6(1): 1637-1646

Dates:
Received: 21 March 2018 **Accepted:** 19 April 2018 **Published:** 24 May 2018

Web Address:
http://ecologyresearch.info/documents/EC0556.pdf

Journal of Research in Ecology

INTRODUCTION

Wheat *Triticum aestivum* L. is an important crop because of its strategic role in food security and its cereals are used to produce the bread loaf that is indispensable for most of the world's peoples (Al-Omari, 2003). It is ranked first among the world's and Iraqi grain crops regarding importance and cultivated area. More than one-third of the world's population relies on this crop and the importance of the crop in human food is due to gluten, which produces the best types of bread (Jones *et al*., 1998; Jamali *et al*., 2000). The cultivated area of wheat reached 1570 thousand hectares in Iraq and produced 2203 thousand tons with the average of yield reached 1403 kg/ha (Agricultural statistics and information technology, 2017). This may be due to the lack of adoption of modern technologies in the field of crop service, especially the critical stages of its life cycle (Knapp and Harms,1988).

In spite of the strategic importance of this crop in Iraq, the rate of grain per unit area is much lower than the rate of global production, as the weed is considered as one of the most important agricultural pests which causes loss in production due to its direct competition at growth requirements like water, light and nutrients with other agricultural crop and its indirect effects, as a result of the growth of other crops, especially wheat became weak and therefore decreased at this condition (Al-Jubouri and Al-Chalabi, 1985). Wheat is a weak competitor compared with other types of crops. The growth of both types of weeds *viz*., narrow and broad leaf plants at the wheat fields are one of the most important problems faced with this crop and leads to low productivity and low quality (Al-Chalabi, 2003). The most important losses caused by the weed is yield reduction, which varied, ranging from 30-50% and sometimes up to 70% according to the density and quality of the weed and the quality of the prevailing weed (Heather *et al.*, 2007).

Weed species and its density

Safi and Suhad (2016) observed that during the growing season, the number of weed species were 15 and among them 12 were broad leaf species. The most common species were sweet clover, wild beets, wild safflower, smeller bind weed and cheese weed. The most spread among the other types of weeds were sow thistle, milk thistle, buckthorn plant, wild carrots, dandelion root and knot weed, the narrow leaf weeds included three species *viz*., lesser canary grass, rigid rye grass and wild oats.

The competitive ability of the accompanied differed according to their different types of weeds. It was found that one of the most important narrow leaf weeds associated with this crop were wild oats *Avena fatua* L. and *Lolium rigidum* L. Gaud, *Lolium temulentum* L., *Phalaris minor* Retz., *Alopecurus myosuroides* L., *Silybum marianum* (L.) Gaertn, *Malva rotundifolia* L., *Polygonum aviculare* L., *Cephalaria syriaca* (L.) Schrad. ex Roem. & Schult., wild mustard *Sinapis arvensis* L., *Beta vulgaris* L., *Raphanus raphanistrum* L., *Melilotus indicus* (L.) All., *Carthamus oxyacantha* M.Bieb., *Lactuca serriola* L. and the prolonged *Convolvulus arvensis* L. and bishop's weed *Ammi majus* L. were also associated with them (Hassawi and Al-Jubouri, 1982; Al-Jubouri and Al-Chalabi, 1985).

In a study in central Iraq, Al-Chalabi (2003) noted that the absence or small number of weeds can allow or encourage the emergence of other types of leaf weeds due to the lack of competition between the two species. However, he noted that the largest density of the weeds in wheat fields return to seven different plant species. The broadleaf weed made up 38.14% and the Narrow leaf weeds were 61.9% of the total density of the weed, and wild oats were the largest proportion of the rest species, whether the weeds are broad or Narrow leaf, by Olsen and Nalewaja (1980); Duke (1985); Samara *et al*. (1987); O'Donovan (1988) noted that wild oats were not only the economically harmful to wheat

yield, but also a strong competitor to some species of other weeds. In addition to its highly competitive ability, it possesses high capacity in the effect of allelopathy on many other plants. Thorne (1982) found that the survival of the weeds with the crop is a limiting factor in the growth and production at later stages.

Al-Chalabi and Al-Agidi (2010a) reported that the density of the narrow leaf weeds were 22.7 plants/m^2 and the broadleaf weeds reached 386.7 plants/m^2. After 90 days of planting, which means that the percentage of high weeds were 5.55%, while the broadleaf weeds formed a ratio of 94.48% of the total density of the weeds. The narrow leaf weeds recorded a lowest dry weight of the weeds that reached 29.6 g/m^2, with an inhibition rate of 68.81%, while the dry weight of the broadleaf weeds were 65.0 g/m^2, with the inhibition rate of 31.51%.

Effect of weed in the vegetative growth

Challaiah *et al*. (1986) and Liebl and Douglas (1987) pointed out that the correlation of species height was better in reducing the growth of the weed than the vegetation cover and the number of tillers. Other researchers (Jones *et al*., 1998; Abouziena *et al*., 2008) showed that the number of tillers influenced by the competition of the weed in general. Caton *et al*. (2003) and Baghestani *et al*. (2006) noted that leaf area is one of the most important factors affecting crop competition with weeds. Garrity *et al*. (1992) emphasized that plant height and number of tillers are important factors in increasing the dry weight of the crop and thus increasing it's competitive ability with the weed.

Al-Chalabi and Al-Agidi (2010a) noted that the effect of broad-leaf weeds competition were more pronounced in affecting plant height than the overall weeds presence and broad-leaf weeds, noting that the absence of weed generally or the absence of broad leaf weeds and the survival of narrow leaves achieved the highest number of tillers that reached 463.3 and 479.5 tillers/m^2 respectively, while the presence of weeds in general and broadleaf weed reduced the number of tillers to 408.9 and 381.7 tillers/m^2 respectively. These results indicated that the presence of weed in general and the broadleaf weeds alone were more effective in reducing the number of tillers compared with the presence of broad leaf weeds which not only differ significantly from the treatment of the absence of weeds, but also may be an evidence of the extent to which the tillers were affected by competing with the weeds, and the characteristics of plant height and early growth force were not significantly affected by competition (OACC, 2008). Tessema *et al*. (1996) found that the narrow-leaf weeds competition had a significant effect on the traits of plant height, number of tillers, leaf area index.

Weeds effect in the yield

Habib and Alshamma (2002) found that wide-scale weed competition resulted in a significant reduction of wheat grain yield at a total rate of 37.4%, and that the absence of the competition factor between the crop and the associated weeds had an effect on increasing the weight of 1000 grain as a component of the crop. Al-Chalabi (2003) found that the total decline in grain yield due to the competition of all types of weeds reached 70%. Challaiah *et al*. (1986) confirmed that Brome grass *Bromus tectorum* L. in Lincoln caused a decrease in the yield of all wheat varieties by 9-21% and 20-40% in the northern Platte depending on the varieties. Turkey variety was the lowest in the reduction rate for being the most competitive for the brome grass compared to other varieties. While the presence of 266 plants/m^2 of different weeds species caused a loss in the grain yield of 15% and that the presence of 83 and 266 plants/m^2 of wild oats *Avena fatua* L. with wheat reduced the yield by 30 and 53% respectively (Attia and Wahib, 1989).

Wellia *et al*. (1998) indicated that increasing the plant density of wild oat reduced wheat yield, since the presence of three plants/m^2 of this plant reduced the yield less than 1% while the reduction rate reached

2.2% with the presence of five plants/m^2 and reached 50-60% with the presence of 100 plants/m^2. This is due to the competition between the plants of this weeds and crop.

Levitt (1980) noted that the competition between weeds and crop plants on the necessary growth factors had adverse effects on yield. Todd and Stobbe (1980) noted that improving the source's efficiency in the supply of photosynthesis during the grain filling period increased grain weight in the period from flowering to physiological maturity. Rao (1992) found that the production of one kilogram of dry matter of the weed was accompanied by a reduction of one kilogram of wheat grain. Brinkman *et al.* (1980) and Essa (1990) noted that the dry matter weight of the plant may increase without increasing the economic yield, causing a reduction in the harvest index. Conversely, the increase in the harvest index in the absence of weeds treatment may be due to the increase of both grain yield and Biological yield in other words the total dry matter.

Al-Chalabi and Al-Agidi (2010b) pointed out that the absence of weeds treatment achieved the highest rate of grain yield of 6.97 tons/ha, where as control treatment (weedy) registered the lowest grain average of 5.08 tons/ha, a decrease in the ratio of 27.12%. The treatment of high weeds did not differ significantly from the absence of weeds achieving a grain yield of 6.78 tons/ha and a decrease ratio of 2.73%, while the grain yield in the broad weed treatment decreased to 5.64 tons/ha, which decreased in a ratio of 19.08%.

The existence of a competition factor of the weeds in general and broadleaf in particular because of their high density has a negative impact causing a significant decrease in the grain yield. It has been observed that water shortage, for example, to which plants exposed at the stage of flowering or the milk phase often leads to failure or lack of grain filling with nutrients (Mohamed *et al.*, 1990) and the weeds may have as a result of competition a role in this shortage, especially in the advanced stages of growth (Al-Chalabi, 2003). Also, the availability and distribution of photosynthetic products in plant tissues after flowering determines the final grain weight (Austin *et al.*, 1980), as well as the other weeds effects such as light-blocking or lupus secretions in the weed, which impede the growth of the crop (Duke, 1985). The increase in grain yield in the treatment of weeds absence may be due to the increase in the number of ears and the number of spike grains and the weight of 1000 grains combined or the increase of one of them. The absence of competition between both the types of narrow leaves and broad leaf weeds in the absence of weeds treatment from the early stages of crop growth till physiological maturation has allowed wheat plants to be better consumed and best utilization of growth requirements, such as light, nutrients and moisture, and growth rates, reflected on the accumulation of dry matter in grains. Therefore, the absence of competition for the weed has indirectly encouraged the increase of accumulation of dry matter in the final estuaries, namely, grains as a result of improved penetration of light and increased photosynthesis and thus increase the amount of representative products directed to the spike, resulting in more grain yields and noted the superiority of the treatment of weeds absence and the presence of high weeds treatment in the biological yield of 18.91 and 19.45 tons/ha respectively. In relation to the weedy treatment and treatment of the presence of broad weeds, in which the biological yield decreased to 15.33 and 16.26 tons/ha respectively, the decrease in the biological yield by weed presence may be due to the competition of the broad leaf weed rather than narrow leaf weeds. This may be due to the low density of the narrow leaf weeds compared with the broadleaf weeds and the low dry weights, which contributed in increasing the height of the plant and the number of tillers and dry weight of plants and thus increased the biological yield.

Khan *et al.* (2000) confirmed that the weed control in wheat has a significant effect on the yield (ton/

ha). Mennan (2004) found that the yield of the short-lived Bezostaja variety was 3420 kg/ha while in the long-term Kate-Al was 3360 kg/ha and that the yield decreased by increasing the numerical density of the weed. The presence of 20 plants of wild oats caused reduction in yield reached 13.3% and 18.6% for Bezostaja and Kate-Al respectively, and reported that the dry matter of both cultivars was also reduced by increasing the density of the weed. The same results were observed with the presence of field foxtail grass *Alopecurus myosuroides*.

Weeds effect in yield components

Khan *et al*. (2007) noted that the maximum rate of the spikes number/m^2 was 281.9 and the maximum spike length was 9.33cm. The highest number was 50 grain/spike and the largest weight of 1000 grain was 30.36g. There were achieved by the treatment of the absence of oat plants compared with other treatments (5, 10, 15, 20, 25 and 30 plant/m^2). In Canada, it was found that the wheat yield and spikes number/m^2 significantly decreased as a result of wild oats competition by 35% for the grain, while the number of spikes decreased by 25% (OACC, 2008).

Al-Chalabi and Al-Agidi (2010b) pointed out that the treated treatment recorded the minimum spike length of 10.13cm, which may give an indication of the effect of different types of weeds on this character, pointing out that the treatment of weed absence in general and the existence of high weeds achieved the highest number of spikes that reached 413.4 and 427.7 spikes respectively in relation to the treated treatment and treatment of broad leaves, which reached 301.9 and 340.3 spike respectively. This may be due to the fact that the absence of weeds allow the crop to grow without relative tension, which reflected on the increase in the efficiency of photosynthesis and thus the crop performance to its activities properly at tillers which was the early stage of crop growth that must be accompanied by the absence of the weed as this will have a positive impact on the early stimulation of tillers and the formation of effective tillers and thereby increasing the number of spikes per unit area. They observed a decrease in the spike grains number in the treated treatment that significantly reached 47.6 compared with other treatments subsequently weeds reached 51.3 grain/ spikes, in the high weeds treatment, and 52.9 grain/ spike in the broad leaf weed treatment. Although the number of grains/spike exceeded in the absence of weeds treatment, and the weight of 1000 grain in the absence of weeds treatment increased than in in the rest of the weeds treatments and reached 39.58g, while 38.78g in the treated treatment while it reached 37.77g and 37.86g in the treatment of high and wide weeds in succession and did not differ significantly from the treated treatment. The absence of the competition factor between the crop and the accompanying weeds have an impact on the weight of 1000 grain as a yield component .

Tessema *et al*. (1996) found that the narrow leaf weeds competition had a significant effect on the, number of spike/m^2, and number of grain/spike, weight of 1000 grains, and harvest index. Khan *et al*. (2000) confirmed that the weed control in wheat a significant effect on the number of fertile tillers/m^2, number of grain/ spike .

Al-Chalabi (2003) confirmed that the weed competition factor for wheat crop has a clear effect on the rate of growth and development of the crop, since the survival of the weed and its lack of control led to a decrease in the number of spikes to 90.7 spike/m^2. Compared with the treatment of weed control, which increased the number of spikes to 314.7. The increase in the number of tillers in the absence of the weed is the result of the absence of competition between both the types of weed, which gave the opportunity for the emerging tillers to grow and develop and therefore to be effective in producing the spikes Subsequently, the increase in the number of spikes in the treatment of

weeds absence may be due to the increase in the number of catalytic tillers in the early stages of crop growth and the absence of competition, which contributed to the greater availability of photosynthetic products for these tillers and their development at the beginning of detection. The importance of light penetration in the absence of weed plants in this treatment may also contribute to the possibility of improving the absorption of water and the transfer of nutrients and guide part of them to meet the growth requirements of new tillers and thus increase the number of load-bearing spikes.

It is also noted that there is no significant effect of the presence or absence of the weeds in the number of spike grains, confirming the results of Aufhamme and Bangerth (1982) and Mahdi *et al*. (2002). It is pointed out that the stage of grain filling comes in the late stages of crop growth. The fullness and ability of the exporter to supply photosynthetic and grain distribution products, are the final estuaries. Since grains are the final destination of these substances, the absence of competition or the low number of weeds and dry weight may lead to the processing of the largest amount of water and the primary elements of the representation of photosynthesis by the crop, which directly affects the weight of grain, and this is in agreement with the Almeida *et al*. (2004) who indicated that the increase of grain yield comes as a result of increasing the number of spikes primarily due to an increase in the number of tillers and increase the number of grain/Spike and 1000 grain weight.

Critical period of competition

Chaudhary *et al*. (2008) reported that the duration of the presence of the weed had a significant effect on the weight of the soft and dry matter of weeds, the number of tillers, the number of spikes/m^2, the weight of 1000 grains, and the grain yield of the wheat. The highest average of grains yield reached 0.06 tons/ha was registered in the weeds absence and treatment 30 days of planting followed by 40 days of 4.96 tons/ha and 50 days of 4.85 tons/ha, while leaving the weeds grow and compete for more than 50 days of planting which caused a significant decrease in the grain yield and yield components with a significant increase in soft and dry weight of weeds.

Ali *et al*. (2002) noted that there was a significant effect of the duration of the weed competition on the growth and components of wheat. The highest yield was 6122.21 kg/ha in the weedless treatments followed by the competition for 4-6 weeks which differed significantly from the weedless transactions. Khan *et al*. (2002) pointed out that the period of the presence of weed had a significant effect on the characteristics of plant height, spikes length, number of spike and the weight of 1000 grains and the biological yield and grain, and stressed that although the competition of the weed during the first 42 days which did not reduce the yield but the presence of weed after this period showed a significant effect on the yield components.

Generally, many studies indicated that the stage of the beginning of growth was crucial in determining the intensity and outcome of the successive competition between the crop and the associated weeds. The life cycle of the wheat crop in the warmer climates appeared to be shorter and have showed the importance of early competition between the plant and the crop, as grains yield and straw significantly reduced when the weed competes with the crop for the length of the growing season, while wheat was not affected and remained free of weeds during the first six weeks of planting or when the yield was 6-10 weeks (Saeed *et al*., 1984). Shad *et al*. (1986) point out that the critical period of weed competition with wheat crop extended from 7-10 weeks after planting. Mishra (1999) confirmed that allowing weeds to grow with wheat crop for 30 days did not show a negative effect on the growth and yield of the wheat. However, the plant height and the number of tillers/m^2, the number of grains/spike, weight of 1000 grains and grains yield decreased significantly as a

result of the presence of weed in the fields of the crop when the duration increased. While Saeed *et al*. (1987) noted that the removal of the weed after 75 days of cultivation was not economically feasible. The critical period of the weeds competition for the crop was the first 4-8 weeks of planting and Ghafoor and Sadiq (1991) recorded a decrease in the grains yield of 29 and 30% during the first and second seasons respectively as a result of competition with the *Phalaris minor* Retz. plant in a density of 200 plants/m^2, and the grain yield in the crop weeds removed after 4-6 weeks of crop emergence which was in the same average of weed free treatment completely.

Ibrahim *et al*. (1991) noted that the presence of the weed with the wheat crop for the length of the growing season caused a reduction in grain yield of 23-30%. Akhtar *et al*. (2000) also found that wheat yield decrease was due to the increased weed competition duration. Singh *et al*. (1985) and El-Hamid *et al*. (1998) confirmed that the absence of weed for the first 60 days after planting yields gave similar results to that given by weed less treatments throughout the growing season.

CONCLUSION

There is a negative impact on the competition of weeds in the wheat crop which has caused competition of the weeds significantly and reduced the final yield. The process of control can reduce the damage resulting from that competition and then increase the final yield. The first stages of growing wheat yield, ranging from 4-10 weeks, are very effective in determining the yield ability of the wheat crop to the accompanying weeds. High temperatures lead to a shortened life cycle of the wheat crop, resulting in early competition between crops and weeds.

REFERENCES

Abouziena HF, Sharara AAF and El-desoki ER. 2008. Efficacy of cultivar selectivity and weed control treatments on wheat yield and associated weeds in sandy soils. *World Journal of Agricultural Sciences*, 4(3): 384-389.

[ASIT] Agricultural Statistics and Information Technology. 2017. Annual wheat production report. The Ministry of Planning and development cooperation. The Republic of Iraq. 20 p.

Akhtar M, Mahmood A, Ahmed J and Iqbal K. 2000. Nitrogen uptake efficiency in wheat (*Triticum aestivum* L.) as influenced by nitrogen level and weed-crop competition duration. *Pakistan Journal of Biological Sciences*, 3(6): 1002-1003.

Al-Chalabi FT. 2003. Biological response of the wheat to control weeds with Diclofop-methyl herbicide alternating with 2, 4-D and its effect in the grain yield. *Journal of Iraqi Agricultural Sciences*, 34(1): 89-100.

Al-Chalabi FT and Al-Agidi HSM. 2010a. Competitive ability if some wheat cultivars to accompanied weeds and its impact on yield and yield component. *Anbar Journal of Agricultural Science,* 8(4): 352-362.

Al-Chalabi FT and Al-Agidi HSM. 2010b. Weed competition effect on wheat cultivars and its impact on growth characters. *Anbar Journal of Agricultural Science*, 8(4): 444-456.

Ali A, Malik MA, Rehman RM. **Sohail R and Akram MM. 2002.** Growth and yield response of wheat (*Triticum aestivum* L.) to different sowing times and weed competition durations. *Pakistan Journal of Biological Sciences*, 3: 681-682 .

Al- Jubouri BA and Al-Chalabi FT. 1985. Weed and weed control. Press Institute of Technical Institutes, Ministry of Higher Education and Scientific Research. 224 p.

Almeida ML, Luis S, Aldo MJ, Antonio CA, Cristiano IN and Armando CK. 2004. Tiller emission and

dry mass accumulation of wheat cultivars under stress. *Scientia Agricola*, 61(3): 266-270.

Al-Omari MR. 2003. Effect of Organic Fertilizer on the Productivity of Municipal Wheat Varieties. Master Thesis. College of Graduate Studies. University of Najah. 55 p.

Attia HJ and Wahib KM. 1989. Understanding crop production-Part one. Dar Al-Hikma For printing and publishing. Ministry of Higher Education and Scientific Research - University of Baghdad. 528 p.

Aufhammer W and Bangerth F. 1982. Growth regulator effects on ear and grain Development in wheat. In Chemical Manipulation of crop growth and development. McLaren JS ed. Butterworth Scientific, London. 359-373 p.

Austin RB, Bingham J, Blackwell RD, Evans LT, Ford MA, Morgan CL and Taylor M. 1980. Genetic improvements in winter wheat yields since 1900 and associated physiological changes. *The Journal of Agricultural Science*, 94(3): 675-689.

Baghestani MA, Eskandar Z and Saeid S. 2006. Iranian winter wheat's (*Triticum aestivum* L.) interference with weeds: I. grain yield and yield competitive index. *Pakistan Journal of Weed Science Research*, 12(3): 131-144.

Brinkman MA, Langer DK, Harvey RG and Burger WC. 1980. Effect of atrazine carry over on malting quality of barley. *Crop Science*, 21(6): 967-973.

Caton BP, Cope AE and Mortimer M. 2003. Growth traits of diverse rice cultivars under severe competition: implications for screening for competitiveness. *Field Crops Research*, 83(2): 157-172.

Challaiah OB, Wicks GS and Johnson VA. 1986. Competition between winter wheat (*Triticum aestivum* L.) cultivars and downy brome (*Bromus tectorum*). *Weed Science*, 34(5): 689-693.

Chaudhary SU, Muzzammil H, Anjum MA and Javed I. 2008. Effect of weed competition period on yield and yield components of wheat. *Journal of Agricultural Research*, 46(1): 47-53 .

Duke SO. 1985. Weed physiology: Reproduction and ecophysiology. Volume 1, CRC Press, Inc. Bora Raton, Florida, USA. 176 p.

El-Hamid MMA, Hassanein EE and Shebl SM. 1998. Weed wheat competition in the Nile delta. *Assiut Journal of Agricultural Sciences*, 29(3): 105-113.

Garrity DP, Moovillon M and Moody K. 1992. Differential weed suppression ability in upland rice cultivars. *Agronomy Journal*, 84(4): 586-591.

Essa TA. 1990. Crops Physiology. Ministry of Higher Education and Scientific Research. 496 p.

Ghafoor A and Sadiq M. 1991. Critical period of weed crop competition in winter wheat. *Pakistan Journal of Agricultural Research,* 12(1): 13-17.

Habib SA and Alshamma AM. 2002. Competitive potential of six wheat varieties with broadleaf weeds in central plains of Iraq. *Iraqi Journal of Agriculture*, 7(5): 157-163.

Hassawi GS and Al-Jubouri BAK. 1982. Weed and weed control. Ministry of Higher education and Scientific Research. University of Mosul Press. 195p.

Heather EM, Navabi A, Frick BI, O'Donovan JT and Spaner DM. 2007. The weed-competitive ability of Canada western red spring wheat cultivars grown under Organic Management. *Crop Sciences*, 47(3): 1167-1176.

Ibrahim M, Shafi M, Anwar SA, Khan MA and Latif SM. 1991. Role of weeds in reducing crop yield and nutrients uptake. Absts. 3rd All Pak. Weed, Sci.

Conference on NWFP Agricultural University Peshawar, Pakistan, October 16-17.

Jamali KD, Arain MA and Mhamd M. 2000. Comparative performance of semi-dwarf wheat (*Triticum aestivum* L.) genotypes. *Wheat Information Service*, 90: 45-46.

Jones P, Evan MK and Bruce AO. 1998. Effects of alien cytoplasmic variation on carbon assimilation and productivity in wheat. *Journal of Experimental Botany*, 49(326): 1519-1528.

Khan IA, Hassan G and Alam I. 2007. Effect of wild oats (*Avena fatua* L.) densities and proportions on yield and yield components of wheat. *Journal of Agriculture and Biological Science*, 2(1): 26-31.

Khan MA, Hassan G, Shah WA and Afridi MZ. 2002. Duration effect of weed competition on the yield and yield components of wheat. *Sarhad Journal of Agriculture*, 18(3): 335-337.

Khan MB, Asif M, Hussain N and Iqbal M. 2000. Agro-economic impact of different weed control strategies in wheat. *Journal of Research in Science*, 11(1): 46-49.

Knapp JS and Harms CL. 1988. Nitrogen fertilization and plant growth regulator effects on quality of four wheat cultivars. *Journal of Production Agriculture*, 1(2): 94-98.

Levitt J. 1980. Response of plant to environmental stresses. Volume 2. Academic Press, New York. 607 p.

Liebl R and Douglas AW. 1987. Influence of Italian ryegrass (*Lolium multiflorum* L.) in wheat (*Triticum aestivum*). *Weed Science,* 35: 819- 823.

Mahdi AS, Jassim AH., Ismail M and Saleh KT. 2002. A new class of soft wheat is developed for the central region of Iraq. *Journal of Iraqi Agriculture - Special Issue / Proceedings of the Fourth Scientific Conference of Agricultural Research,* 7(4).

Mennan H. 2004. The competitive ability of *Avena* spp and *Alopecurus myosuroides* Huds. influenced by different wheat (*Triticum aestivum* L.) cultivars. *Turkish Journal of Agriculture and Forestry*, 28(4): 245-251.

Mohamed MA, Steiner JJ, Wright SD, Bhangoo MS. and Millhonse DE. 1990. Intensive crop management practices on wheat yield and quality. *Agronomy Journal*, 82(4): 701-707.

[OACC] Organic Agriculture Center of Canada. 2008. Helping wheat compete. Final Research Report. 34 p.

O'Donovan JT. 1988. Wild oat (*Avena fatua* L.) infestation and economic returns influenced by frequency of control. *Weed Technology*, 2(4): 495-498.

Olsen WA and Nalewaja JD. 1980. Antagonistic effects of MCPA on wild oat (*Avena fatua*) control with diclofop. *Weed Science*, 29(5): 566-571.

Rao VS. 1992. Principles of weed science. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi. 555 p.

Saeed SA, Rao AR, Hussain M, Bajwa AM and Yaqub M. 1987. Weed infestation, competition and control in wheat (*Triticum aestivum* L.). Proceedings of the Pak-Indo-US Weed Control Workshop, NARC, Islamabad, Pakistan, March 11-14, 99-110 p.

Saeed SA, Sadiq M and Nisar A. 1984. Effect of weed competition on wheat (*Triticum aestivum* L.). *Pakistan Journal of Agricultural Sciences*, 21(3-4): 237-241.

Safi A and Suhad MA. 2016. Control of wheat weeds using herbicides and reflication on yield. *Al-Furat Journal of Agricultural Sciences*, 8(1):134-141.

Samara JS, Dhillon SS and Brar HS. 1987. Comparative efficacy of herbicide for weed control in wheat.

Journal of Research, 24: 19-21.

Shad RA, Khan BR and Ziauddin M. 1986. Studies on techniques for improved weed management in wheat. Annual Conf. Indian Soc. Weed Science. 185 p.

Singh RD, Venugopal K, Gupta RK and Singh GB. 1985. Study of weed flora, crop weed competition and chemical weed control for wheat. Annual Conf. Indian Soc. Weed Sci. Sikkim, India. 73-102.

Tessema T, Tanner DG and Hulluka M. 1996. Grass weeds competition with Bread wheat in Ethiopia: effects on selected crop and weed vegetative parameters and yield components. *African Crop Science Journal,* 4(4): 399-409.

Thorne GN. 1982. Distribution between parts of the main stem shoot and the tillers photosynthetate produced before and after anthesis in the top three leaves of main shoots of Hobbit and Maris Humstman winter wheat. *Annals of Applied Biology*, 101(3): 553-559.

Todd BG and Stobbe EH. 1980. The basis of the antagonistic effect of 2,4-D on diclofop-methyl toxicity to wild oat (*Avena fatua* L.). *Weed Science*, 28(4): 371-377.

Wellia US, Dhaliwal KB and Brar LS. 1998. Competitive interaction between wheat and wild oat in relation to wild oat population density. Conference on Agriculture towards Sustainable Development. Chandigarh, India, 15-17 Nov. 430-434 p.