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RESEARCH ARTICLE

INTERFERENCE EFFECTS OF WILD MUSTARD AND WILD OAT ON GROWTH INDICES OF WHEAT UNDER DIFFERENT NITROGEN LEVELS

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ABSTRACT

To evaluate the influences of nitrogen levels and weed density on growth indices of wheat a two years field experiment was conducted at Research Field of Islamic Azad University of Ahvaz-Iran in 2007-8 and 2008-9 cropping season. The results showed that increasing nitrogen application from 90 to 210 kg N ha^{-1} increased the negative interference effects of wild mustard and wild oat on Total Dry Matter (TDM), Leaf Area Index (LAI) and Crop Growth Rate (CGR). Inter specific competition of wild mustard and wild oat significantly decreased the plant height, TDM, LAI and CGR and maximum values were noted in zero density of wild mustard and wild oat. Among the nitrogen levels the highest TDM, LAI and CGR was observed in the application of 150 kg N ha^{-1}.

INTRODUCTION

Relationship of plant ontogeny with some factors such as temperature, nitrogen status, plant density and irrigation are fundamentally influencing on different growth indices such as plant height, number of leaves and leaf area etc. Nitrogen supply determines the longevity and size of leaves and the development as well as longevity of branches (Hay and Porter 2006). Increasing leaf area causes increase in capturing of solar radiation in canopy and enhances the dry matter accumulation. Decrease in leaf area index reduces the conversion efficiency of absorbed solar radiation in to dry matter accumulation (Sharifi *et al*., 2011). Dry matter accumulation in cereals depends on the relationship between source and sink. The source has a potential capacity for photosynthesis whereas the sink has a potential capacity for utilizing these products. Therefore, for the best source-sink regulation, a balanced mineral nutrition is essential. Warraich *et al*. (2002) reported the effect of nitrogen on source-sink relationship in wheat. They showed that increasing nitrogen level from zero to 180 kg ha^{-1} led to a significant increase in dry weight, leaf area index, relative growth rate and net assimilation rate in wheat. However the application of nitrogen had no-significant effect on increasing leaf area duration.

Crop fertigation is an important component to achieve higher crop production (Blackshaw 2005). Weed interference in crops can be reduced by the manipulation of crop fertigation (Di Tomaso 1995). For increasing crop yield amongst various nutrients, N is major (Camara *et al*., 2003), Therefore, studies on effects of nutrients particularly N at various levels on crop-weed growth and competition are important. A study about the competition between wheat, *Triticum aestivum* L. and wild oat, *Avena fatua* L., under different nitrogen levels (75, 100 and 125 kg ha^{-1}) showed that the wheat plant height was affected by the wild oat density. The height of wheat plant at 50 wild oats per m^{-2} was 83.8 cm as compared to 90.1 cm at zero density of wild oat m^{-2} (Hassan and Khan 2007). Karimmojeni *et al*. (2010 a) in a study on weed-corn competition observed that there is a negative relationship between leaf area index of maize and *Xanthium strumarium* and *Datura stramonium* density. Increasing density of weeds had caused decline in LAI of maize. The reduction in LAI due to competition with *X. strumarium* was more than competition with *D. stramonium*. Weeds flora is varied in different areas depending on climatic conditions. Although in most area some of them are common. Wild oat, *Avena ludoviciana* L., and wild mustard, *Sinapis arvensis* L. are the most common weeds in wheat field worldwide (Labbafi *et al*., 2010). Therefore this experiment was conducted to study the interference effects of wild mustard and wild oat on growth indices of wheat under different nitrogen levels.

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MATERIAL AND METHODS

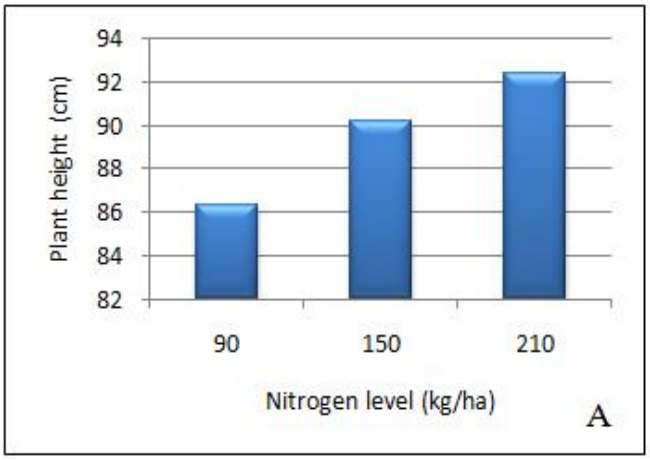
The two years field experiment was conducted at Research Field of Islamic Azad University of Ahvaz-Iran in 2007-8 and 2008-9 cropping season to study the effects of wild mustard, *Sinapis arvensis* L. and wild oat, *Avena ludoviciana* L. on growth indices of wheat, *Triticum aestivum* L. Var. Chamran under different nitrogen levels. The Experiment was performed in split–factorial and in randomized complete block design with three replications in additive series. Three nitrogen levels 90, 150 and 210 kg ha^{-1} were assigned to main plot, whereas wild mustard densities (0, 5, 10 and 15 plants m^{-2}) and wild oat densities (0, 25, 50 and 75 plants m^{-2}) were kept into sub-plots. Weeds were chosen as a result of their high loss in cereal crop all over the world and wheat was chosen because it is widely cultivated cereal worldwide and fed world growing population. Wheat seed density was maintained at 400 seeds per square meter. The seeds of wild oat and wild mustard were sown manually on the same day as that of wheat. All other weeds were removed manually throughout growing season. The height of wheat plant was measured from the base of first node at ground level to the tip of the uppermost spikelet

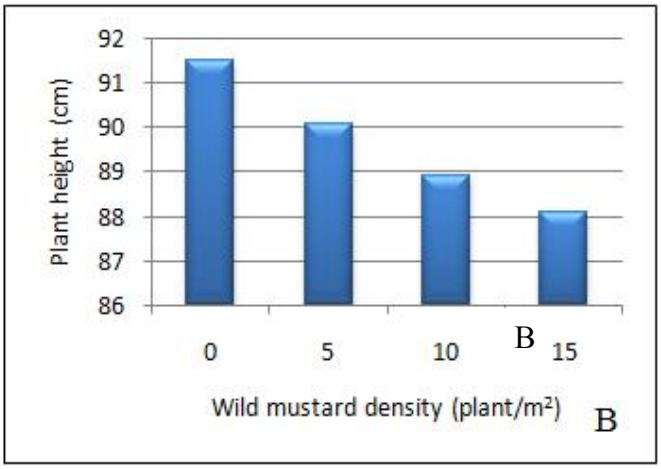
at harvest stage. The growth indices of wheat like total dry matter accumulation, leaf area index and crop growth rate were determined at the intervals of 25 days. To determine growth indices, all the wheat plants of 50 cm height in second and third row in each plot were harvested. These samples were oven dried at 70 ^{o} Celsius (initially for 48 hours) till the constant dry weight was obtained.

RESULTS AND DISCUSSION

Plant height

The results of present study (Fig. 1 A) indicated that the plant height of wheat at maturity responded positively to increased level of nitrogen. The plant height in application of 210 kg N ha^{-1} was 6.06 cm higher than 90 kg N ha^{-1}. This result was in the line with Giambalvo *et al*. (2010) who noted that the nitrogen application had a positive influence on wheat height. The height was higher in the application of 80 kg N ha^{-1} as compared to zero kg N ha^{-1}. Similar study on corn demonstrated that increasing nitrogen from zero to 180 kg led to increase in height of corn (Barker *et al*., 2006). Growth attributes are highly influenced by application of fertilizers. Nitrogen has pivotal role in increasing the height of plants. In seedling stage various types of crops are positively responding to the dose of N application up to completion of vegetative stage. The maximum increase in height of wheat can be explained on this basis. However at maturity N application has no any effect on growth attributes. Once the grain filling starts the photosynthets are translocated from source (leaves) to the sink (grains) and there is no further increase in plant height. Our results (Fig. 1 B and C) showed that increasing wild mustard and wild oat density decreased the final height of wheat. The density of 15 and 75 plants of wild mustard and wild oat decreased the wheat height by 3.4 and 5.5 cm as compared to their zero density respectively.





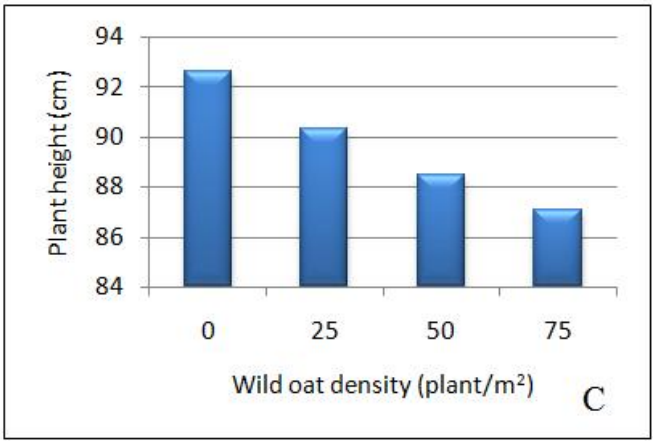
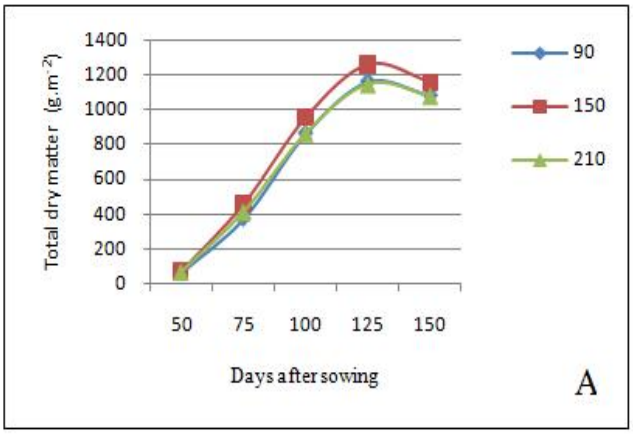


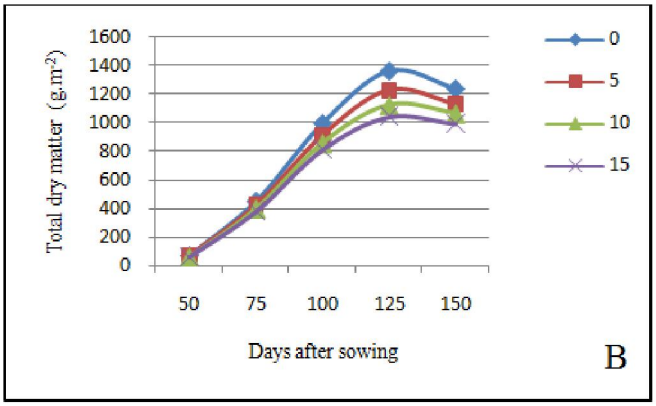
Fig. 1 Effect of different nitrogen levels (A), wild mustard (B) and wild oat (C) densities on plant height of wheat

An investigation of competitive effects of *Xanthium strumarium* and *Datura stramonium* on corn revealed that plant height was reduced in the presence of both weed species. The highest density of *X. strumarium* significantly decreased corn height by 33 cm as compared to mono culture of corn (Karimmojeni *et al*., 2010 a). In another study, wheat exhibited negative response in height to increasing wild oat, *Avena fatua* L., density. The results showed that 40 plants of wild oat m^{-2} lead to decrease the wheat height by 7.2% as compared to weed free treatment (Khan *et al*. 2008). In weed-crop competition, weeds are heavily absorbing the nutrient resources in the soil and grow luxuriantly. As the availability of nutrients for crops reduced their growth is hampered as compared to growth of weeds. Not only for the nutrients but there is sharp competition for other resources like water and growth regulating factors. The allelopathic influence of the weeds with the crop is second important factors for the reduction of plant height.

Total dry matter

Dry matter weight is a good indicator for measuring the growth and tissue activation. The results indicated that in all treatments (Fig. 2), the total dry matter of wheat increased till 125 days after sowing and it decreased from 125 days after sowing till harvesting due to increase aging of leaves (senescence), reduction in leaf area index and leaf area duration. Increasing nitrogen from 90 to 150 kg ha^{-1} had increased the total dry matter accumulation. However the application of 210 kg N ha^{-1} reduced the total dry matter (Fig. 2 A). Increasing TDM with increasing nitrogen from 90 to 150 kg ha^{-1} may be attributed to optimal level of photosynthesis, higher leaf area and an increase in chlorophyll content. However at 210 kg N ha^{-1} dry weight loss increased by increasing competitive ability of wild mustard and wild oat.





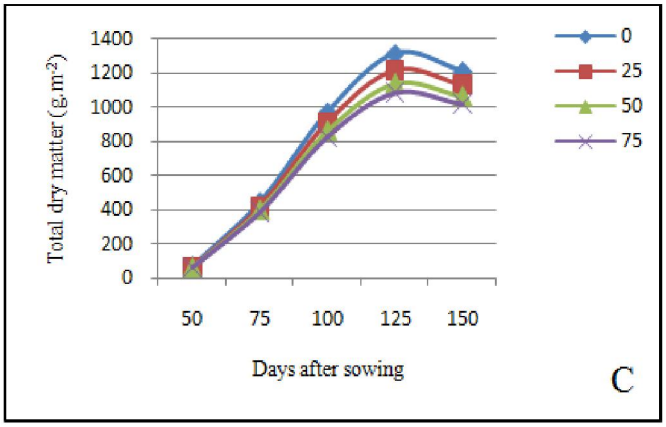


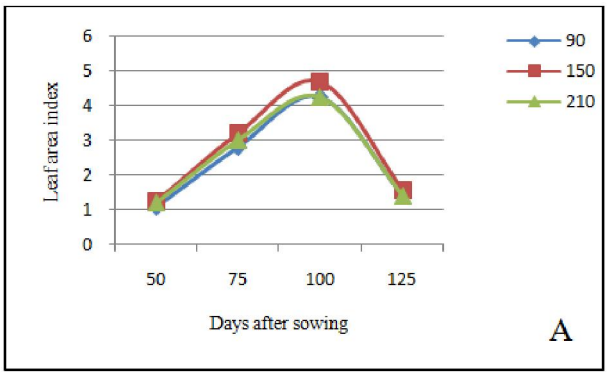
Fig. 2 Effect of different nitrogen levels (A), wild mustard (B) and wild oat (C) densities on total dry matter of wheat

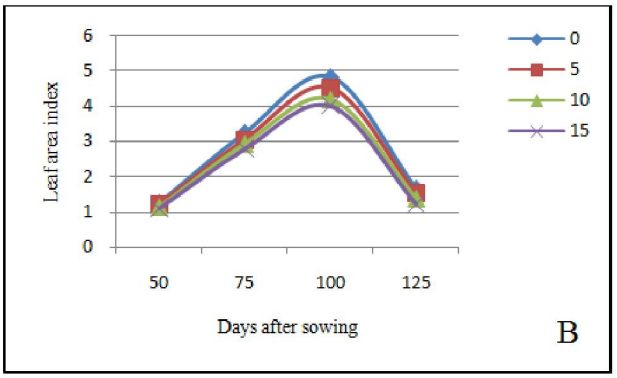
The results also showed that increasing wild mustard and wild oat density reduced the dry matter accumulation. The maximum of TDM was observed in zero density of weeds and the minimum was observed in the highest infestation of weeds (Fig. 2 B and C). This result was in the line with Sheibany *et al*. (2009) who noted that total dry matter of corn was reduced in the competition with *Amaranthus retroflexus*. Cathcart and Swanton (2004) revealed that above ground dry matter of corn was increased at higher level of nitrogen fertilizer under weed free condition while it was decreased in the presence *Setaria viridis* L., at each nitrogen level.

Leaf area index

An investigation of leaf area index under weeds densities and nitrogen levels indicated that in all treatments, LAI increased till 100 days after planting and then it was decreased till harvesting (Fig. 3). The reduction of LAI from 100 days after sowing may be due to increased leaf aging, shading and competition among plants for light and other resources. The results showed that increasing nitrogen from 90 to 150 kg N ha^{-1} increased the LAI of wheat. However application of 210 kg ha^{-1} had lowered LAI than 150 kg N ha^{-1} (Fig. 3 A). A progressive reduction in leaf area index was observed with a successive increase in wild mustard and wild oat densities. Among the weeds densities, the highest LAI was recorded in zero density of weeds and the lowest was noted in the highest infestation of weeds in all sampling stages (Fig. 3 B and C). Chikoye *et al*. (2008) stated that increasing nitrogen level increased corn, *Zea mays* L., leaf area. Rastgoo *et al*. (2004) reported that increasing wild mustard, *Sinapis arvensis* L., density decreased the leaf area index and dry matter of wheat, *Triticum aestivum* L., through increasing its leaf area and dry matter accumulation. Sheibani and Ghadiri (2012) reported the leaf area index of wheat, *Triticum aestivum* L., was decreased in the presence of weeds, *Avena ludoviciana* and *Hordeum spontaneum*, competition as compared to weed free treatment.

Williams and Lindquist (2007) revealed that weed interference (namely: barnyardgrass, *Echinochloa cruss-galli* L. Beauv., common lambsquarters, *Chenopodium album* L., green foxtail, *Setaria viridus* L. and redroot pigweed, *Amaranthus retroflexus* L.) greatly affected the LAI and decreased the maximum LAI of sweet corn, *Zea mays* L. The maximum of LAI was decreased by 23 to 33% by weed interference in early planting. Leaf area index has highly positive correlation with net assimilation rate (NAR) and plant productivity. In present study number of leaves per plant, size of the leaf and consequently the leaf area might have decrease due to weed competition. Also, lack of nutrients and non availability of resources as well as allelopathic impact of weeds have lead to reduction in LAI.





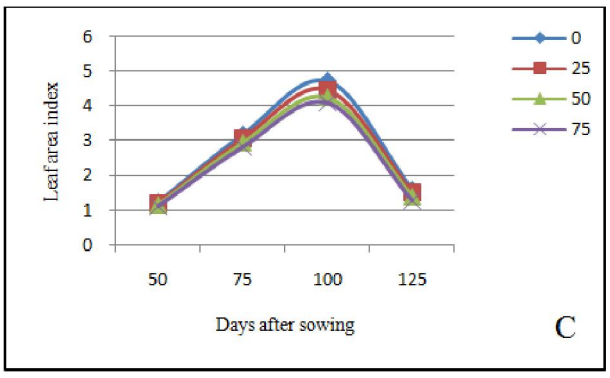


Fig. 3 Effect of different nitrogen levels (A), wild mustard (B) and wild oat (C) densities on leaf area index of wheat

Crop growth rate

The results in all treatments (Fig. 4) indicated that crop growth rate increased till 100 days after sowing and after that it decreased till harvesting. The reduction in crop growth rate from 100 days after sowing up to maturity was as a result of aging of lower leaves and reduction in LAI. The results showed that among nitrogen levels the highest CGR was recorded in the application of 150 kg ha^{-1} (Fig. 4 A) and increasing wild mustard and wild oat density significantly decreased the crop growth rate. Among weeds density the maximum of CGR was observed in zero density of weeds and the minimum was

observed in the highest infestation of weeds (Fig. 4 B and C). The competitive ability of 5, 10 and 15 plants of wild mustard at low level of nitrogen was less than competitive ability of 25, 50 and 75 plants of wild oat respectively. While, increasing nitrogen level increased competitive ability of wild mustard more than wild oat and increased negative effects of wild mustard on CGR. Cathcart and Swanton (2004) in a study of effects of N fertilizer and green foxtail, *Setaria viridis* (L.) Beauv. competition on corn, *Zea mays* L. found out that the corn LAI, CGR and shoot dry matter were decreased in the presence of green foxtail at each N level. Karimmojeni *et al*. (2010 b) reported that the density of 4 and 16 plants of *Xanthium strumarium* decreased the crop growth rate of corn, *Zea mays* L., by 50% in 2006 and 32% in 2007 respectively whereas the density of 4 and 16 plants of *Datura stramonium* reduced the CGR by 22% in 2006 and 38% in 2007 respectively.

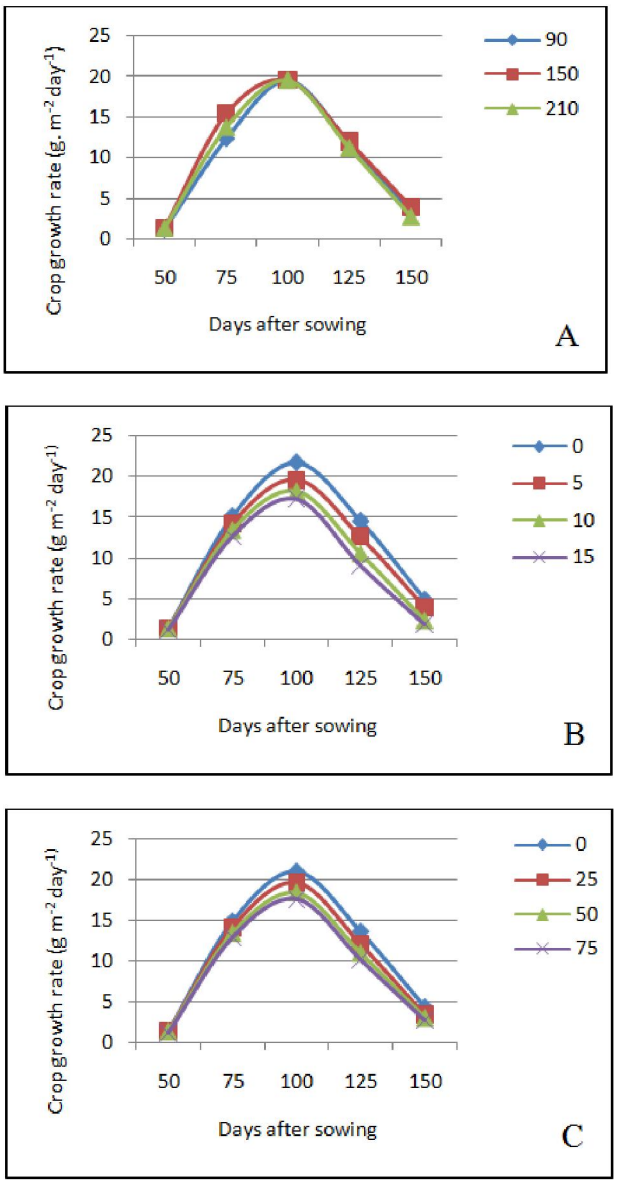


Fig. 4 Effect of different nitrogen levels (A), wild mustard (B) and wild oat (C) densities on crop growth rate of wheat

In conclusion it can be stated that wild mustard and wild oat have negative impact on growth indices of wheat variety Chamran under different nitrogen levels. The competition of both the weeds significantly reduces total dry matter, leaf area index and crop growth rate as compared to weed free condition. Result indicated that application of N was more beneficial for weeds than wheat. Therefore, farmers should consider crops as well as weeds when fertilizer application programs are planned.

REFERENCES

Barker, D. C., Knezevic, S. Z., Martin, A. R., Walters, D.T. and Lindquist, J. L. 2006. Effect of nitrogen addition on the comparative productivity of corn and velvetleaf (*Abutilon theophrasti*). *Weed Sci* 54:354-363.

Blackshaw, R. E. 2005. Nitrogen fertilizer, manure and compost effects on weed growth and competition with spring wheat. *Agron J* 97:1612-1621.

Camara, K. M., Payne, W. A., Rasmussen, P. E. 2003. Long-term effects of tillage, nitrogen, and rainfall on winter wheat yields in the Pacific Northwest. *Agron J* 95:828-835.

Cathcart, R. J. and Swanton, C. J. 2004. Nitrogen and green foxtail (*Setaria viridis*) competition effects on corn growth and development. *Weed Sci* 52:1039-1049.

Chikoye, D., Lum, A. F., Abaidoo, R., Menkir, A., Kamara, A., Ekeleme, F. and Sanginga, N. 2008. Response of corn genotypes to weed interference and nitrogen in Nigeria. *Weed Sci* 56:424-433.

Di Tomaso, J. M. 1995 Approaches for improving crop competitiveness through the manipulation of fertilization strategies. *Weed Sci* 43:491-497.

Giambalvo, D., Ruisi, P., Miceli, G. D., Frenda, A. S. and Amato, G. 2010. Nitrogen use efficiency and nitrogen fertilizer recovery of durum wheat genotypes as affected by interspecific competition. *Agron J* 102:707-715

Hassan, G. and Khan, H. 2007. Effect of wild oats (*Avena fatua* L.) density on wheat yield and its components under varying nitrogen regimes. *Pak J Bot* 39:2585-2594.

Hay, R. K. M. and Porter, J. R. 2006. The physiology of crop yield. 2nd ed. Blackwell Publishing Ltd. 342 p.

Karimmojeni, H., Mashhadi, H. R., Shahbazi, S., Taab, A. and Alizadeh, H. M. 2010 a. Competitive interaction between maize, *Xanthium strumarium* and *Datura stramonium* affecting some canopy characteristics. *Aust J Crop Sci* 4:684-691.

Karimmojeni, H., Rahimian Mashhadi, H., Alizadeh, H. M., Cousens, R. D., Beheshtian Mesgaran, M. 2010 b. Interference between maize and *Xanthium strumarium or Datura stramonium*. *Weed Res* 50:253-261.

Khan, I., Hassan, G., Khan, M. I. and Gul, M. 2008. Effect of wild oats (*Avena fatua* L.) population and nitrogen levels on some agronomic and physiological traits of wheat. *Elec J Environ Agri Food Chem* 7:2723-2734.

Labbafi, M. R., Hejazi, A., Mayghani, F., Khalaj, H. and Mehafarin, A. 2010. Evaluation of allelopathic potential of Iranian wheat (*Triticum aestivum* L.) cultivars against weeds. *Agric Biol J North America* 1:355-361.

Rastgoo, M., Ghanbari, A., Banayan, M. and Rahimian, H. 2004. Growth analysis of wild mustard (*Sinapis arvensis*) and winter wheat in response to amount and timing of nitrogen application. *Sci J Agri* 27:51-63.

Sharifi, R. S., Bigonah Hamlabad, H and Azimi, J. 2011. Plant population influence on the physiological indices of wheat (*Triticum aestivum* L.) cultivars. *International Res J Plant Sci* 2:137-142.

Sheibani, S. and Ghadiri, H. 2012. Integration effects of split nitrogen fertilization and herbicide application on weed management and wheat yield. *J Agr Sci Technol*. 14:77-86.

Sheibany, K., Baghestani Meybodi, M. A. and Atri, A. 2009. Competitive effects of redroot pigweed (*Amaranthus retroflexus*) on the growth indices and yield of corn. *Weed Biol & Management*. 9:152-159.

Warraich, E. A., Ahmed, N., Basra, S. M. A. and Afzal, I. 2002. Effect of nitrogen on source-sink relationship in wheat. *Inter J Agri & Biol* 4:300-302.

Williams, M. M. and Lindquist, J. L. 2007. Influence of planting date and weed interference on sweet corn growth and development. *Agron J* 99:1066-1072.

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