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The study of the effect of nitrogen rate and duration weed interference periods on yield and yield components of corn (*Zea mays* L.)

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Abstract

Performance elements, an experience is implemented in summer 2010, at the station of Ahvaz agricultures research center as broken plot in a design framework of accidental blocks with 3 repetition. The main factor of different amount of nitrogen include 3 level N60, N120, N180 kg/lit pure nitrogen of urea resource & secondary factor of weeds intervention include 3 levels (i) continuous weed until the end of corn growth period (w1), (ii) one time weed in 6 leave level (w2), (iii) complete intervention of weed with corn until the end of corn growth period. The acquired results indicated that weed intervention on yield & yield component has a meaningful effect & by increasing the period of weed intervention, the grain yield is reduced. Increasing weed competition make a meaningful effect on grain weight, performance, biological performance & harvesting index. But increasing amount of nitrogen from N120 kg/lit to N180 kg/lit had not a meaningful effect on grain performance & in some cases due to high pressure, the competition from weed make reduction of grain performance, (once weed treatment & all season intervention). In low & high level of nitrogen, biological performance & corn performance is respectively affected by weed. According to the results of this experience, it can be resulted that by reducing competition time of weed, increasing N can make grain performance enhancement. In contrast to weed competition time, increasing nutritive ingredient is an affected weed growth more than agriculture plant &makes weedcompetitionpowerenhancement.

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Introduction

Agriculture always struggle with weeds & reach to a significant progress. Human struggle with weeds by had & using animals & now it is continued through chemical & mechanical method (Rahimian *et al*, 2003). Weeds not only reduce the agriculture plants production &increasing agriculture costs, but also make some problem for public in different ways. Some of the weeds problems are as follow : (i) low performance of agriculture plant & animal & reduction of land consumption efficiency, increasing the costs of insect & herbal sickness control, reduction of product quality, increasing the problem of water management (Rhimian *et al*, 2003). Corn is a 4 carbon plant which according to its high potential of grain & forage production is developed for animal & birds feed in Iran & its cultivation is often prospered in the most provinces. The studies indicate that about 25 to 30 problematic weed are growing in corn fields which are consist of one year & several year types (vafabakhsh, 1995) which the weed damage in corn will be variable which it depends on density, type mixture, relative time of greening, climatic conditions, agriculture plant number (Williams *et al,* 2008) and other factors. If corn is not a weak competition relation to other plants, but however, need to control the weeds. Result of plant & weed intervention depend on some factors related to place particularly essential nutritive ingredients (Abouziena *et al,* 2008; Marin *et al*, 2007; talker *et al,* 1991; Tollenaar *et al,* 1994). reduction of force power efficiency (Hence, nutritive ingredients are known as a probable solution for weed management (walker and Buchanan, 1982).

Also the most weeds use nutritive ingredients more than its need and so lux consumers may use fertilizer rather than agriculture plant. Instead nutritive ingredients make plants growth improvement, many studies indicate that adding more fertilizer has some benefit for weeds (Thomas *et al,* 2002). It is clear that plant and weed have different respond to nutritive ingredients. In all type of nutritive ingredients, N is an element make anxiety concerning weed competition. Many researches are done about weeds, Carlson and Hill (1986). Reported that increasing N fertilizer to infectious wheat to wild oatsmakes increasing weed density and reduction of plant performance. Acafer and Di date (1976) perceived that increasing N in rice is useful for cyperusrotundus & make reduction of light absorption, reduction of leaf surface index & reduction of rice grain performance.

Haas and streibig reported that album chenopodiu & polygonum convolvulus show a better reaction to high levels of N. Iqbal and wright (1997) perceived that Album chenopodiu biomass & brassica caber is significantly increased by increasing soil N from 20 mg/kg soil to 120 mg/kg which both respond to increasing N more than wheat.

N is often used in Iran corn fields, but many researches are done about N effect & weed intervention on corn performance. Many studies indicated that we absorb high amount of mineral rather than plants & make reduction of soil fertility & ultimately reduction of plant performance.

Abouziena *et al* (2008): Increasing amount of N can cause the enhancement of plant performance, but weed may have a negative effect on performance. Different result is reported about N effects on competition of corn with weeds. In a greenhouse experiment, Teyker *et al* (1991). Observed that by increasing amount of N its absorption in amarauthus retroflexus is more than corn & in higher level of N, the intervention of tum bleweedis feasible in corn. Other researchers reported that when the soil fertility is increased through adding N, weeds competition capability is might increase due to higher absorption efficiency (DiTomaso, 1995; sibuga and Baandee, 1980). Toller *et al.* (1994) reported that biomass reduces harvesting index & final corn performance is low N condition in contrast to high N and this is a short time after greening weed & its intervention with corn. According to previous statement & significant of N effect on corn performance & also intervention effect of weed under effect of different amount of N, an experiment was done about these conditions. This

study is an attempt to achieve optimum Nitrogen rate for corn production and yield components are determined.

Effect of weed interference on yield and yield components critical to understanding the interaction of weeds. Interactive effects of nitrogen and weed interference on yield susceptibilities to these two factors.

Materials and methods

This experiment is implemented in Ahvaz agriculture researches center in 2009. Preparing land is included plough, two perpendicular drive and leveling the field. After choosing the design implementation place & before preparing operations, 16 plants of field is accidentally selected for sampling in order to soil analysis (In order to determination of N fertilizer). After distribution triple super phosphate fertilizer with amount of 200 kg, the field hitting disk. Then, some rows with distance of 75 cm are separated by groove maker. The type of used corn was single cross 704. Seeds were disinfected by gas poisoning boxing tyram & are cultivated at 27, May 2009.

The seeds cultivation is executed by hand & heap like (3-4 seeds in every in depth of 4 cm) in 75 cm rows (6 rows in every plot in length of 6 m) with the distance of 20 cm on rows (with density of 400 seeds in every square meter) & then the corns are thinning in 3 leave stage. According to high solubility for preventing N penetration of one plot to another one, a main stream is prepared for water accumulation & one stream for water exit. First irrigation was done one day after cultivation & next irrigation was done every 7 days until the end of growth the season. The method of irrigation was water leak during the experience no poison was used. The experiment was executed as broken plot in a design framework of accidental blocks with 3 repetitions. The main factor was N fertilizer level & secondary factor was weed intervention. The different amounts of N were N60, N120 and N180 kg/lit of pure N from urea source. Secondary factor (weed intervention) were w1 (weeding until the end of corn growth), w2 (complete intervention of weed with corn until the end of growth period.

To evaluate variables, first, every plot is divided into 2 halves. First half was for destruction sampling & second half for final performance. Two lateral rows of every plot & half meter of middle was eliminated as a border. In order to performance determination of a 3 square meter level is determined in sampling time & grain performance on the basis of 14% humidity. The elements of corn performance was included number of corn in bush, number of row in corn, number of grain in row & number of grain in corn & weight of 100 corns. From every 4 bush in every plot is measured one week before final harvesting.

In order to statistical evaluation & drawing graphs, it is used statistical software of SAS & EXCEL. To evaluate averages, it is used Duncan s multiple range test.

Results and discussion

Row number in corn

The results indicated that different amount of N effect on number of row in corn was not meaningful (table 2). As the result showed that weed intervention on number of corn row was not meaningful. The number of corn row in levels of N60, N120 & N180 kg/ha were 13.27, 13.80& 14.02 respectfully comparing the average indicated that the maximum number of row appertained to treatment w1 & the minimum of it for treatment w3.

Makarian (2000) reported that tumbleweed intervention had no meaningful effect on corn row. It is appeared that number of corn row is a genetically characteristic with high consistency & is insignificantly positioned under environmental condition & field managerial (kuchaki et al, 2004).

Number of grain in row

Variance experiment results indicated that different amount of N on number of grain is meaningful in probability of 1% (table 1). Positive cohesion of amount of N consumption is shown with number of

grain in row (table 4) which had a significant enhancement by increasing N application. (Table 2) as if the maximum number of grain is gained in treatment N120, N180 kg/lit (table 1). It is appeared, as Akintoye *et al* (1999). Reported, diminishing competition & disappearing available flowers due to good condition for feed in high level of N in the stages of determination of number of ovum in row, make an increase of grain number in row.

Having no different between these 2 treatments is related to having high amount of N & availability to stages of rapid growth of plant. Russell *et al* (1983). reported that more absorption in 6 leave stage to silk week stage for corn make an increase of grain number in row through suitable nutritive condition for plant during differentiation of spikelet& flower growth & consequently reducing spikelet disappearing variance analysis results indicated that weed intervention on grain number had 5% variation probability (Table 1).

Negative cohesion of weed treatment with grain number in row indicated that by performing weed treatment. The grain number is meaningfully reduced (table 4). Minimum & maximum of grain number were 34.20 & 29.03 respectfully which are acquired from treatment of stable weeding (w1) & complete intervention of weed (w3). But weed intervention, reduce grain number in row. Grain number in one time weeding & overall season intervention is significantly low. But the variation between overall season &no competition treatment were not meaningful. Normally, grain number in row is reduced in weed overall season treatment in comparing with continuous weeding.

The grain number is controlled through ovum No. which developed peak & exit. Lack of food or radiation during 10 to 14 days before pollination is significantly reduced grain No. in row (Nourmohammadi *et al*, 1998). High competition pressure of weeds is reduced availability to water & nutritive ingredients for corn & then reducing grain Number& consequently reducing grain No. in corn.

Makarian (2000) also reported that mutual effect of different amount of N & weed intervention on grain No. in row were not meaningful (Table 1).

Grain number in corn

Effect of different amount of N on grain No. in corn is meaningful in level of 5% (table 1). By increasing application of N, the grain No. in corn increased.

Maximum grain No. in corn with the average of 455.59 grain was related to N180 kg/ha treatment application which have no meaningful difference with N120 kg/lit. The minimum grain No. is acquired in N60 kg/lit with average of 397.55 grains (table 2). Critical period for constructing grain in corn is 1 to 2 weeks after silk week until 3 weeks after silk week having cultured materials & delivering then to corn have a close relation with grain No in corn (Tollenaar and Nissans, 1981). It is appeared that in the lack of N condition & depletion of N for leaves, is reduced leaf level index & its solidity & consequently the essential cultured materials for constructing grain is reduced. This result was similar to Legg and Benet (1979) results. Zinselmeier *et al* (1995) reported that the final grain No. in corn is determined during pollination & insufficiency of photosynthetic material for growing embryonic cell hasan negative effect on grain No. in corn.

Effect of weed intervention on grain No. in corn is meaningful at level of 1% (table 1-4). Overall the season, grain No. is reduced more & more due to high competition pressure & reduction of availability to water & nutritive ingredients during pollination & after it. Grain No. in corn depends on plant genetically potential & being nutritive ingredients during the stage of conversion of vegetative meristem to natal meristem and peak period (nourmohammadi *et al*, 1998). In this experiment, weed intervention from implant time to harvesting comparing with no competition treatment, make a reduction of 30% of grain number in corn, but this reduction isn't always linear. Aevanaz *et al* (2003) also reported that the most critical element of corn performance to weed intervention & N were grain No. in corn. Effect of

weed intervention on grain No. in corn was meaningful at the level of 1%. According to average comparison of weed intervention, promotion of weed intervention makes reduction of grain number in corn, as if maximum number of it is related to a treatment without weed & the minimum of it is related to a treatment with weed intervention in every m2 (Table 2).

Time promotion of weed intervention, make reduction of sigmoid grain number in corn. Also, for a given time of weed intervention or a period without weed, N application increases the grain number in corn.

There is also another report which indicated that grain number in corn has the most shares in visible differences in grain performance. For example, Nezovic *et al* (1997) reported that reduction of grain number in clusters is the main reason for performance reduction of sorghum in competition with Amaranthus retroflexus. Williams *et al* (2006) reported that among related attributes to corn, row No & grain number in corn is meaningfully reduced under effect of Ambrosia trifida. In competition condition of plants with weeds, product growth is reduced in stage of peak period due to reduction of nutritive ingredients & makes increase of grain disappearance (Nourmohammadi *et al,* 1998).

In fact, grain number reaction in corn to weed competition is a logical relation, because strategy of plant for competition with competition stress is mainly the reduction of grain number in bush there by the grain weigh remain stable & make a sufficient power for germination of the next generation.

Effect of weed intervention of grain No. in corn was meaningful at the level of 1% (table 1). According to positive cohesion of grain number in row with grain No. in corn (table 4), number of corn is increased by using N in weeding condition & in weed intervention condition, N120 & N180 has not a meaningful effect on increasing grain No. in corn to rather than N60 (table 3). Estefan (2003) reports that limitation of weed limits N absorption & presence of a problem in delivering it to photosynthetic organs & so reduce the cultured materials for corn & grain No. in corn is reduced due to increase of grain competition for nutritive, ingredients.

Grain Weight 1000

Variance analysis result for 1000 corns indicated that the different amount of N on 1000 corn weight was meaningful (table 1). Positive cohesion of N amount with 1000 corns weight (table 1) indicated that by increasing consumption N application, 1000 corns weight is increased in high level of N (N120, N180 kg/lit) (Table 2).

Because N enhancement make increasing dry material production & leaf level strength & so current photosynthesis during filling grain & also Rezaee *et al* (1993). &uhart and Andrade (1995) reported that grain weight mean depends on delivering material to corn between flowering stage to grain reach & it depends to leaf life time after pollination & the relation of source & aim. It is expected that grain weight is increased by increasing N consumption. These results are accordance with Osborne's results (2002) and Banziger results (2002). Variance analysis results of 1000 corns indicated that weed intervention on weight of 1000 corns was meaningful (table 1). By increasing weed intervention, weight of 1000 corn, is reduced as if weed intervention were 224.55, 208.56 and 198.77 respectively. Although, by increasing weed intervention time, weight of 1000 corns is reduced, but the variation between no competition weed treatment were not meaningful. The Minimum weight 1000 corns (198.77g) was related to overall season treatment & maximum of it (224.5g) was related to continuous weeding treatment. Makarian *et al* (2004) also reported that weight of 1000 corns have a negative cohesion with duration of weed intervention & a positive cohesion with duration of weed lack, but this effect was not always meaningful & had a small share in reduction of performance. It is clear that weed intervention through reduction of leaf level stability & competition for essential material make reduction of 1000 corns weight but it is appeared that

reduction of weight in corns is not much & corn respond to weed intervention is mainly the reduction of grain No. in corn.

Table 1. Analysis of variance yield components (number of rows per ear, Number of grain in row, Grain number in corn, Weigh of one thousand grains) and Grain performance, harvest index, and grain protein based on the mean square.

SOV	df	Grain yield	Weigh of 1000 seed	Grain number in ear	Number of grain in row	Number of rows per ear	HI	Biological
R	2	4166	101/51	669	8/825ns	0.2517	38.016	6719
N	2	49295*	897/63*	10462*	55**/802	0.6514ns	100/726**	67511*
Ea	4	4439	158/11	1544/3	10/333	0.6204	5/731	8729
W	2	117300**	1523/94**	17527/9**	60/429*	0/6007ns	890825**	22661**
N*W	4	14680**	84/79ns	3213/03**	15/649ns	0/5208ns	10/154ns	28986**
Eb	12	1234	95/93	357/8	9/827	0/4521	5/171	4718
cv		5/1	4/62	4/35	9/92	4/90	5/04	4/35

**and * ns respectively significant at the one percent and five percent level, and no significant difference

Table2. Comparison of yield components (rows number of corn, Number of grain in row, number of grains per ear, Weight of one thousand grains) and Grain performance, harvest index.

Treatment	Harvesting index (%)	Biological (gr/m2)	Grain yield (gr/m²)	Weight of one thousand grains (gr)	Grain number in corn	Number of grain in row	Number of rows per ear
Nitrogen (kg/ ha)							
N60	40/3919 b	1498.33 b	607.51b	203b	397.5b	30.01b	a 27.13
N120	42/7342 b	1594.62a	700.91 a	209.9 ab	443.6 a	32.15 a	13.8a
N180	46/9908a	1640.73a	753.65 a	219 a	455.5 a	32.43 a	14.02 a
Weed							
W1	47/0212 a	1726/76 a	811.31a	224.55a	479.6 a	34.2a	13.99a
W2	41/5897 b	1596 b	664.23 b	208.56 b	424.8 b	31.35b	13.57a
W3	41/5073a	1410/92 c	586.53 c	198.77c	392.3 c	29.03 c	13.52 a

Table 3. Comparison of the effects of weeds and nitrogen on Grain number in corn, Weight of one thousand grains, Grain performance, biological yield.

	Treatment weed* nitrogen	Biological yield (gr/m²)	Grain yield(gr/m²)	Grain number in corn	Weight of 1000 (gr)
Nitrogen (Kg /ha)	weed				
N60		1615/8c	682/881 c	431/55bc	211 c

N120	Full weed*	1721/37 b	801/955 b	476/701 b	224/333 b
N180		1843/06 a	949/077 a	530/789 a	238/333 a
N60		1584/4cd	642/813 c	416/246 c	213/333 c
N120	1 time weeding*	1537/19d	704/143 c	452/522 b	207/366 c
N180		1666/3 bc	645/750 c	405/738 c	212/333c
N60		1294/66 e	496/843 d	344/871 d	192 d
N120	Full interference*	1525/2 cd	596/615 c	401/99 c	198 c
N180		1412/81d	666/137 c	430/24bc	206/333 c

Means with same letter in each column are not significantly different at probability level of 5%.

Grain yield

Effect of weed intervention on grain No. in corn was significant at the level of 1% (table 1). According to comparisons between N levels, the lowest amount was related to N60 kg/lit with the average of 607.51 g/m2 and the highest was related to N180 kg/lit with the average of 753.65 g/m2 (Table 2).

Positive cohesion of amount of N has a meaningful effect on grain performance although between applications of N120, N180 is not a main difference (table 2). According to positive cohesion & grain performance, amount of N has an important effect on grain performance. These results indicated that N effect on grain performance enhancement was through grain No. in corn & grain weight (uhart and Andrade, 1995; Osborn, 2003).

Uhart and andrade (1995) and Tesa (1988) stated that N positive effect on light reception &increase photosynthesis on plant growth acceleration, leaf level index & its stability in corns make more distribution & aggregation of dry material to grains. Sadeghi (2000) reported that grain number production potential in corn & weight enhancement had a cohesion with plant growth acceleration from silk week stage to the end which its result is grain performance increase. Strong cohesion between leaf level index & performance is reported by researches (kamperath Nunez, 1969; Dwye,r 1991). Daynard and tollennar (1982) declared that final corn performance depends on successes of flowers growth, its complete fertilizing, fetus development, starch aggregation & protein in grain & each one needs a continuous cultured material supplying.

The results of variance analysis for corn performance are exhibited in Table 1. The results indicated that in weed intervention reduction in comparison, with weeding (w1), (w2) one time weeding & (w3) weed intervention were 664.23, 586.53% respectively (Table 2). If, weed is not controlled, corn performance may be reduced from15% to 100% which it depends on No. type of weed (Ardekanian, 1996).

For example, Nezovic *et al* (1994). Mentioned performance reduction from 5% to 34%. In this experiment, intervention effect of 0.5 to 8 bushes of amaranthus in one meter of corn row was meaningful & by increasing time of weed intervention, the grain performance is reduced. Increasing N amount from N120 to N180 had no meaningful effect. In high density of weed, increasing nutritive ingredients is beneficial for weeds. By an integral management, it can be used fertilizing as a weed control tool.

Ramazani reported that (2000) increasing weed density for grain performance is more in high & mean level rather than low level.

Biological performance which indicates the aggregation of dry material in aerial parts in harvesting period was under effect of experimental treatments. Different amount of N on biological performance was meaningful. Positive cohesion between N amount & biological performance (Table 4) indicated that biological performance by consumption of N120, N180 had a meaningful increase rather than N60. Highest biological performance from N180 is acquired with average of 1640.73 g/m² (Table 2). According to positive cohesion with leaf level index (Table 4) it is appeared that N effect on performance is due to positive effect of N on photosynthesis material in leaves & stem.

These results are similar to majidian and ghadiri (2003), Sepehri (2002), Tohidinejad (1994), Roy and Tripathi (1987). Andrade and Uhart (1995) resulted

That negative effect of N lack on leaf level reduction & its stability make reduction of efficiency of radiation, cultured material amount & dry material aggregation. Variance analysis results indicated that weed intervention 1% probability level had a meaningful difference on biological performance. Negative cohesion between weed intervention & grain performance indicate that (Table 1) biological performance is reduced by increasing weed intervention.

According to positive biological performance with grain performance & leaf level index, these cases are reduced. Biomass enhancement of plant in good weeding condition make a sufficient strong physiological resource for using received light & dry material production more & more. These results are accordance with Lyle and Brodsky (1995).

Osborne *et al* (2002). By increasing weed intervention due to increasing competition (within form and out form) & being under condition of vegetative and natal growth, the performance is reduced. The most powerful cohesion is between grain performance & biological performance (table 4).

Reduction of biological performance is due to weed density. Ramazani (2000) and Hoseininia (2000) reported that by increasing weed intervention, biological performance is reduced. Many researches indicates that adding N fertilizer to weeds in infected plot, make sever negative effect of weed on biological performance (Ramazani *et al*, 2000; Hoseininia *et al,* 2000).

Different amount of N effect & weed intervention is meaningful for biological performance. Mohajeri and Ghadiri (2003) reported that weed intervention condition by increasing N to 100 kg/lit had a meaningful effect on wheat biological performance but not more than 100 kg/he.

Harvesting index

Variance analysis results (Table 2) indicated that different amount of N & weed had a meaningful difference.

Harvesting index states the proportion of photosynthesis material distribution between economic performance & biological performance (Ellis tone, 1979). In fact enhancement of harvesting index is indicator of photosynthesis material delivering from plant to grain. As it is shown in table 2 we cannot see a meaningful difference between N fertilizer levels & harvesting index as if N180 treatment has the highest percent of harvesting (46.49%) which before is reported by Moocher *et al* (1988). They reported that increasing N from 0 to 42 kg/lit, make harvesting index double. Also korazbi & mac determined that grain performance increase is due to biological performance & harvesting index. Fertilizing method is important for harvesting index. In grained plant, the harvesting index is scale of dry material efficiency to natal part which can be under effect of environmental condition (Sandarac *et al.*, 1997). Also more application of N cause biological performance increase in plant but have a reduction effect on amount of photo distribution which leads to reduction of harvesting index. (Gomez and Anderson, 1994). Mohajeri and Ghadiri (2003) observed in an experiment that N increase from 0 to 100 kg/lit make

a meaningful promotion in wheat harvesting index. This subject is phenomenal in low density of wild mustard but over 100 kg/lit, the promotion was not significant. Also they reported that the highest wheat harvesting index is acquired in a plot without weed. Variance analysis results (Table 2) indicated that weed intervention has a meaningful difference for harvesting index. Also, the highest amount of corn harvesting index was in a plot without weed & the lowest amount was related to a plot with weed intervention in m2. Tollenaar *et al* (1994). Stated that corn harvesting index is reduced due to weed intervention. Similar results are acquired by Balk Shaw (1991) about bean. Also in another study, Tollenaar *et al* (1994). Stated that in high pressure of weed, the harvesting index in low level of N is reduced but in high amount of N & high pressure of weed had no effect on harvesting index. On the other hand, some researchers believe that harvesting index is not under effect of weed competition (Izadi Darbandi, 2003; Samaie *et al*, 2006). Totally, this experiment results indicated that increase of weed intervention through row No. in corn, grain No. in row, grain No. in corn & weight of 1000 corns lead to reduction of biological & grain performance. Also it is indicated that in low level & high level of N, biological performance & grain performance respectively are affected by weed competition. In desired level of N, biological performance effect was approximately equal with grain performance. It is appeared that increase of consumption amount of N in the field which has weeds. Make a serious competition on performance & corn performance elements, so in this condition, it is advised the consumption amount be proportional to desired level of N consumption & if the amount of N consumption increase, the field have to clear by different method & we can distribute fertilizer in field.

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