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Estimation of Leaf Area and Some Components of Yield in Corn Cultivars Affected Urea Foliar Application

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Abstract: To understand the related based features of effective performance, according to the duration of grain filling importance, in the grain yield experiment took place in split plot as completely randomized blocks design with three replications in 2009, located at agricultural station of Islamic Azad University, Tabriz branch. Experimental treatments of this survey included cultivars in three levels: early maturing (SC. 307), average maturing (Jeeta), and late maturing (SC.704) and foliar application included in seven levels: control treatment (lack of foliar application use), teaseling appearance, earning appearance, beginning of grain filling, grain pasting, concurrent foliar application in teaseling appearance and beginning of grain filling stages and concurrent in teaseling appearance, earning appearance, beginning of grain filling and grain pasting. The results showed that urea foliar application had a meaningful significant on increasing grain performance as well' urea simultaneously foliar application in the levels of taselling, earning, early grain filling and pasting emergences with different cultivars increased the grain cultivar performance (Jeeta) about 23.5% rather than other observer nurturers; Also, foliar application has a significant effect on chlorophyll content index, leaf area index and leaf durability; therefore, based in these results it can be recommended to use foliar application as an effective method to maintain chlorophyll canopy and leaf area index for increasing the ultimate performance.

Key words: foliar application, chlorophyll content index, leaf area index

INTRODUCTION

Nowadays, fertilizing on the leaf and vegetarian bodies has been used wide pared, because, the leaves and other avian bodies can absorb nutrients as gas from stomata as well; however, absorbing nutrients as ion from leaves is very restricted; when this is restricted by the stem, foliar application is suggested; during germination step, the activity of stem is decreased because of competence to absorb carbohydrate between germinating bodies (grain and fruit) and the stems and then it causes to decrease the rate of absorbing nutrients towards the stem (root)(Alam, 2006 and Hopkins, 2004). Therefore, in these cases, foliar application of nutritional elements decrease this activity and it will have a good effect on optimizing the performance. It's true that the roots play a key role in absorbing the nutrients from plant tissues, but foliar application is also increasing these nutrients from the leaf rather than the soil (Scheiber *et al*, 1962). The application of different Nitrogen nurturers influence on the growth of corn causing different plant physiological changes during flowering and graining steps (Girardin *et al*, 1987), the percentage of light penetration, active photo synthetic light, the efficiency of light, sharing dry matter into germinating bodies, leaf area index, leaf area durability and the speed of production growth are under nitrogen conditions (Cox *et al*, 1993). Urea foliar application makes an increase of grain weight in two ways: 1) increasing the production of dry matter and decreasing the limitation of target during endosperm meristhemic step. 2) increasing the durability of leaf area and longevity of grain filling period; studies by Uhart and Andrade (1995) showed that the speed of production growth, leaf area index and leaf area durability are under nitrogen conditions so that increasing soil nitrogen makes the leaf area increased too, then it upgrades the efficiency of light more and more that finally it leads to the optimized grain performance (Georage, 2003). According to these findings, this survey aims are studying the effects of foliar application and the best timing on corn cultivars with different attendance periods.

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MATERIALS AND METHOD

This survey is carried out in the form of split plan experiment, based on complete randomized blocks design in 3 replications. The cultivars as main plot include: a_1: early maturing (SC. 307), a_2: average maturing (Jeeta), and a_3: late maturing (SC. 704), and different foliar application of nitrogen as sub plot included: b_1: lack of foliar application use, b_2: teaseling appearance, b_3: earning appearance, b_4: beginning of grain filling, b_5: grain pasting, b_6: concurrent foliar application in teaseling appearance and beginning of grain filling stages, and b_7: concurrent application in teaseling appearance, earning appearance, beginning of grain filling and grain pasting. Foliar application of nitrogen (Urea fertilizer) was selected according to experimental treatments in 5 percent concentration.

In order to evaluate the trend of leaf area index and duration, the sampling was done after pollination and grain formation 12 times with five day intervals. In each sampling, two plants were randomly selected from every experimental unit. After transmitting to the laboratory, corn leaves was measured by leaf area meter (Model AC 200A). These data were used for estimating the leaf area duration. Leaf area duration is calculated via the following relation (Gebeyehou *et al*, 2002).

$$LAID = \frac{LAI_2+LAI_1}{2} \times (T_2-T_1)$$

After taseling, ten competitive plants were selected randomly from two middle rows and traits like number of leaf, Number of sequence in earning and Length of earning were measured. After ripening grain yield and 1000 kernel weight were measured. The related variance analyzing is calculated whit SPSS and MSTATC. The averages were compared with applying Duncan test in five percent possibility and the figures were drawn by using Excel.

RESULTS AND DISCUSION

Chlorophyll Content Index (CCI):

The results of data variance showed that the effect of foliar application periods on chlorophyll content index has one percent significant probability; this topic shows that, nitrogen is effective in increasing chlorophyll content index; the high degree of this index is CCI = 28.96. Related to nurturer that has been used four times during taselling, earning, early – graining and pasting the grain; It also causes 57.22% increase in the related index (CCI) lout the low rate of this relates to pasting the grain (CCI = 18.42) causing again 36.39% of this CCI; this process shows that the high number of foliar application has incredible influence on CCI (Table 1).

Number of leaf:

According to the governed results, it is determined that, different cultivar effects in one percentage level have a significant effect on this feature, the other related nurturers and the period of applying urea and bilateral effects in these two factors have been linked into a significant effect in five percent probability on the leaf cultivars, so, the results showed the overage bilateral effects of cultivars and foliar usage periods on this significant difference in five percent probability (Fig. 1). The highest number of leaf cultivars based on foliar application were in taselling, earning, early grain filling and pasting in cultivar SC. 704 with average 14.42 but the lowest numbers of leaf relates to cultivar SC. 307 in earning emergence (Fig. 1). An increase of leaf cultivar in foliar application in SC. 704 rather than earning in SC. 307 was about 37.33%. According to correlation table, the leaf cultivar with dry weigh is (r^2 = 0504), The dry stem (r^2 = 0.326), and biomass in area (r^2 = 0.525), That this has a positive correlation with a significant effect based on one percent probability. Due to the role of leaf cultivar in grain filling, photosynthesis, performance and it elements on increasing the total grain weight, dry leaf weight, the number of grain in earning, Biomass in area and grain performance were existing in this regard. Generally, the main process of dry matter formation in earning is similar to other sigmoid plants; Although the light absorption influences on the plants growth, an increase of leaf in the field causes to boost the rate of list absorption (Penny and Jenkyn, 1975). The results of Friedrich *et al* (1999) tests using two 214, 286 kg.N/ha nurturers, showed that applying nitrogen fertilizer or compost makes the bushes high, high activity in the bushes, dry stem weight, dry bush matter and leaf area as well as leaf area index become high efficient cases.

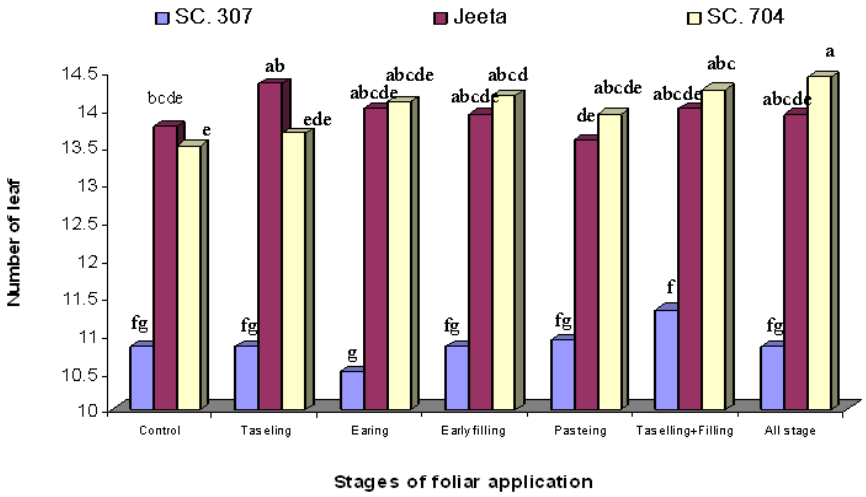

Fig. 1: Effect of cultivar and foliar application on number of leaf

Leaf area index:

The governed results showed that the effect of different cultivar levels and foliar application nurturers on the index property has a significant five probability effect; cultivar "Jeeta" has the highest leaf area and cultivar SC. 307 with the lowest index of leaf area exists (Fig. 2). This cultivar (Jeeta) high genetically could increase its leaf area index after 95 days cultivation; then it reached to its normal degree after 135 days with partial decrease; In the other hand, the cultivar SC. 307 also showed a little decrease after 95 days cultivation pointing to an increase during 110-120 days after cultivation; but after 120 days to the late of growth period kept its leaf area index as well (Fig. 2). Enlargement of leaf area controls genetically depends on leaf nitrogen, but these cases lead to differentiate the lea area between the different cultivars; so, providing nitrogen in different steps especially after flowering has an important effect on leaf area activity (Luther and Moler, 1988).

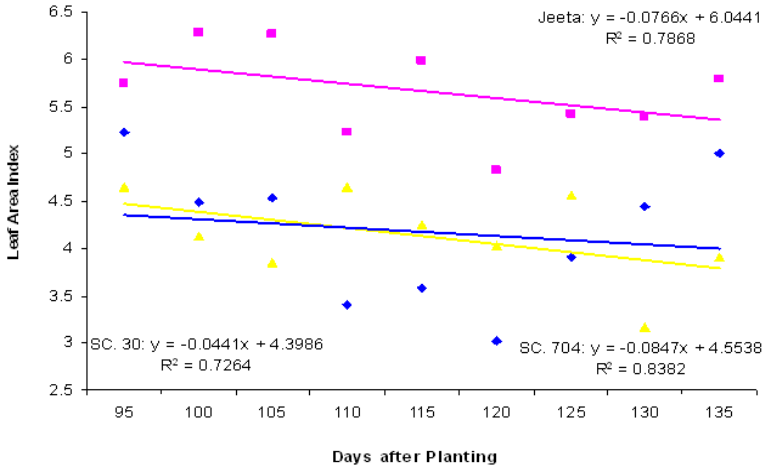

Fig. 2: Effect of different cultivars on leaf area index trend

The comparison of leaf area index in foliar application shows that applying foliar solvent along with taselling, earning, grain filling and grain pasting rather than the lack of foliar from 95 days after cultivation increase the leaf area index; Also, these results showed that, all foliar nurturers devote to high leaf area (Fig. 3). Because, it must be noted that, the beginning of flowering (germination growth), leaf growth and other germinating limbs get limited but the wide part of the leaf gets larger because of enlarging cells and the only difference is nitrogen – feeding into the leaf cells due to the effects of foliar application, these results were matched with Lather and Moler (1988) reports. Also, the comparative results of the averages showed that, foliar application in all three steps, taselling, early grain filling also has a significant effect rather than other foliar on leaf area index (Fig. 3). High enlargementel the photosynthetical leaf area in early grain filling has

an especial effect on performance economically; this also increases leaf durability in the mature step as a result of collapsing the leaves (Eckhoff, 2001). According to the results, there is a significant correlation of one percent probability in these following cases: Leaf area index with leaf durability (r^2 = 0.901), speed of grain filling (r^2 = 0.461), leaf dry weight (r^2 = 0.449), stem dry weight (r^2 = 0.354), Biomass (r^2 = 0.362), grain hundred weight (r^2 = 0.337), total grain weight (r^2 = 0.254). As usual, the lack of nitrogen leads to decreasing leaf area and devoting low photosynthetic minerals into leaves? One way to eliminate this deficiency is to apply nitrogen foliar application; therefore, increasing leaf area and it durability can be a basic components of increasing leaf dry weight, grain hundred weight, biomass and grain performance. Penny and Jenkyn (1975) reported that foliar application during gleaning wheat increased on average 15% leaf area index.

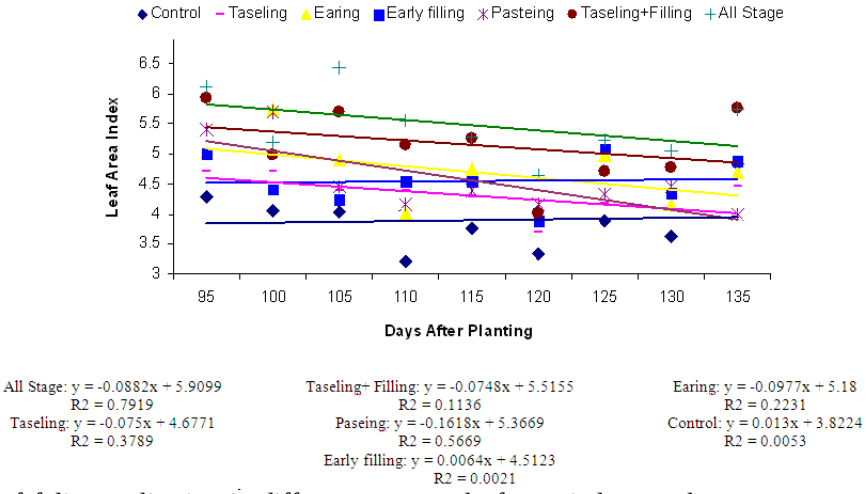

Fig. 3: Effect of foliar application in different stage on leaf area index trend

Leaf Area Duration:

The results showed that the effects of different foliar nurturers in one percent probability has a significant effect on leaf area durability; Also this process had a five percent significant effect on the same feature. The study of different cultivar levels showed that among these cultivar, "Jeeta" had the highest leaf area index from 95 days to 135 days after cultivation to growth period; the cultivar SC. 307 in despite of a decrease could maintain its leaf area durability during 105 days to 120 days after cultivation; this cultivar could maintain leaf area durability from 120 days after cultivation rather than decreased SC. 704 cultivar, the studies related to this subject showed that, foliar application along with taselling, earning, early grain filling and grain pasting had the highest leaf area index during the growth period absorbing the high degree of nitrogen and this caused to increase leaf area index rather than no foliar nurturer, the completed studies about leaf area durability showed that leaf area durability is a complementary case for leaf area that includes both durability and photosynthetic tissue development; the results showed that, all foliar nurturers than no foliar have a suitable leaf area durability itself; Also, the increase of foliar application numbers (urea fertilizer) could influence on leaf area index in addition to leaf area durability (Fig. 4). In the study of interactive effects, different cultivar reaction was completely different rather than foliar application solvents. So, the results showed that the high leaf area durability relates to foliar application in cultivars SC. 307 with 31.07 m^2 in a day and lowest durability goes through SC. 704 with 14.07m^2 in a day; this foliar nurturer in SC. 307 led to increase with 120% rather than SC. 704 cultivar .The completed tests about leaf area durability showed that durability and index of the leaves due to the lack of nitrogen before its deadline decreased and as it came out from the cycle leads to provoke aging all leaves (Allanjones, 1985), but foliar application prevents this aging of all leaves as well (Alvin, 2003 and Seligman, 1993). Koc *et al* (1989) studied the effect of foliar application after gleaning on leaf area durability; They found that this process happened in wheat gleaning did not increase leaf area duration Koc *et al* (1989) with studying wheat cultivars reported that, some cultivars having large and wide leaf area could absorb high nitrogen causing to longer leaf area durability. The higher degree of urea fertilizer added into the foliar solvent, leaf area durability increases but no urea solvent causes to decreases leaf stability; As it is shown in (Table 2), there is a positive correlation (one percent probability) between these: leaf area index (r^2 = 0.901), 1000 kernel weight (r^2 = 0.458) and grain yield (r^2 = 0.350); the number of row in ear (r^2 = 0.281) there are also a positive correlation with five percentage probability and this indicates the highest leaf area duration features.

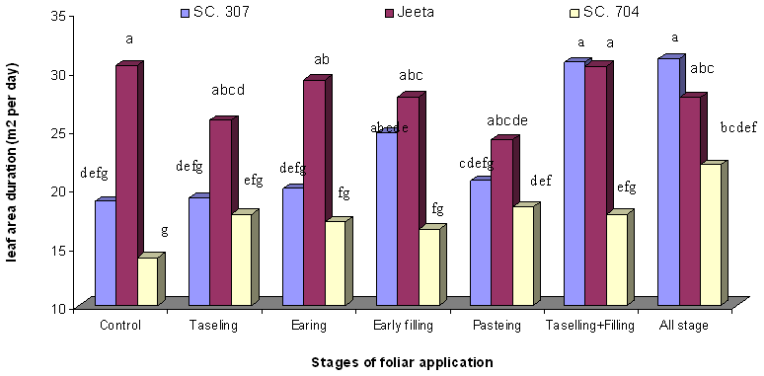

Fig. 4: Effect of cultivar and foliar application on leaf area duration

Number of Row in Earning:

The governed observations from row in ear showed that different foliar application levels had a significant effect on five percentage probability; the most row in ear referred to foliar application with taselling, earning emergence, early grain filling and grain pasting with 14.94 row (Table 1). Among foliar solvents in different steps, simile tenuous foliar application with foliar solvent in earning emergence had a significant difference that increased row in ear about 6.25% In practice, the number of grain seedling in earning is a genetically feature but it is a little influenced by environmental and managerial of field system; As it is shown in (Table 2), there is a positive and significant correlation in earning sequence with these: The number of grain in row (r^2= 0.559) and grain yield (r^2 = 0.489), along with five percentage positive correlation; An increase in these row, the grain yield increases, too.

Length of ear:

The results from data variance analysis determined that, the effect of different levels in foliar application had a five percentage significant effect on this feature; the highest length in earning included in these: Simultaneous foliar in taselling and early grain filling with 17.36 cm and the lowest rate is 15.93 cm; in the first this percentage is 8.97 rather than no foliar (observer) (Table 1).

According to correlation results, earning length with grain yield (r^2 = 0.532), leaf area index (r^2 = 0.336) and leaf area duration (r^2 = 0.437) has a positive correlation as well; and 1000 kernel weight (r^2 = 0.308) relates to five percentage positive correlation, too. Smith *et al* (2004) and Cox *et al* (1993) observed that in all different cultivars, corn (earning) with an increase of nitrogen, the height of bush, earning length, grain thousand weight and grain performance has increased;

1000 Kernel Weight:

Simultaneous foliar application in taselling, earning emergence, early grain filling and grain pasting with 32.02g and 8.39% increase but no foliar with 29.54g indicates the lowest rate of this case. Among solvents, the above mentioned foliar applications could increase the grain hundred weight respectively as follows: 3.38%, 3.24%, 2.91% 1.55% and 0.91% (Table 1). Saradon and Gianibelli (1990) found that foliar application of wheat in gleaning period and 14 days after gleaning, the grain thousand weight has been increased. According to the correlation results, there is a positive significant relationship in one percent probability level as follows: grain yield (r^2 = 0.553), number of grain in row (r^2 = 0.380), leaf area index (r^2 = 0.337), leaf area duration (r^2 = 0.458); but leaf number (r^2 = 0.304), length of ear (r^2 = 0.308) is available in this test, with five percent probability level. An increase in leaf number, and leaf area index leads to increase photosynthetic materials in the plant limbs. Peltonen (1992) studied the effect of foliar application in different growth level of wheat and concluded that foliar application in the formation of ovary branches as well as double sided level of grain performance have been increased about 13%; this is because of increasing grain number in the cluster not in grain thousand inauguration.

Grain Yield:

The final grain weight is one of the most important components of the performance that it is determined by two factors: rate of grain growth and grain filling period; this case is mostly referred to “Jeeta” cultivar with 1430 g was highest and “SC. 307” cultivar with 914.3g as the lowest one (Fig 5).

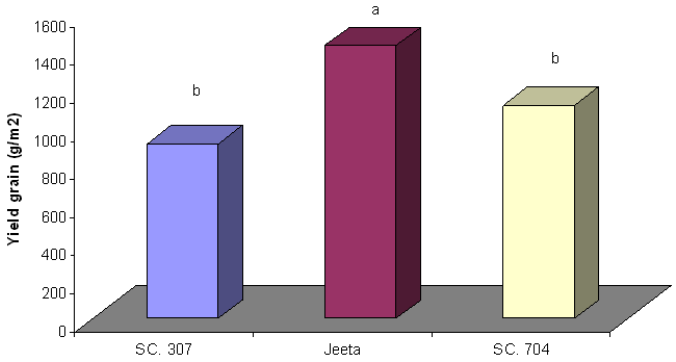

Fig. 5: Effect of cultivar on grain yield

Among foliar application in different levels, the highest grain yield refers to taselling, earning emergence, early grain filling and pasting with 1.328 kg.m^{-2} and the lowest grain yield with 1.075 kg.m^{-2} as no foliar application; Above mentioned foliar application showed 23.5% increase in the grain yield (Table 2); grain yield had a positive significant correlation with these: 1000 kernel weight (r^2 = 0.553), the number of row in ear (r^2 = 0.489), number of grain in ear (r^2 = 0.847), number of grain in row (r^2 = 0.800), length of ear (r^2 = 0.532) and leaf area duration (r^2 = 0.350) as well as leaf area index (r^2 = 0.234). The studies of Hopkins (2004) showed that the most essential role of nitrogen in the wheat growth period along with high quality of grain and plant quantity performance.

Patrick reported that, Nitrogen foliar application increases wheat grain production especially when this process happens before the emergence of leaf stamen; In this step, urea foliar application can be more advantage than nitrogenous soil (Patric, 2004).

Conclusion:

From the all mentioned researches, it can be concluded that nitrogen fertilizer (compost) is an essential agricultural factor that has been affected on the growth indices; Therefore the correct selection of this fertilizer can cause to normalized combination of the growth indices for making good optimization of the performance. As it's mentioned, nitrogen plays a key role in the bush's leaves and developing leaf area, it influences on the size and lifelong of the leaves as well. So, it can be stated that nitrogen foliar application on the bush and positive correlation shows its important on preservation of plant's limbs as well as increasing plant ability to absorb high level of light and photo synthetic materials; All these factors are crucial for increasing the number of row in ear, number of grain, 1000 kernel weight, and finally it upgrades the grain yield as well.

Table 1: Effect of stages of foliar application on traits

Stages of foliar application	Grain yield (kg/m2)	1000 kernel weight (g)	Chlorophyll Content Index	Number of row in ear	Length of ear (cm)
Control	1.075^{b}	29.54^{b}	20.77^{b}	14.33^{abc}	15.93^{b}
Taseling	1.088^{b}	30 ^{ab}	22.30 ^{ab}	14.83 ^{ab}	16.24^{b}
Earing	1.091^{b}	^{ab} 30.50	21.14^{b}	14.06^{bc}	16.11^{b}
Early filling	1.142^{ab}	29.81 ^{ab}	^{b} 20.76	14.67^{abc}	15.53 ^{ab}
Pasting	1.175^{ab}	^{ab} 30.40	^{b} 18.42	14.17^{abc}	16.68 ^{ab}
Taselling+Early filling	1.176^{ab}	^{ab} 30.54	^{ab} 22.16	13.94^{c}	17.36^{a}
All stage	1.328^{a}	32.02^{a}	^{a} 28.96	14.94^{a}	^{ab} 16.93

Table 2: Correlation of between traits

	Chlorophyll Content Index	Grain of Yield	1000 kernel weight	Number of ear	Number of leaf	Length of ear	leaf area index	leaf area duration
Chlorophyll Content Index	1							
Grain of Yield	-./098	1						
grain hundred weight	./107	0/553**	1					
Number of row in ear	-./067	0/489**	./234	1				
Number of leaf	-./191	0/584**	0/304*	./201	1			
Length of ear	./108	0/532**	0/308*	./156	-./080	1		
Leaf area index	./091	0/254*	0/337**	./243	./005	0/336**	1	
Leaf area duration	./048	0/350**	0/458**	0/281*	-./016	0/437**	0/901**	1

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