Nat. Volatiles & Essent. Oils, 2021; 8(5): 13100-13113

In study the effect Leaf Removal and row spacing on function and some biological traits of two grain corn cultivars

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Abstract

The aim to the effect Leaf Removal and row spacing on function and some biological traits of two grain corn cultivars Karun 701 and Koosha as two separate experimental designs in Bam city during the cropping years of 2019-2018 and 2020-2019 as a Twice-harvested plot Was conducted. This study was assigned in the form of a randomized complete block in two row spacings of 40 and 70 cm, sub-plots to two cultivars Karun 701 and Koosha and sub-sub-plots to 6 selection factors. The results showed that the yield of corn plant in the number of seeds per row, number of rows corn, number of seeds corn, grain weight and biological traits including chlorophyll concentration, leaf area index, under the influence of Leaf Removal and row spacing and interaction These two decreased significantly.
Keywords: Corn, plant height, plant diameter, cultivar, defoliation, row spacing.

Introduction:

With the increase in population rates, many changes have taken place in the economy and in food systems. This increase in inequality and food insecurity affects all dimensions. Hence, the competition for food supply is more than other cases. Food security and self-sufficiency of the agricultural sector have been considered and the focus of this sector has been emphasized. (Walter E.L. Spiess,2016)

Corn is one of the most important grains that is a very important food plant in most parts of the world and most of the agricultural lands in the world are dedicated to corn. It is widely cultivated in most continents. After wheat and rice, corn is the most important crop.(sorkhi, 2006) and has been of particular interest because of its widespread use as a staple food (Patricia Giraldo et al., 2019) in many industries, especially the food industry, and its widespread use in the livestock and poultry industries directly or indirectly. Concentrate or food and food supplement and its consumption as a raw material of some energy carriers is vital. Many uses for humans, livestock, industrial products) including starch, oil, beverages, sweeteners, adhesives, industrial alcohol and fuel. Of biology (pharmacy, food industry, etc.) (Bolatova Z, Engindeniz S, 2018).

Planting cultivars that are compatible with the climatic conditions of each region will increase grain yield per unit area. Corn varies in type, size, weight, and growth habit (Nleya T, Kleinjan J, 2019).

Many factors are involved in increasing or decreasing the grain yield of corn. The selection of superior, compatible and high-yield hybrids in each region is one of the main factors in increasing the production and yield of corn grain (Rafiq CM, Rafique A, 2010), growth pattern in kidney The cultivars are almost the same, but the time of occurrence of each stage depends on the genotype, growing season, planting date, climatic conditions and the amount of available nutrients (Sadeghi and Bagheri 2018).

Corn grain yield depends on the genetic potential of the genotype used, soil characteristics, field management methods and agronomic and climatic factors. Tandzi, Mutengwa, 2019) (Potential yield is the maximum yield that can be achieved by using the product in a given environment. Potential yield is largely determined by a specific combination of factors, such as solar radiation, soil type, temperature, plant density, potential Genetically determined genotypes are determined by biotic and abiotic constraints (Liu Z et al, 2016; Đalović, 2014; Ndhleve S, Nakin, MDV, 2017).

Increasing productivity per unit area through crop management is one of the most important cases, which by applying crop management can increase the effective effects on yield and yield optimization (Gezahegn, 2019). Planting pattern design is one of the most important and scientific activities that is used to sustain agricultural ecosystems and optimize the consumption of institutions. In fact, the proportional planting of different crops of a farm should be such that maximum economic efficiency based on maintaining farmers' income (Tabatabai and Shakeri 2011).

Adjusting the optimal density in corn because this plant is not able to produce tillers, is very important to achieve optimal yield by increasing the distance between plants, due to reduced competition for growth limiting factors, the possibility of absorbing water, light and nutrients. And this factor itself increases photosynthesis, (Sorkhi, 2016) One of the factors that can increase or decrease the light radiation inside the vegetation is the genetic structure of the plant and the appropriate planting arrangement that increases the yield per unit area. (Pedersen et al, 2003). The problems of the typical planting pattern are improper arrangement and short spacing of plants on the row, which causes the competition between plants to start cornlier and this competition to intensify by increasing plant density per unit area. (Sorkhi, 2016).

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Grain yield is affected by intra-plant competition for the distribution of photosynthetic and extra-plant materials for the use of environmental growth factors Farnia and Mansouri, 2014. Corn is very sensitive to plant density and if the density used is low, the production factors will not be optimized. On the other hand, excessive increase in plant density causes sterilization of flowers and reduced grain yield. Maximum yield is achieved when competition The inside and outside of the plants are minimized for growth factors and the plant can make the most of these factors (Hashemi et al., 2005).

In order to identify the mechanisms controlling grain filling, manipulation of source power and destination size has been Leaf Removal d in several studies Moriondo et al. 2003) Some evidence has shown that most grain yields have been associated with balance between origin and destination (Zhang et al, 2010)

Seeding indirectly reduces yield by reducing photosynthesis, and in cases where the economic yield is plant shoots, it directly affects yield. In general, the removal affects all developmental processes and consequently the aerial parts. In several studies, it has been observed that plant height, leaf area index, light absorption and photosynthesis, shoot dry weight, yield and yield components have been poorly affected (Behrozi M etal, 2016).

Due to the importance of the above, the purpose of this study was to the effect of Leaf Removal and row spacing on function and some biological traits of two corn cultivars, Karun 701 and Koosha, in the climate of Bam.

Materials and methods

This experiment is in the form of two separate experimental designs in Bam city with a longitude of 58 degrees and 36 minutes east and a latitude of 29 degrees and 10 minutes north and an altitude of 1050 meters above sea level separately in the two cropping years 1397-98 and -99. It was implemented in 1398.

For this purpose, the single cross-hybrid hybrid Karun 701 with desirable morphological and phenological characteristics such as 30% more pollen grains and good tolerance to drought stress in which a reduction of 3-4 irrigations is possible, Koosha new hybrid resulting from the intersection of paternal line S61 and mother line K17 / 1263.

The experiment was performed as a double-split plot in a randomized complete block design, in which the main plot (A) was divided into two rows 40 (a1) and 70 cm (a2), the sub-plots (B) into two cultivars Karun 701 (b1) and Koosha (b2) and sub-plots (C) were selected based on 6 factors. Each sub-plot consisted of 6 planting rows with a length of 6 m and a distance between rows of 40 and 70 cm.

Chinese leaf treatment was performed on all plants of each plot. The leaves were removed with garden shcorns and from the knot, ie both the leaf blade and the pod were removed.

In this experiment, yield components of corn plant including number of seeds per row of corns, number of rows corn, number of seeds corn, 1000-seed weight, leaf dry weight, dry matter weight, grain yield and biological traits in two cultivars single cross Karun 701 and Koosha Was examined. Statistical analysis of this study was performed by ANOVA test by SPSS software.

Discussion and results

Leaf cutting, cultivar and their composition had a significant effect on the yield of plant components and biological traits.

the weight of one thousand seeds

Data analysis table of variance for 1000-seed weight showed that the effect of row spacing treatment on 1000-seed weight in the first and second years was significant ($P < 0.01$). The difference in 1000-seed weight of Karun and Koosha cultivars was significant in two years of experiment ($P < 0.05$). Also, the interaction effect of row spacing with cultivars tested in experimental years was significantly different ($P < 0.01$),(table-1). The effect of treatment The interaction effects of picking with row spacing and cultivar were significant at 1% probability level and this significance was also observed in the second year of the experiment, while the three-way interaction effect of row spacing, cultivar and picking was not significant. Increasing the row spacing from 40 to 70 cm reduced the weight of thousand seeds.

In a study of Soleimani et al, They or the rate of decline in leaf aging are under consideration. The interaction effect of hybrid in planting pattern had a significant effect on the number of seeds corn and by increasing the density and using a single row planting pattern, the lowest number of seeds corn was created (Soleimani et al. 2015).

At high densities, the lower branches of the canopy may have limited light reception, so plants may experience a decrease in grain weight due to reduced production of photosynthetic material that can be transferred to the seed (Seyed Sharifi et al. 2012). Similar results were reported in a 2005 study by Boquet et al., Valenciano and Frade.

In a study by Tawaha et al., It was stated that with increasing plant density, the weight of 222 seeds decreases due to insufficient photosynthetic material during the grain filling period (Tawaha.,2005).

It seems that due to the same conditions for cultivars, the difference in the weight of 100 seeds of cultivars is more genetic. The earlier the digit, the shorter the grain filling period and the lower the weight of each grain (Seyed Sharifi et al., 2012).

Similar results show that excessive plant density often increases competition between plants, causes leaf shade and reduces the amount of resources available in the plant (Morris, Hamilton, and Harney. 2000).

Selectivity by reducing photosynthesis indirectly reduces yield and in cases where economic yield is plant aerial parts directly affects yield. It generally affects the development of all growth processes and, consequently, the air organs. Numerous studies have shown that leaf area index, light absorption and photosynthesis, dry weight of aerial parts, yield and yield components have been negatively affected by selection (Moriondo et al, 2003; Albacete et al, 2014).

number of rows of seeds corn

The effect of row spacing, cultivar and picking treatments on the number of seed rows corn in the first year showed that the effect of cultivar on the number of seed rows was significant (P <0.05). Also, the effect of planting row spacing (P <0.01) and the effect of germination (P <0.01) on the number of grain rows per corn corn were significant. In the first year of the experiment, the interaction between cultivar and planting row spacing at 1% probability level and the interaction between planting row spacing and defoliation at 5% probability level on the number of seed rows corn were significant. The interaction effect of cultivar and germination was significant at 5% probability level on the number of grain rows corn(table-1). The three-way effect of cultivar, row spacing and defoliation was not significant. Interactions in the second year showed similar results.

In the Barimavandi study, complete defoliation reduced the number of seeds per column and row to zero. It is possible that the removal of the leaves at this stage stimulated the vegetative growth of the plant and directed the flow of photosynthetic material to these organs. In the case of nitrogen application, removal of the upcorn leaves reduced the number of seeds per row. The upper leaves of corn are younger and more exposed to light, so they have a higher photosynthetic potential. Losing these leaves can do more harm than good(Barimavandi, 2010).

Also, in a study conducted by Heidari in 2016, it was reported that the number of seeds per row and column had a positive and significant correlation with each other and with the weight and length of corn and grain yield. Increasing the length and weight of corn provides the necessary bed to increase the number of seeds in the column and row, complete defoliation in the tassel stage caused zero grain yield. Under these conditions, no seeds formed on the corn. Removal of plant leaves is equivalent to removal of photosynthesis of these organs. (Heidari 2016)

Number of seeds per row of corns

The effect of row spacing treatment on number of grains corn row was significant. At the level of 1% probability, the effects of row spacing and germination on the number of grains corn row are significant. The effect of cultivar at 5% probability level on number of seeds corn row was significant. The results of the second year of the experiment were similar to the main effects of the first year. The interaction effect of planting row spacing in cultivar (P <0.01), planting row spacing in emergence (P <0.05), cultivar in defoliation (P <0.01) (table-2).was significant in the first and second years. The tripartite effect was not significant in any of the experiments. Comparison of the average of Koosha and Karun 701 cultivars in terms of number of seeds per row showed that Karun 701 cultivar with an average of 33.89 in the first year and 33.58 in the second year was superior to Koosha cultivar with averages of 33.7 and 33.39. Harvesting also had a significant effect on the number of seeds per row. The average number of seeds per row in the treatment of 50% leaf removal in the blister stage was the highest with 34.90 and with 32.85 in the treatment of 100% leaf removal in the 7-leaf stage was the lowest.

Comparison of the mean number of seeds corn row showed that by increasing the row distance from 40 to 70 cm, the number of seeds corn row from an average of 34.07 to 33.55 in the first year and from an average of 33.73 to 33.25 in the second year The results of this report are consistent with the study of (Mazaheri et al. (2002).

The number of grain rows corn is one of the important components of grain yield in corn that is strongly affected by competition between plants (Saberi et al., 2010).

Soleimani-Fard et al. Stated in their study that the decrease in the number of grain rows corn under the conditions of low nitrogen consumption was attributed to the lack of nutrients allocated to the destination and the reason was a decrease in leaf area index, reduced leaf area durability. According to Sinclair, the speed and amount of photosynthesis of plants are known. Physiological competition on the cultivated material is strongly concentrated at the stage when the number of seeds in the corn row is determined. It can be said that competition is reduced by reducing the distance between plants. Intensified and the number of fertilized flowers corn is less and as a result a smaller number of seeds is produced (Soleimani Fard et al).

In a report on the moderation of the effect of plant spacing on the row on yield and yield components of rapeseed cultivars, it is stated that with increasing density, the number of seeds per pod decreases and the number of seeds per pod is negatively correlated with plant density. Which has decreased with increasing the number of grains per row and has brought studies to confirm its study (Etedal, 1396).

In fields with long row spacing, the soil will not be completely covered with corn leaves, and as a result, part of the solar energy, instead of being absorbed by the leaves, causes direct evaporation from the soil surface. Farrokhinia et al., 2009 reported that dehydration by reducing photosynthesis As a result, lack of cultivated sap reduces plant height and ultimately reduces seed yield. (Farrokhinia et al. 2009) For this reason in most countries try to create hybrids that have vertical leaves with a smaller angle to the stem To be able to reduce the distance between the rows and thus increase the density (Noor Mohammadi et al., 1997).

Johnson (1990) reported that delayed tassle and pollination were caused by cornly tassleing at the 5-leaf stage. Morivando et al. (2003) found that the removal of the four upper, middle, and lower four leaves and the removal of a total of 12 corn leaves at the cornbing stage reduced yields by 58, 38, 17, and 99 percent, respectively.

In a experimental performed by Saeed and his colleagues, cutting the leaves above the corn reduced the length of the corn. Decreased corn length and baldness, number of seeds corn row and yield were observed in 700, 604 and 301 cultivars, respectively. The highest number of rows corn, number of seeds per row and yield were obtained from the control treatment. Corn leaf cutting treatment and lower corn leaf cutting treatment were in the second place in terms of the amount of these three traits. The leaf cut treatment above the corn produced the lowest number of rows, number of seeds per row and yield. In cornly 301 cultivar, lower corn and no leaf cut treatments had similar performance, but in medium-sized 604 and late 700 cultivars, the yield in leafless treatment was higher than other treatments. (Saeed et al., 2007) .

Also, in a study conducted by Heidari in 2016, it was reported that the number of seeds per row and column had a positive and significant correlation with each other and with the weight and length of corn and grain yield. Increasing the length and weight of corn provides the necessary bed to increase the number of seeds in the column and row, complete defoliation in the tassel stage caused zero grain yield. Under these conditions, no seeds formed on the corn. Removal of plant leaves is equivalent to removal of photosynthesis of these organs (Heidari 2016).

Complete defoliation in the thasseling stage reduced grain yield to zero. Under these conditions, no seeds formed on the corn. Removal of plant leaves is equivalent to removal of photosynthesis of these organs. Although other organs, such as the stem and pod of the corn, remain and can photosynthesize, the complete removal of the leaves during the thasseling phase may disrupt the flow of photosynthetic material to the corn and seeds, and the material resulting from photosynthesis of the stem or storage Remains in place for re-transfer in this organ. (Gittins, C., 2010).

Aggarwal, et al. (1990) stated that defoliation of maize reduced the rate of grain dry matter accumulation in 20 days after corming. Barnett, and pearce (1983) reported that in defoliated maize, after stem formation, carbohydrates for grain filling increased and yield increased. Trappeniers (1992) stated that defoliation in the grain paste stage increased water use efficiency by reducing respiration.

grain performance

Analysis table of variance of data for grain yield showed that the effect of row spacing treatment on grain yield in the first and second years was significant (P <0.01). Also, the difference in grain yield of Karun and Koosha cultivars in the two years of experiment was significant (P <0.05). Also, the interaction effect of row spacing with the cultivars tested in the experimental years on grain yield showed a statistically significant difference (P <0.01) (table-3). The effect of hatching treatments, interaction of hatching with row spacing and cultivar on grain yield at 1% probability level was significant and this significance was also observed in the second year of the experiment, while the three-way interaction of row spacing, cultivar and picking on grain yield was significant. It did not make sense.

Hicks et al. (1977) studied short-day and long-day hybrids of corn and found that 50% and 100% germination in the 13-step stage reduced grain yield by 3.5% and 28.3% in short-day and hybrid hybrids, respectively. 0.1 and 30.8% yield was increased in day hybrids. Hanway (1969) in the study of the effect of two levels of 50 and 100% germination on cornly, medium and late maturing hybrids of corn in the 12-leaf stage, the emergence of tassels and tillering that in cornly hybrids after 100% leaf removal in the stage The amount of leaf material was less than late and medium clay hybrids. Based on the average cultivars, in general, in 50% of germination in these stages, grain yield decreased by 85, 75 and 80%, respectively, and in 100% of germination, by 70, 2 and 31%. It seems that germination in the emergence stage of Tassel will have the greatest decrease in grain yield compared to the later and cornlier stages.

Saleh et al. (2008) compared the two-row and one-row planting patterns in corn and concluded that the grain yield in the two-row planting pattern was higher than one row, which is in line with the findings of the present study. Is. (Saleh et al., 2008).

Chlorophyll concentration (SPAD index)

The effect of row spacing, cultivar and picking treatments on SPAD index in the first year showed that the effect of cultivar on SPAD index was statistically significant (P <0.05). Also, the effect of planting row spacing (P <0.01) and picking effect (P <0.01)(table-3). on corn SPAD index was significant. Similar results were obtained in the second year.

In the first year of experiment, the interaction between cultivar and planting row spacing at 1% probability level and the interaction between planting row spacing and defoliation at probability level at 5% probability level on SPAD index were statistically significant. The 5% probability on the SPAD index was significant. The three-way effect of cultivar, row spacing and defoliation was not significant. The interaction effects of treatments on SPAD index in the second year showed similar results. Comparison of the mean effects of row spacing on corn SPAD index showed that this index decreased with increasing row spacing. Thus, this index decreased from an average of 51 and 51.7 in the first and second years with a row spacing of 40 cm to 50.3 and 50.9 with a row spacing of 70 cm in the first and second years, respectively.

There was no significant difference between Karun 701 and Koosha cultivars in terms of SPAD index. Different levels of germination caused a significant difference in chlorophyll index during the first and second years of the experiment. Increasing the amount of germination, especially in the pre-pollination stages, severely reduced the chlorophyll index. The highest SPAD index of 50% in the vesicle stage was 52.3 and 53 in the first and second years, respectively. The lowest chlorophyll index of 49.3 and 49.9 was observed from 100% leaf removal treatment in 7-leaf stage in the first and second years. Vasilas and Seif observed that at intensities of 50 and 100 seed drills at the pollination stage, grain yield decreased by 46 and 52%, respectively.).

Hicks et al. (1977) stated that in corn, pre-emergence defoliation increased the moisture content of the panicle at harvest time and delayed ripening, while post-emergence defoliation accelerated maturation. Johnson (1990) reported that delayed tasseling and pollination were caused by cornly tasseling at the 5-leaf stage. Morivando et al. (2003) found that the removal of the four upper, middle, and lower four leaves and the removal of a total of 12 corn leaves at the cornbing stage reduced yields by 58, 38, 17, and 99 percent, respectively.

As leaf area decreases and defoliation increases, the structural properties of the leaf and the biochemical parameters of its components change. The activity of enzymes involved in photosynthesis decreases in the case of non-stomatal inhibition of photosynthesis. In C4 plants, it is reported that intercellular spaces and chloroplast positions are disrupted by drought stress due to CO2 emission and light penetration following a reduction in photosynthetic activity.

Leaf area index

The ratio of plant leaf area to soil surface by which the plant is occupied is called leaf area index (Momeni Fili et al. 2014). The difference in leaf area under the effect of planting distance treatment in the first year of the experiment was significant ($P < 0.01$). The effect of cultivar also showed that the leaf area weight in Karun and Koosha cultivars was significantly different ($P < 0.01$). Similarly, the effect of pollination on corn leaf area in the first year was significant ($P < 0.01$). The results of the second year of the experiment also showed that the difference in leaf area under the influence of planting distance ($P < 0.01$), cultivar ($P < 0.05$) and germination ($P < 0.01$)(table-4). treatments was statistically significant. Comparison of the mean of treatments due to row spacing showed that with increasing row spacing, leaf area decreased. So that the average leaf area decreased from 5.98 to 5.90 in the first year and from 6.8 to 6.7 in the second year. Of course, the difference in leaf area between Karun 701 and Koosha cultivars was statistically significant. Leafing levels showed the highest leaf area related to 50% leaf removal treatment in the vesicle stage with averages of 6.13 and 7.02 in the first and second years, respectively, and the lowest leaf area related to 100% leaf removal treatment In the 7-leaf stage with averages of 5.7 and 6.6 were tested in the first and second years, respectively.

In a study reported by Behvarzi et al, It was stated that fertilization indirectly reduces yield by reducing photosynthesis, and in cases where the economic yield is the shoots of the plant, it directly affects the yield. Affects the developmental processes and consequently the aerial parts. Leaf area index, light absorption and photosynthesis, shoot dry weight, yield and yield components have been affected by defoliation (Behvarzi et al., 2015).

And Board (2004) in their study of the effect of defoliation on soybeans found that by removing one third of the leaves in the middle stage of grain filling, the leaf area index decreased by 41%. In the same experiment, by removing two thirds of the leaf area, this index decreased by 56% (Board et al. 1997).

Biological function

In the study of the effect of planting row spacing on the biological yield of corn, it was found that the difference between different planting intervals in terms of biological yield is significant at the level of 1% probability, also Karun and Koosha cultivars showed a significant difference in terms of biological yield ($P < 0.05$). The effect of selective treatment on the biological yield of maize was significant ($p < 0.01$)(table-2). The interaction effects of row spacing between planting and cultivar were significant at the level of 5%, row spacing and emergence of 1%, cultivar and defoliation of 1%. The interaction effect of ternary row spacing, cultivar and picking was not

significant. The results of the second year of the experiment also showed that the effects of the dual interaction principle with similar probabilities of the first year were significant, while the tripartite effect was not significant in the second year.
Comparison of the average effect of planting row spacing treatment on biological yield showed that in the first and second years of the experiment, increasing row spacing from 40 to 70 cm caused a decrease in biological yield from 26.36 to 25.62 tons per hectare in the first year and from 26.92 It dropped to 26/17 in the second year. Biological yield is the result of the number of rows of seeds, the number of seeds per row and the weight of 1000 seeds. As observed for the performance components, all of these components decreased with increasing row spacing for the reasons mentioned. It seems that the reduction of biological yield can be considered as a result of the reduction of yield components.
In a study conducted by Sadeghi and Ranj, it was reported that grain per ear had a positive and significant correlation with 1000-seed weight and number of seeds per ear. Thousand grain weight and number of grains per ear directly affect grain weight per ear and grain yield. In the same study, a report from a friend and colleagues stated that a high and significant positive correlation was observed between high length, 100-grain weight and net grain yield in the plot. Also, from the study of Gonzalo et al., They reported that by examining the recombinant populations of inbred maize line, by finding a number of gene loci, grain yield showed a positive and significant correlation with cluster length (ear). Gonzalo et al. Have recommended that the use of lines with longer cob length or number of grains per row and more grains per row is useful in breeding corn and producing suitable compounds and causes yield stability in hybrids of maize produced (Sadeghi and Ranj, 2014).).
Sharifi and Namvar in 2016 in a study on the population of corn plants at three levels (7, 9 and 11 plants per square meter) with three levels of inter-row spacing (45, 60 and 75 cm). The results of this study showed that the maximum plant height (179.07 cm), total dry matter (592 g / m2) in 91-83 days after planting in plots with 11 plants per square meter and row spacing of 45 cm Was. The biomass of this plant was significantly affected by the density and distance within the row. Their findings are based on the observations of researchers such as Amanullah et al. (2009) who reported that with increasing density of corn biomass within the row within 45 cm (484.4 g / m2) The plant matched the maximum amount of biomass produced(. Sharifi and namvar, 2016).
The effect of different cultivars on biological yield showed that Nosrat cultivar with an average of 24470 kg / ha was the highest biological yield of Radara The effect of different density levels on this trait showed that the density of 350 seeds per square meter had the highest biological yield. The reason for the significant difference between cultivars can be mentioned that Nusrat cultivar due to better distribution of leaves in the stem and optimal reception of radiation with more dry weight and more photosynthetic materials are produced and sent to growing organs. Produced higher biological yield than local cultivar. Also, the reason for the significant difference between the densities is that the density of 350 seeds per square meter produced the highest biological yield due to the proper distribution of plants on the ground and the absorption of maximum solar radiation compared to other densities. In addition, the results of this study were consistent with others(Sarmad, 1989).

Conclusion

Yield of corn plant in number of seeds per row, number of corn rows, number of corn seeds, Thousand seed weight and biological traits including chlorophyll concentration, leaf area index, under the influence of leaf removal and row spacing and the interaction of the two significantly decreased during Showed two consecutive years.
Acknowledgments

The Islamic Azad University of Bam, which supported this study, is hereby thanked.

(Table-1)Analysis of variance of Number of Rows and the weight of one thousand seeds

		average of squares			
Sources of changes	Degrees of freedom	Number of Rows		the weight of one thousand seeds	
		first year	second year	first year	second year
block	2	ns7/915	7/99ns	0/015ns	**0/015ns**
Row spacing	1	435/50*	440.00*	0/822*	**0/831***
Main plot mistakes	2	4/490	4/536	0/008	**0/009**
type	1	70/401*	71/0128*	0/133*	**0/134***
Type*Row spacing	1	44/481*	44/940*	0/084*	**0/085***
Sub-plot mistakes	4	5/091	5/144	0/010	**0/010**
Defoliation	5	684/383*	691/43*	1/292*	**1/305***
Row spacing* Defoliation	5	30/818*	31/135*	0/058*	**0/059***
Type* Defoliation	5	59/848*	60/465*	0/113*	**0/114***
Row spacing* Defoliation*type	5	11/710ns	11/831ns	0/022ns	**0/022ns**
Sub-plot errors	40	4/314	4/358	0/008	**0/008**
CV%	2	16/3	14/3	8/3	**11/8**

*,** There is statistically significant difference at the level of 5% and 1%: ns,not significant difference respectively

(Table-2)Analysis of variance of number of seeds per row and biological function.

		average of squares			
Sources of changes	Degrees of freedom	Number of seeds per row		Biologist function	
		first year	second year	first year	second year
Block	2	0/076ns	0/085ns	0/190ns	**0/198ns**
Row spacing	1	4/177*	4/215	9/885*	**10/310***
Main plot mistakes	2	0/043	0/048	0/104	**0/108**
Type	1	0/675*	0/690	1/534*	**1/600***
Type*Row spacing	1	0/427**	0/480*	0/986*	**1/010***
Sub-plot mistakes	4	0/049	0/052	0/114	**0/119**
Defoliation	5	6/56*	6/83*	15/631*	**16/302**
Row spacing* Defoliation	5	0/296*	0/312*	0/695*	**0/059***
Type* Defoliation	5	0/574*	0/590*	1/377*	**0/725***

Row spacing* Defoliation*type	5	0/112ns	0/137ns	0/264ns	**1/437***
Sub-plot errors	40	0/141	0/162	0/097	**0/101**
CV%		8/65	10/7	11/9	**12/3**

*,** There is statistically significant difference at the level of 5% and 1%: ns,not significant difference respectively

(Table-3)Analysis of variance of leaf area index grain performance and Chlorophyll index(SPAD).

		average of squares			
Sources of changes	**Degrees of freedom**				
		grain performance		**Chlorophyll index(SPAD)**	
		first year	**second year**	**first year**	**second year**
Block	2	0/035ns	0/037ns	0/171ns	**0/175ns**
Row spacing	1	1/828*	1/906*	9/41*	**9/638***
Main plot mistakes	2	0/019	0/020	0/097	**0/099**
Type	1	0/284*	0/296*	1/52*	**1/558***
Type*Row spacing	1	0/179*	0/187*	0/96*	**0/948***
Sub-plot mistakes	4	0/021	0/022	0/11	**0/113**
Defoliation	5	2/890*	3/014*	14/78*	**15/14**
Row spacing* Defoliation	5	0/129*	0/134*	0/66*	**0/682***
Type* Defoliation	5	0/355*	0/266*	1/29*	**1/324***
Row spacing* Defoliation*type	5	0/049ns	0/511ns	0/25ns	**0/0259ns**
Sub-plot errors	40	0/018	0/019	0/09	**0/095**
CV%		11/5	10/7	14/2	**11/7**

*,** There is statistically significant difference at the level of 5% and 1%: ns,not significant difference respectively.

(table-4) Analysis of variance of leaf area index Comparison of leaf dry weight traits of dry matter weight of corn.

		average of squares	
Sources of changes	**Degrees of freedom**		
		af area index	
		first year	**second year**
Block	2	0/002ns	0/003ns
Row spacing	1	0/129*	0/169*
Main plot mistakes	2	0/001	0/002
Type	1	0/021*	0/027*

Type*Row spacing	1	3/013*	0/017*
Sub-plot mistakes	4	0/002	0/002
Defoliation	5	0/203*	0/366*
Row spacing* Defoliation	5	3/009*	0/012*
Type* Defoliation	5	0/018*	0/023*
Row spacing* Defoliation*type	5	0/003ns	0/0051ns
Sub-plot errors	40	0/001	0/002
CV%		8	8/7

*,** There is statistically significant difference at the level of 5% and 1%: ns,not significant difference respectively

Number of Row					
Sources of changes		**first year**	**second year**	**first year**	**second year**
Row spacing (cm)	**40**	**15/101a**	**15/179a**	**347/564a**	**492/262a**
	70	**14/887b**	**14/964b**	**342/646b**	**478/427b**
Type					
	Kuroon	**150/037a**	**15/114a**	**346/094**	**488/070a**
	Kusha	**14/951a**	**15/028a**	**344/16b**	**482/619b**
Leafing levels					
Witness		**14/912c**	**14/688c**	**343/203c**	**479/811c**
%100removal of leaves in the 7-leaf stage		**14/574d**	**14/649d**	**335/445d**	**458/377d**
%50 removal of leaves in the 7-leaf stage		**15/269b**	**15/347b**	**351/418b**	**503/060b**
%50 removal of leaves in the 14-leaf stage		**14/898c**	**14/975c**	**342/899c**	**478/920c**
%50removal in the blister stage		**15/487**	**15/566a**	**356/439a**	**517/540a**
%100 removal in the blister stage		**14/826cd**	**14/902c**	**341/226c**	**474/360cd**

Treatment levels that have at least one letter in common are at the 5% level in the same statistical group.

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