# Investigation of wheat genotypes morphological properties: A case study in Iran

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**ABSTRACT :** Investigation of the physiological and morphological indices of crop growth are explicitly essential in terms of evaluating the effective parameters on yield and its components, which can assist in determining crop growth sages and analyzing yield production. One of the best methods to determine the significant traits on yield is to analyzethe correlation between yield and these traits. The non-significant trait correlation with yield do not have a practical application in program of breeding. In this study, in order to evaluate the properties of 19 wheat genotypes along with a control cultivar (Chamran), an experiment was conducted in a randomized complete block design with three replications in two cropping years of 2017-18 and 2018-19 in Marand region of Iran. Thirteen traits including performances and yield components were measured and analyzed. Significant differences were observed between the genotypes of both experimental groups in terms of most of the studied traits. The genotypes of the two experimental groups were also significantly different in some traits.

**KEYWORDS**: morphological properties, Yield Components, wheatGrain yield, randomized complete block

## I. INTRODUCTION

In any plant type grain yield is the results of a number of compound physiological and morphological processes affecting each other and arising at different growth stages [1-3]. It is a complex and quantitative feature that is highly affected by a number of genetic parameters and environmental fluctuations[4-6]. Direct selection for yield, in plant breeding programs could be misleading and successful selection depends upon the data on the genetic diversity and dependence of morpho-agronomic traits with yield. Dependence studies provide a better understanding of the correlation of different characters with grain yield [7]. Therefore, selection have to be done based on these factors characters after evaluating their correlation with the yield [8].The correlation researches among yield contributing traits canassist in indirect selection of yield components. The correlation is a pragmatic method to improve selection criteria for accumulating optimum arrangement of yield contributing traits in a simple genotype [9]. The study of correlation coefficients among different traits with grain yield aidsin deciding about the relative significance of these traits and their values as selection criteria [10] and therefore, results in a directional model for yield prediction [11].

Regarding the study of Qureshi et al. [12], characters which significantly and positively correlate with yield may be used for indirect selection of high-yield genotypes without yield assessing. Relationships of different traits with yield, among different traits and their direct and indirect effects on each other provides an origin for a successful breeding programs [13, 14]. It is revealed in the study of Deb and Khaleque[15] that knowledge about the interaction and association of various traits with yield greatly assist the breeder in selection work with more accuracy andprecession. Yield components have myriads of inheritability; so, according to these traits the plant selection would be a quick and confident way for riddling all of the plants and improvement of the yield [16]. Today, the agricultural sector accounts for about 26 percent of gross national income, and 20 percent of agricultural production and 2.6 million hectares of the country's arable land are allocated to wheat cultivation. Wheat is one of the strategic products of the country and constitutes more than 45% of protein and 55% of calories required by the population [17]. Wheat is one of the major cereals that is widely produced in the world and in Iran due to its ease of production and importance in human nutrition, so that today it provides the main food of more than 35% of the world's people. Also, in terms of production and area under cultivation, it is the most important strategic product in agriculture in Iran and the world, and its increasing attention is considered [18]. According to the FAO [19], the current area under wheat cultivation in the world is more than 215 million hectares and its production amounts to 675 million tons. Experts predict that demand for wheat will increase by 40% by 2020, so a rapid increase in wheat production is essential [20, 21].Grain yield in cereals as the most important characteristic is affected by its components such as number of grains per spike, grain weight, number of spikes per unit area and related traits. In order to achieve proper performance, all performance components must have the desired balance and balance in relation to each other. Yield and yield in wheat are affected by crop management, genotype and environment.

Studies have shown that different genotypes have different yields under the same conditions [22]. In this study, different genotypes of wheat in terms of yield and yield components in Marand crop area have been studied to determine the best genotype among the studied genotypes.

## II. MATERIALS AND METHODS

The experiment was conducted as a randomized complete block design with three replications on 19 advanced wheat cultivars along with Chamran cultivar as a control according to the following planting plan. To prepare the planting land, the land in question, which was in a state of fall last year; in early October, due to the occurrence of the first effective rainfall, the plow was first plowed and disked and then the ground was leveled. The dimensions of the plots are 8 m in length, 1.2 m in width and 20 cm in row spacing. After complete maturation, half a meter was removed from the beginning and end of each row. Each treatment consisted of six rows of 5 m planting. The first and sixth rows were removed as margins and four middle lines were harvested. From the middle four lines of each plot, 20 plants were randomly selected and the studied traits were counted and measured. Shrubs were crushed after drying and straw and seeds were separated and then yield per unit area was determined.

**Considered Traits :** The traits that were evaluated in this experiment were:
1. Number of seeds per spike, 2.The weight of one thousand seeds, 3. Harvest index, 4. Bush height, 5. Number of fertile paws, 6. Number of spikes per square meter, 7. Spike length, 8. Number of nodes per stem, 9. Number of days until maturity, 10. Number of days until pollination, 11. Number of days until the advent of the spike, 12. Biological function, 13. Grain yield

**Statistical analyzes and calculations :** Before performing the statistical calculations, the normality of the data was first tested. If necessary, the data in percentage were normalized with Arcsin and the data obtained from the count were normalized by subtraction. Simple analysis of variance of traits, comparison of mean traits with Duncan's multiple range test at 5% probability level and simple correlation between studied traits were performed. Then, multiple regression analysis was performed based on stepwise method and finally path analysis was performed to identify the traits with the highest effect on performance. Genotypes were grouped using cluster analysis. For statistical analysis of SAS (version 9), SPSS (version 12) and MSTAT-C software and comparison of means with Duncan test at 5% probability level and necessary graphs with the help of Excel software (version). 2013) was drawn.

## III. RESULTS AND DISCUSSION

**Results of Analysis of Variance and Comparison of Means :** The coefficient of variation of the studied traits in the studied genotypes of the first year experiment ranged from 0.58 to 24.00% (Table 1) and in the studied genotypes of the second year experiment from 1.13 to 4.83% (Table 1) and in the combined analysis of the studied genotypes ranged from 0.38 to 17.08% (Table 1), which is the reason for the high accuracy of the experiment. The results of analysis of variance of the studied genotypes of the first year experiment are shown in Table 1. Fertile tiller number, spike length, 1000-seed weight, number of spikes, number of spikes and grain yield at the level of 1% probability and in terms of biological yield at the level of 5% probability, there is a statistically significant difference due to high genetic diversity among genotypes. It is studied in terms of the above traits. Also, the difference between these genotypes in terms of number of nodes per stem and harvest index is statistically insignificant.

**Grain Yield :** Comparison of the mean of first year experimental genotypes in terms of grain yield (Figure 1) showed that the maximum grain yield was related to genotype No. 2 (N-19-19) with 8733 kg / ha and the lowest yield was related to genotype No. 16 (Gonbad) with It was 4663 kg per hectare. Comparison of the mean of second year experimental genotypes also showed that the maximum yield of this group was related to genotype No. 3 N-91-19 with 9448 kg / ha and the lowest was related to genotype No. 17 (Morvarid) with 4621 kg / ha (Figure 2).
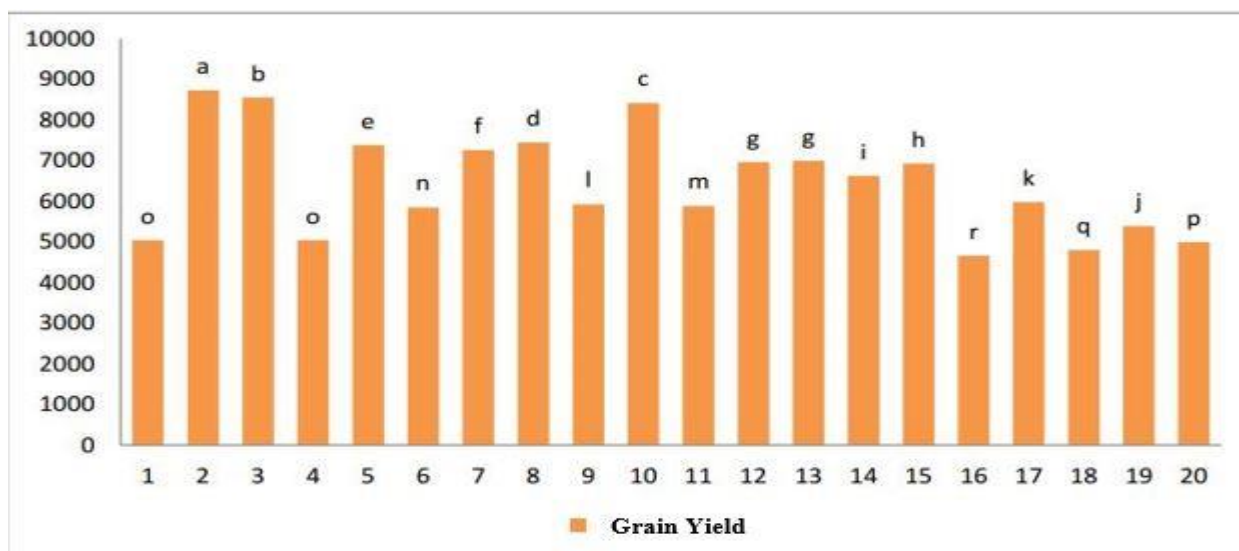
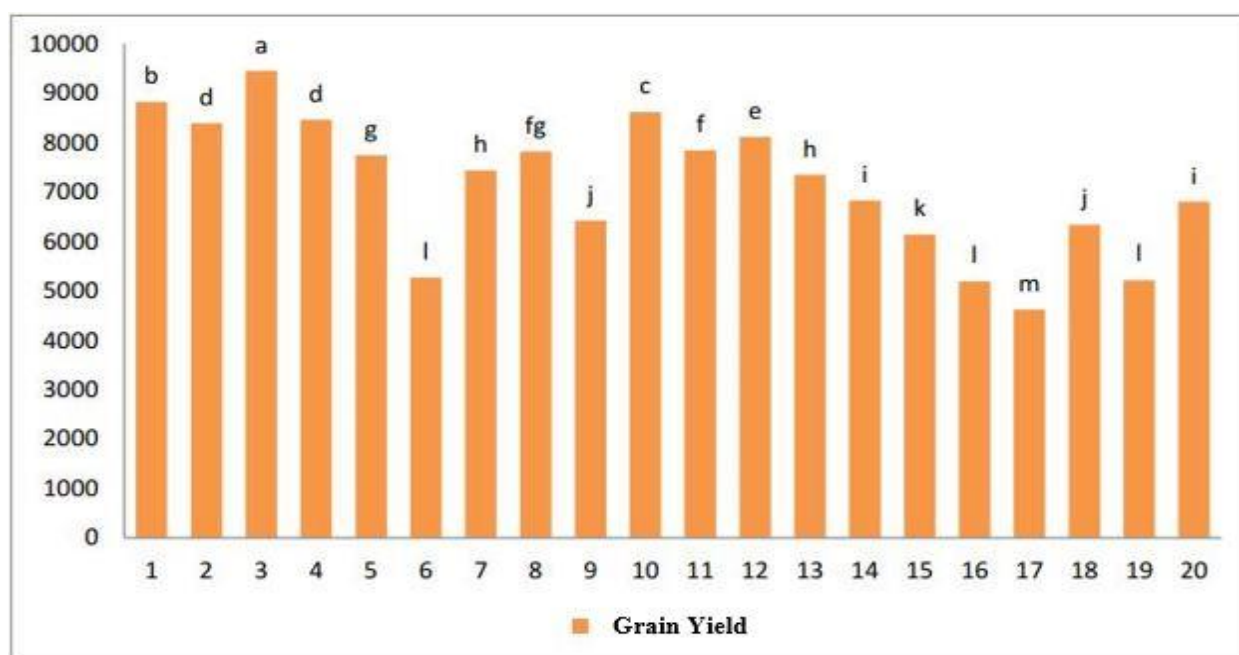**Figure 1. Comparison of mean grain yield in the studied genotypes**



**Figure 2. Comparison of mean grain yield in the studied genotypes**

Genotype No. 16 (Gonbad) of the first year experiment, which produced the lowest grain yield, was also in the lowest value in terms of number of spikes. Genotype No. 17 (Morvarid) of the second year experiment, which produced the lowest grain yield, was also in the lowest value in terms of number of spikes. Examination of the obtained results shows that the high yield of genotype No. 2 (N-1992-194) of the first year experiment is due to the higher number of spikes and the number of seeds per spike. Comparison of the mean of the year showed that genotype No. 3 (N-91-9) with an average yield of 9003 kg / ha had the highest yield and genotype 16 (Gonbad) with an average yield of 4924 kg / ha had the lowest yield.Considering that genotype No. 20 (Chamran) had an average yield of 5900 kg / ha, genotypes No. 15 (Radia) and 9 (N-93-121) with the average yield of 6536 and 6172 kg / ha, respectively, had the highest yield per hectare in comparison with Chamran. Genotypes No. 19 (Darya), 18 (Shiroodi), 6 (N-87-20), 17 (Morvarid) and 16 (Gonbad) showed lower performance than the control genotype, respectively.Varga et al. [23] also showed that there was a significant difference between different wheat genotypes in terms of grain yield. The results of the present study also confirmed the study of Varga et al.

**Number of days until the advent of the spike :** Comparison of the mean of the studied genotypes in terms of day to spike in the first year showed that genotypes No. 1 (N-92-9), 9 (N-92-12) and 16 (Gonbad) all three with

an average of 137 days, the most days and Genotype No. 10 (N-93-15) with an average of 3.132 had the shortest day to spike (Figure 3). Comparison of the mean of genotypes in the second year experiment showed that genotype 15 (Radia) with 174.7 days had the highest and genotype 10 N-93-15 with 131.7 days had the lowest day to spike (Figure 4). Comparison of mean means showed that genotype number 15 (Radia) with 155.2 days had the highest and genotype number 10 (N-93-15) with 132 days had the lowest day to spike.
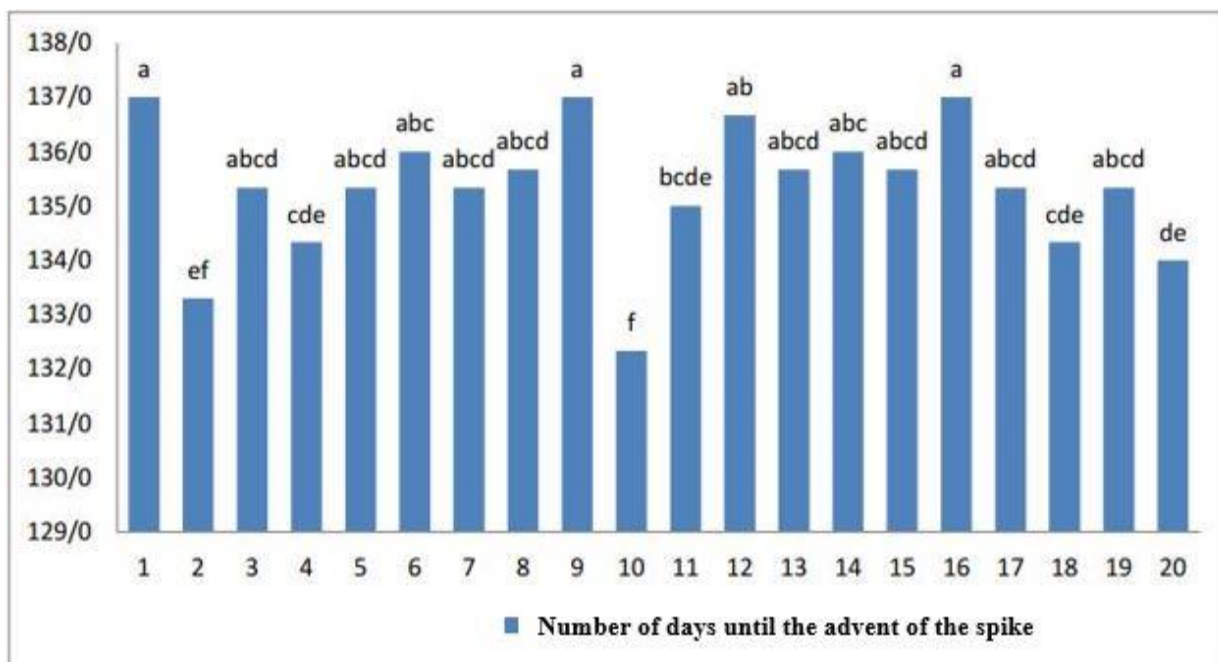


**Figure 3. Comparison of the average number of days to the emergence of spike in the studied genotypes**
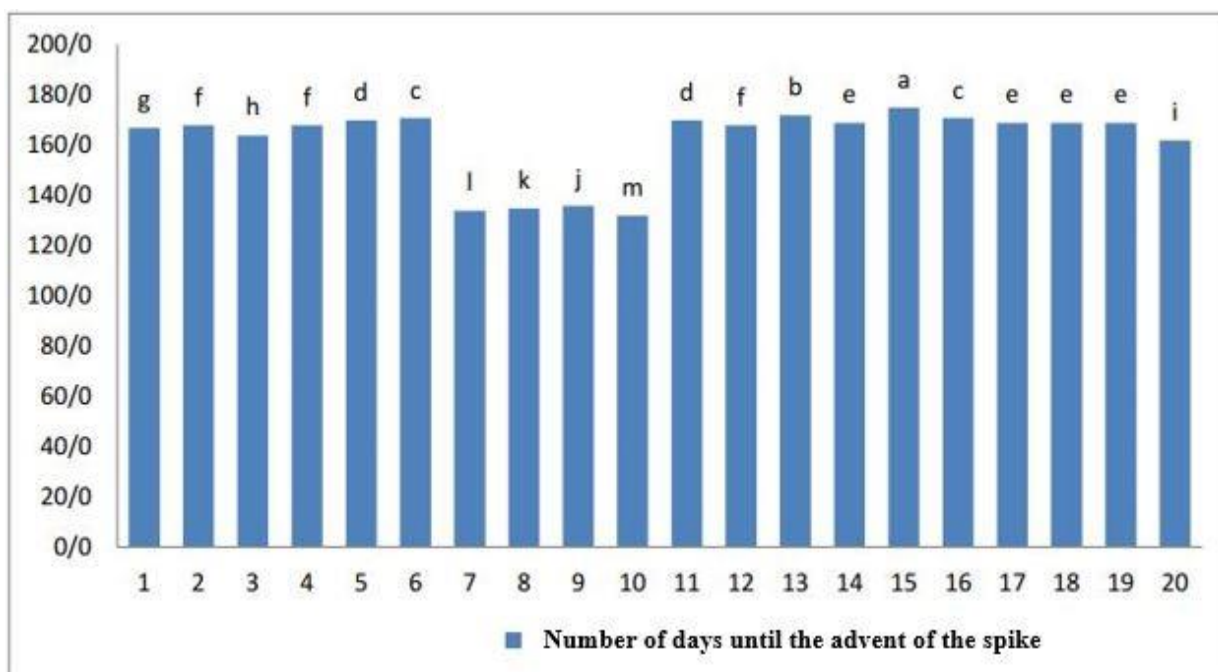


**Figure 4. Comparison of the average number of days to the emergence of spike in the studied genotypes**

**Number of days until pollination :** The range of changes in the number of days to pollination in the first year experiment among the studied genotypes varied from 135.7 to 139.7 days. The average total number of days to pollination in the 20 genotypes was 138.3 days. Genotypes No. 1 (N-92-9), 12 (N-94-11), 9 (N-93-12) and 14

(N-94-12) have the highest number of days to pollination and genotype No.10 (N-93-15) had the lowest number of days to pollination among the studied genotypes (Figure 5).
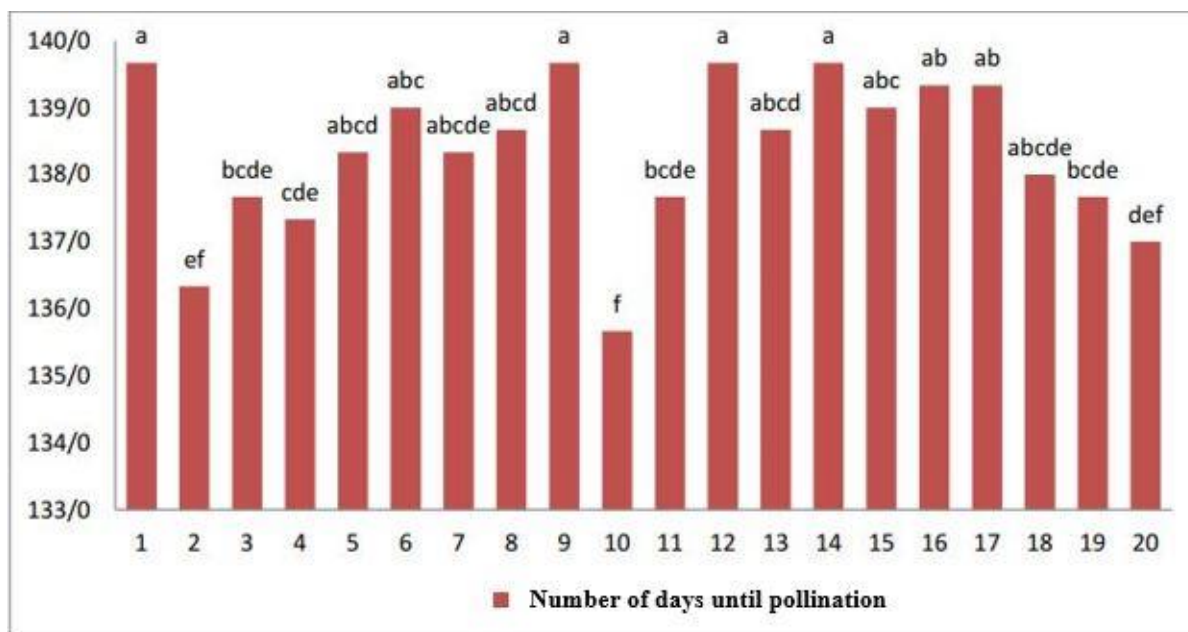


**Figure 5. Comparison of the average number of days to pollination in the studied genotypes**

In the second year experiment, according to the results of mean comparison, the distribution of this trait in the studied genotypes varied between 178.7 days in genotype number 15 (Radia) and 134.7 days in genotype No.10 (N-93-15) (Figure 6). The results of comparing the mean showed that the range of changes in the number of days to pollination among the studied genotypes varied from 135.2 days in genotype No.10 (N-93-15) to 158.8 days in genotype number 15(Radia), the mean of the total number The day to pollination was 151.8 days.
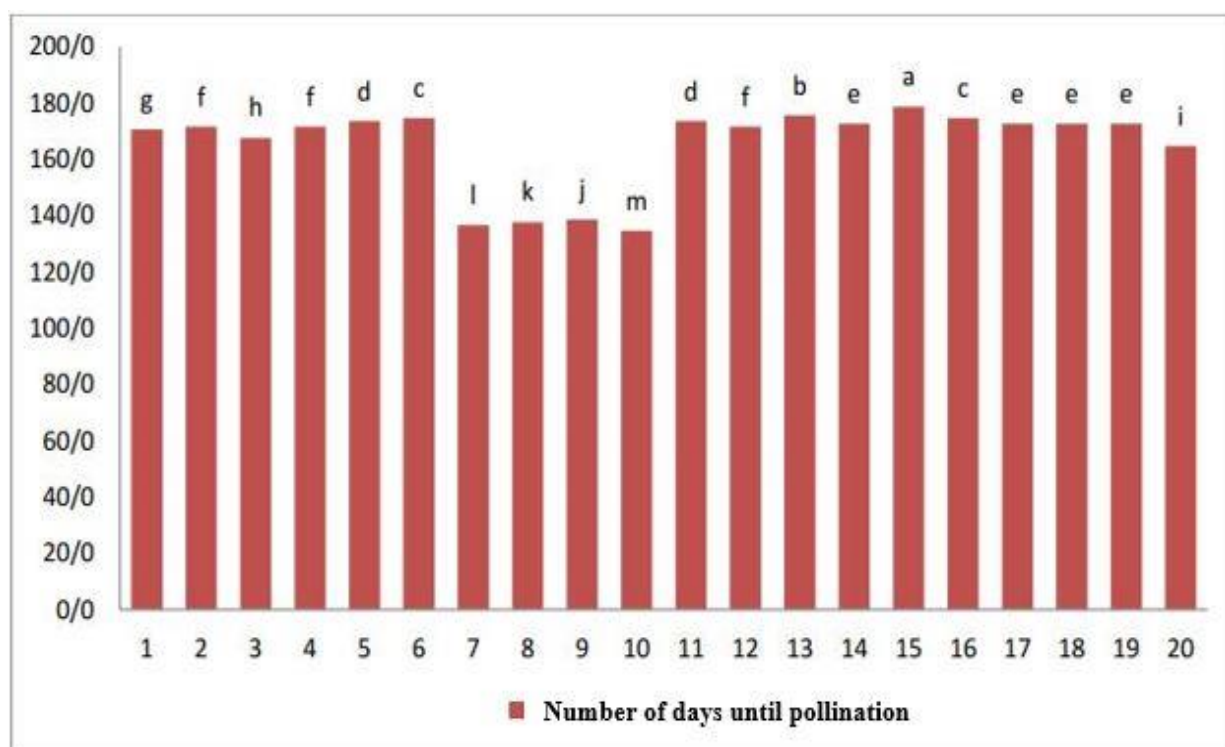


**Figure 6. Comparison of the average number of days to pollination in the studied genotypes**

# IV. CONCLUSION

In this study significant differences were observed between the genotypes of both experimental groups in terms of most of the studied traits. The genotypes of the two experimental groups were also significantly different in some traits. The following are the most prominent results of the study:

1. Genotypes No. 15 (Radia with the average yield of 6536 kg/ha, had the highest yield per hectare
2. Genotypes No. 1 (N-92-9), 9 (N-92-12) and 16 (Gonbad) all three with an average of 137 days, the most days and Genotype No. 10 (N-93-15) with an average of 3.132 had the shortest day to spike.
3. Comparison of the mean of genotypes in the second year experiment showed that genotype 15 (Radia) with 174.7 days had the highest day to spike.
4. Genotypes No. 1 (N-92-9) has the highest number of days to pollination.

**Table 1. Analysis of variance of evaluated traits in the studied genotypes**

| Sources of change | Degrees of freedom | Number of days until the advent of the spike | Number of days until pollination | Number of days until ripening | Bush height | Number of fertile paws | Spike length | Number of nodes per stem | Biological function | Harvest index | the weight of one thousand seeds | Number of spikes per square meter | Number of seeds per spike | Grain yield |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Block | 2 | 6.017 | 6.017 | 0.717 | 40.082 | 0.615 | 1.608 | 0.024 | 0.001 | 434.806 | 30.005 | 1071.117 | 3.350 | 1266666.67 |
| Genotype | 19 | 4.456 | 4.052 | 17.364 | 21.29 | 0.726 | 1.594 | 0.042 | 0.015 | 607.81 | 21.32 | 10045.9 | 19.7 | 4747023 |
| Error | 38 | 0.911 | 0.841 | 0.890 | 18.005 | 0.187 | 0.290 | 0.028 | 0.008 | 346.723 | 3.871 | 34.450 | 4.017 | 0.001 |
| Coefficient of variation (percentage) | | 0.71 | 0.66 | 0.58 | 4.48 | 16.47 | 5.83 | 5.16 | 19.91 | 24.00 | 4.50 | 1.71 | 4.17 | 1.99 |

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