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Evaluation Yield and Components Yield on Three Hybrids Maize in Hungary

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Abstract: We evaluated on physiological traits on 3 hybrids on maize in Hungary. We used Loupiac, Sushi and Armagnac hybrids for this experiment. Samples were taken in Debrecen. The Experimental Station is situated on the Hajdúság Loess Ridge, and the soil is a lowland chernozem with lime deposits and a deep humus layer, formed on loess. It has medium hard loam texture. The daily precipitation sum was determined with local measurements, while the daily radiation and temperature data were provided by the Meteorological Observatory Debrecen the National Meteorological Service in Budapest Samples were taken in location in Debrecen. In 2017 the total rainfall from May until October was 314 mm in Debrecen, which was 236 mm for winter period before sowing. Result showed genotype and traits and interaction trait in Genotype was significant in one percent. In Path analysis on different traits in grain yield, weight 1000 seeds in direct effect with grain yield of 0.95 indicate that this weight of 1000 seeds is very strong. GGE Bi-plot showed that Loupiac hybrid is highest grain yield and Armagnac hybrid is least grain yield.

Keywords: Maize, GGE bi-plot, Path analysis

Introduction

Corn has more genetic diversity than other cereals. Today, as a result of the efforts of nonproductive researchers, the plant is cultivated in most parts of the world to modify maize cultivars and produce new hybrids. More corn is sown for the use of grain and silage, which has different uses. Approximately 25-20% of the world's total maize products can be consumed directly in different shapes (corn flour, sweetened and canned, etc.) in human nutrition and 60-75% in different forms such as grain, pulp, powder, etc. The animal feeds. In addition, about 5% of corn production is also used for industrial products. In starch factories, they extract corn, starch, livestock feed, sugar syrup and oil (Kaplan, et.al, 2016).

Maize (Zea mays L.) is used in animal nutrition either as green fodder or silage. It is one of the most important juicy roughage (Erdal et al., 2009). High unit-area yield and adaptation capacity, availability for silage, high energy content, sufficient sugar content to preserve for long durations without any additives, the greatest digestible nutrient content, high nutritional values, long-duration storage and fresh consumption in winters, make maize as the most preferred plant for livestock feeding (Kusvuran et al., 2015).

The GGE biplot has been used to identify high yielding and adapted cultivars by many researchers such as Fan et al. (2007) and Setimela et al. (2007)for maize, Yan et al. (2000) and Morris et al. (2004) for wheat, Samonte et al. (2005) for rice, Dehghani et al. (2006) and Yan and Tinker (2005) for barley, Sabaghnia et al. (2006) for lentils and Kang et al. (2006) for common bean. Furthermore, superior crop cultivars must be evaluated on the basis of multiple traits to ensure that the selected cultivars have acceptable performance in variable environments within the target region (Yan and Rajcan, 2002; Yan and Tinker, 2005).

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Globally, maize production is entering a pivotal period when modern biotechnology is sufficiently powerful to make better maize plants for sustainable grain production in a changing climate. The maize genotype proposed here may shed light on targeted maize improvement in the near future. Increasingly promising genetic resources for elite maize traits are being discovered using high-throughput omics approaches, particularly genomics, proteomics and metabolomics. The application of these genetic resources in breeding practices can significantly increase the gene pools and allow for the modification of many important agronomic traits in maize. Conventional breeding programs combined with molecular modification techniques (e.g., gene transfer and genome editing) will greatly accelerate the speed of the creation of maize genotype. The creation of maize genotype and their subsequent application in production may play a vital role in ensuring sustainable grain production in a changing climate (Simons, 2014).

In multi-environment experiments, beside the primary trait, significance of other characteristics is also identified. However, GGE biplot graphs should accurately and efficiently be interpreted along with the objectives of the study. In silage maize, beside silage yield, the other plant characteristics may also vary with environmental conditions. The plant characteristics to be used in variety selection in maize to be cultivated in different environments of target region should be determined before to design a study on maize cultivars. However, there are not studies in literature assessing silage yield and yield characteristics of several maize genotypes under different environments. In present study, Genotype × Trait (GT), Environment × Trait (ET) and Trait Association × Environment (TAE) of different plant characteristics of 25 silage maize genotypes grown in six environments were assessed through GGE biplot analysis. Study investigating different plant characteristics of maize genotypes in different environments that stem diameter, green leaf weight ratio and plant height were identified as the mostly correlated traits with silage yield in all environments. GGE biplot method allowed efficient and reliable assessment of investigated traits in different environments. With this method, how a trait changed in each environment was identified, how traits are correlated with each other in each environment was assessed and the environments contributing the assessment of maize genotypes were identified. It was also concluded that GGE biplot method could reliably be used in assessment of different characteristics of silage maize genotypes grown in different environments (Kaplan, 2017).

Method and Materials

Samples were taken in location in Debrecen. The Experimental Station is situated on the Hajdúság Loess Ridge, and the soil is a lowland chernozem with lime deposits and a deep humus layer, formed on loess. It has medium hard loam texture. The soil type is solonetz, strongly calcareous, meadow chernozem, with loam or sandy loam texture.

In 2017 the total rainfall from May until October was 314 mm in Debrecen, which was 236 mm for winter period before sowing.In Hungary, 10–12 °C daily variation is nearly constant at least from the point of view of the phonological phases of maize; according to our studies this is the case also in other regions. Detailed investigations were performed in Canada, USA, and in Western and Eastern Europe. Extended climatological analyses revealed that in the region of 40–46° latitude of North America the daily variation of the temperature during the vegetative phase of vegetative development of maize (May-July) was around 12 °C, and the difference between the regions referred to was some tenth of degrees only, whereas in Western Europe – e.g. England, where maize is grown – daily variation is 6.5 °C. In Western Europe the variation is 10.0–11.0 °C, in Southern Europe 6.0–8.0 °C, respectively. After all, the question of base temperature ought to be solved by different approaches in those regions.

We measurement important traits in maize include: number of rows (NR), number seed on per cob (NSC), Weight of all seed (WS),weight of cob (WC), seed/cob rate(SC), Number of seed in column(NOSC),height plant(HP), Length ear(LE), outer ear diameter(OED), number of nodes (NON), stem diameter(SD),leaf number(LN), weight 100 seed in wet(WSW) and hybrids r this experiment are G1: Armegnac, G2: Loupiac, G3: Sushi).we analysis this data by genstat software.

Result

Analysis of Variance shows that a Genotype and traits and interaction trait in Genotype was significant in one percent. This result show there are different significant between traits and genotypes (table 1).

Table 1. Analysis of variance

S.O.V	Df	SS	MS
Genotype	2	2737.3	1368.65**
Error	8	1367.4	170.9
Traits	11	607993.2	55272.1**
Traits ×Genotype	22	23266.1	1057.55**
Error	88	90328.3	3542.61
Total	131	725691.3	

In Path analysis on different traits in grain yield, weight 1000 seeds in direct effect with grain yield of 0.95 indicate that this weight of 1000 seeds is very strong. Also, the plant height in the indirect effect through the weight of 1000 seeds shows a value of 0.45, which is an average value. In this statistical model, the number of leaves by the indirect effect on plant height indicates the value of 0.382, which is a low amount (table 2).

The phenotype as well as genotype correlation and path analysis of agronomic yield and yield contributing characters were analysed in 39 inbreds of maize (Zea mays L.). Grain yield has positive and significant correlation with ear diameter, number of kernels per row, number of kernel rows per ear, ear height, ear weight with husk, ear weight without husk, plant height, 100 grain weight and ear length both at genotypic and phenotypic levels. Path analysis revealed that that ear weight with husk, number of kernel rows per ear, number of kernels per row and 100 grain weight showed highest direct effect on grain yield per plant. The direct effects of plant height, ear height and ear diameter were also considerable. Whereas the remaining characters exhibited negative direct effect on grain yield per plant (V.Natara et al, 2014).

Tabel 2. Determine the direct and indirect effects of different traits

Traits	direct effect	Indirect effect through				
		Weight 100 Seeds in Wet	Plant Height	Leaf Number	Stem Diameter	Length ear
weight 1000 seed in wet	0.95	-	0.14	0.1	0.003	0.057
Plant Height	-0.09	0.45	-	0.382	0.062	-0.02
Leaf Number	0.12	0.004	0.11	-	0.09	0.056
Stem Diameter	0.06	0.05	0.01	-0.003	-	0.10
Length ear	0.11	0.18	-0.04	0.08	-0.001	-

Determine the Performance of Superior Cultivars Using the GGE bi-plot Graphical Method

Figure 1 shows the position of the hybrids, traits and axis of the mean traits. In order to plot this axis, first the mean point of the specified attributes is then connected to the point from the origin of the linear coordinates. Also, in the origin of linear coordinates, the mean axis of the traits is perpendicular. In this figure, the figures that are at the end of the positive axis are the mean of attributes, based on all the traits are more effective. Using this form and considering the mean grain yield, genotypes were evaluated. Generally, genotypes positioned in the positive direction of the horizontal axis are more effective than the negative side of this axis. According to this form Lupiac hybrid, the highest grain yield and Armegnac hybrid showed the least grain yield. The average grain yield of the cultivars is as follows:
Lupiac > Sushi>Armegnac.

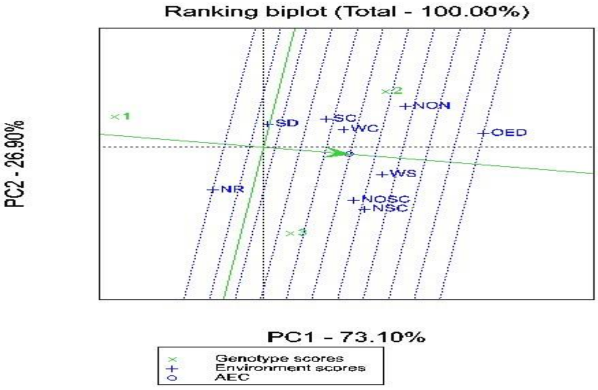

Fig2: Biplot for interaction between Traits and genotype (number of rows (NR), number seed on per cob (NSC), Weight of all seed (WS),weight of cob (WC), seed/cob rate(SC), Number of seed in column(NOSC),height plant(HP), Length ear(LE), outer ear diameter(OED), number of nodes (NON), stem diameter(SD),leaf number(LN), weight 100 seed in wet(WSW). G1: Armegnac, G2: Loupiac, G3: Sushi).

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