Journal of Plant Biology and Agriculture Science

Abstract

Vol. 3, Iss. 2

2022

Review on Genetic Variability in different Genotypes of Maize (zea mays L)

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ABSTRACT

Maize (Zea mays L.) is that the world's third most vital cereal crop that has remarkable productive potential. The primary centre of origin of maize is considered by most authorities to be Central America and Mexico, where many diverse types of maize are found. It is one of the leading economic crops of the world. Besides its uses as food and feed, maize is a priority and strategic crop to respond to the world's quest for alternative energy sources. In Ethiopia, it ranks first in total production and yield per unit area and it is the staple crop for millions of people. The selection for high yield with desirable traits depends on the genetic variability in the existing germplasm. Successful breeding programs need adequate genetic variation for selection and improvement supported necessity. Knowledge of the magnitude of genetic variability, heritability, and genetic gains in the selection of desirable characters could assist the plant breeder in ascertaining criteria to be used for the breeding programs. Many studies on genetic variability with the help of suitable biometrical tools such as variability, heritability, genetic advance gives an idea about the extent of genetic variability present in the population. Heritability is a suitable measure for assessing the magnitude of the genetic portion of total variability and genetic advance aids to make improvements in the crop by selection for various characters. This review paper was prepared to assess the genetic variability, heritability, genetic advance of maize genotypes.

Key words: Maize, Genetic variability, Heritability, Genotypes, Correlation

Introduction

Maize (Zea mays L, 2n=2x=20), a member of the Gramineae (Poaceae), is one of the oldest cultivated crops. Maize is predominately cross-pollinated by wind, but self-pollination is also possible. Maize is the most important crop worldwide and a basic trade product recurring ingredient for millions of people in Sub-Saharan Africa. Currently, maize is widely grown in most parts of the planet over a good range of environmental conditions ranging between 50º latitude north and south of the equator. Maize has a wide range of adaptations and is an important cereal crop in Ethiopia as a source of both food and cash. Maize is one of the foremost important cereal crops in the world following wheat and rice. It is widely used for food, feed, fuel, and fibre in many parts of the world. Maize has broad morphological variability and geographical adaptability thanks to its cross-pollinated nature. According to World Food and Agriculture, 197 million hectares of land were covered by maize and produced 1,134 million tons of maize grain in the 2017 production season. Maize is one of the main cereals that play a core role in Ethiopia's agriculture and food economy. It has the largest smallholder farmers' coverage and greatest production and consumption compared to other cereals. According to the CSA 2017/18, maize exceeds tiff, sorghum, and wheat by 58.9, 62.4, and 80.7%, respectively, with a total production of 8.4 million tons produced over 2.1 million hectares. About 11 million formers contributed to maize production and productivity (3.9-ton\ha). The Portuguese introduced maize to Ethiopia within the 16th or 17th century. Since its introduction, it has gained importance as the main food and feed crop. In Ethiopia, maize growing agro-ecologies are broadly classified into four major categories: mid-altitude sub-humid (1000-1800 m.a.s.l), highland sub-humid (1800-2400 m.a.s.l.), lowland moisture stress areas (300-1000 m.a.s.l.) and lowland sub-humid (<1000 m.a.s.l.). Currently, the national maize research program has three main breeding stations located within the above three major agro-eclogies excluding the lowland sub-humid agro ecology. Several improved OPVs and hybrids with resistance to certain biotic stresses

were released for giant scale production across different agro-ecologies by these breeding centres of the National Maize Research Program of the Ethiopian Institute of Agricultural Research (EIAR). The high altitude sub humid agro ecology, including the highland transition and true highlands, is next to the mid-altitude agro ecology with greater maize area and production in Ethiopia. This agro-ecology covers an estimated 20% of the land dedicated to annual maize cultivation and consisted of quite 30% of small-scale farmers who depend upon maize production for his or her livelihoods. Maize breeding in Ethiopia has been ongoing since the 1950s and has skilled three distinctive stages of research and development. These are from 1952 to 1980, the most activities were the introduction and evaluation of maize materials from different a part of the planet for adaptation to local condition, from 1980 to 1990, the work was focused on the evaluation of inbred lines and development of hybrid and open-pollinated varieties. From 1990 to this, the most activities were (a) extensive inbreeding and hybridization, (b) development of early maturing or drought-tolerant cultivars, and (c) collection and improving maize with adaptation to highland agro-ecologies. As a result, various improved hybrids and open-pollinated varieties were released for large-scale production, especially for mid-altitude zones. The high land maize breeding program was also started in 1998 together with the international maize and wheat improvement centre. The main goal of all maize breeding programs is to get new open-pollinated varieties (OPVs), inbred lines, and from their hybrids and synthetics which will outperform the prevailing cultivars with reference to a variety of traits. In working toward this goal, attention must be paid to grain yield because the most vital agronomic trait. Genetic diversity is that the existed variability within the genotypes of the individuals of a population that belongs to the same species. The variation could prevail within the entire genome, chromosomes, gene, or within the nucleotide levels. Maize is both phenotypically and genetically diverse. Genetic variability among individuals in population offers effective selection. Genetic diversity among maize lines is often examined supported by morphological traits. Grain weight and grain yield; kernel weight and days to maturity, ear height, days to slinking, % tryptophan content, cob length and 1000-seed weight; ear length and diameter; days to 50% an thesis, days to 50% silk emergence, days to maturity, ear aspects, grain yield, plant height, ear height and a number of diseased cobs are variables which will contribute to genetic diversity assessment. Characterization of obtainable maize genotypes supported phenotypes is critical to utilize the resources. The existing magnitude and nature of genetic variability among genotypes matters the preference of approaches of breeding for genetic improvement of a crop. The probability that two randomly sampled alleles are different is genetic diversity. The space reflects a definite amount of genetic difference present among the genotypes. These measures are often calculated by measuring morphological characteristics and/or using molecular markers. Albeit, phenotypic evaluation has useful attributes for grouping inbred lines and populations, these phenotypic traits have limitations in distinguishing variation in highly related genotypes and elite breeding germplasm thanks to genotype by environment interaction (GEI). Advances in molecular technology have produced a shift towards detecting individual differences using molecular markers. The character and magnitude of genetic variability of each elite maize inbred line is an important however limited number of highland maize inbred lines are characterized thus far due to only certain researches are conducted for the agro-ecology. Generally, knowledge of the nature and magnitude of variation in genotypes is of great importance to developing genotypes for top yield and other desirable traits. The magnitude of genetic variability, heritability, and genetic advances in the selection of desirable traits are pertinent and compulsory issues for the plant breeder to think about the traits during the crossing in the breeding program. Monitoring of genetic advances in crop improvement programs is important to live the efficiency of the program. Periodic measurement of genetic advances also allows the efficiency of the latest technologies incorporated into a program to be quantified. Estimation of genetic progress in variety development helps breeders to form a choice on the increment of productivity also on considers the breeding strategies within the future. Therefore, the target of this paper is to review the genetic variability and future trends of maize genotypes.