

BIOMETRIC INDICATORS OF THE GROWTH AND DEVELOPMENT OF MAIZE (ZEA MAYS L.)

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Annotation: This article provides general information about maize (*Zea mays* L.), focusing on its biometric characteristics, adaptability, and tolerance to salinity and temperature stress.

Keywords: Salt-tolerant plants, transpiration coefficient, aerial roots, adventitious roots, pesticide, tassel, cob, preceding crops, temperature sum.

Introduction. At present, large-scale measures are being implemented in Uzbekistan to develop the agrarian sector and accelerate agricultural production. According to the Resolution of the Government of the Republic of Uzbekistan “On the Strategy for the Development of Agriculture for 2020–2030” (No. 06/19/5853/3955), population growth and climate change are identified as key factors affecting national food security. The strategy sets important targets such as increasing the average grain yield to 70 centners per hectare by 2025, expanding forage crop areas to 12 percent of total farmland, and improving livestock productivity. Maize (*Zea mays* L.) is widely cultivated not only as a forage crop but also as a valuable raw material for environmentally friendly biofuel (bioethanol) production. In addition, maize acts as an effective phytomeliorative plant, absorbing salt ions from the soil during its vegetation period and improving soil reclamation conditions. Globally, 23–25 percent of arable lands are affected by salinity, while in Uzbekistan this figure reaches 50–55 percent. Soil salinity creates serious challenges for the development of both crop production and livestock farming. Planting salt- and drought-tolerant crops as predecessors helps restore soil fertility, and maize serves as an excellent example of such a crop. Maize is one of the most drought-resistant cereal plants, able to withstand extremely high temperatures. Its seeds germinate well at soil temperatures of 12–14 °C and rapidly at 16–18 °C. However, young and mature plants are highly sensitive to frost. Maize can grow at air temperatures up to 35–40 °C, and it requires a total effective temperature sum of 2250–2500 °C from sowing to maturity. Being a short-day and light-demanding plant, maize produces high yields in regions with abundant sunshine and low cloudiness. It has a lower transpiration coefficient than many other cereals, and its deep root system enables efficient use of soil moisture. Maize grows well on fertile loamy, meadow-gray, black, and chestnut soils but can also tolerate moderately saline lands. Nevertheless, well-aerated and well-drained soils are most suitable for its growth. Like other cereals, maize grows slowly at the early stages and is sensitive to weed competition. Germination occurs 10–15 days after sowing, tillering after 25–30 days, stem elongation after 40–50 days, tassel emergence after 55–65 days, and flowering 5–6 days later. Depending on the variety, the growing season lasts 90–145 days. This study presents data on maize plants grown under saline soil conditions and analyzes the changes in their biometric parameters during the vegetation period.



Materials and Methods. Among the soils of Uzbekistan, saline soils occupy a significant area. When cultivating crops on highly saline lands, it is essential to select plant species that are well adapted to such conditions. Prior to planting, soil preparation is carried out carefully, including the leaching of excess salts before fertilizer application.

During the growing season, plants require considerable amounts of macroelements (100–300 kg/ha) and smaller quantities of microelements (in grams per hectare). Microelements enhance the uptake of phosphorus and potassium from the soil. Crops such as wheat, barley, maize, and peas are particularly sensitive to phosphorus deficiency; therefore, the minimum optimal soil phosphorus content for these crops should be 120–150 mg/kg. In 2015, cereal crops in Uzbekistan were cultivated on approximately 1.285 million hectares of irrigated land and 250 thousand hectares of rain-fed land. Cereal crops are divided into several groups based on their morphological and biological characteristics. Within the group of gramineous crops (family *Poaceae*), maize (*Zea mays* L.), sorghum (*Sorghum bicolor*), rice (*Oryza sativa*), millet (*Panicum miliaceum*), and, from the *Polygonaceae* family, buckwheat (*Fagopyrum esculentum*) are included. These crops share several common characteristics: their grains lack longitudinal grooves, they develop a single primary root system, and their inflorescences appear as tassels or panicles. The cultivated varieties are typically spring crops, thermophilic, short-day plants, and—except for rice—highly tolerant to drought conditions.

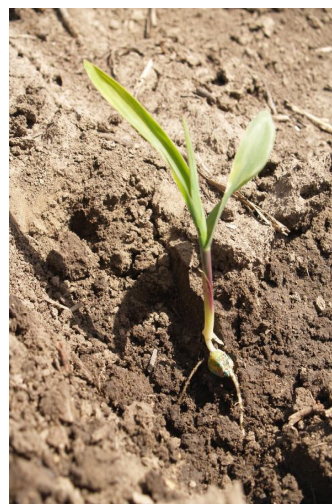
In tall cereal crops such as maize (*Zea mays* L.) and sorghum (*Sorghum bicolor* L.), aerial (supporting) roots develop from the above-ground stem nodes. These roots help the plant remain upright and prevent lodging. The root system of maize is highly branched and fibrous. Under optimal growth conditions, the total length of the roots, excluding root hairs, can reach approximately 1.5 meters. When root growth is unrestricted, the root system of a mature maize plant may extend about 1.5 meters laterally and up to 2.0 meters or even deeper vertically into the soil.

Results of the Study. The stems of cereal crops are straw-like and either hollow or filled with a spongy pith. They are divided into nodes and internodes. Short-stemmed species usually have 5–7 nodes, whereas maize (*Zea mays* L.) and sorghum (*Sorghum bicolor* L.) may have 10 to 25. The length of the internodes increases gradually from the base upward. The stem is capable of branching; lateral shoots develop from underground or above-ground nodes. The middle part of the stem is thicker, while the upper section becomes thinner. In cereal crops such as oats, sorghum, rice, millet, and maize, the tassel represents the male inflorescence. In maize, the ear (cob) is the female inflorescence. Maize is a monoecious plant with separate male and female flowers: the male flowers are grouped in the tassel, and the female flowers are arranged in the ear.

The leaves of cereal crops are simple and consist of a leaf blade, sheath, ligule, and auricles. The leaf grows from the stem node and tightly wraps around the stem, providing strength and maintaining its upright position. At the junction between the leaf sheath and the blade are the ligule and auricles. The ligule prevents rainwater from passing between the leaf sheath and the stem. It also helps the leaf attach firmly to the stem. The grains are round (in millet and sorghum) or irregular in shape (in maize). The amount of water required for seed swelling and germination varies among species: maize requires 37–44%, while millet and sorghum need 25–38% (relative to seed weight). Cereal crops can germinate even at very low temperatures — 8–10°C for maize and millet, and 10–12°C for sorghum and rice. Cross-



pollinated plants include rye, maize, and sorghum. In these species, the floral bracts open, allowing pollen to be dispersed by the wind. The tassel (male inflorescence) of maize blooms about two days earlier than the ear (female inflorescence). Pollen is carried by the wind to the silks of the ear, where it lands on the receptive stigmas and fertilizes the ovary. Artificial pollination in maize can increase yield. The middle part of the ear usually produces the largest grains. In panicle-type cereals (such as oats, rice, millet, and sorghum), flowering begins from the upper part of the panicle; therefore, grains at the top develop better. This should be taken into account in seed production. Spring cereals (wheat, barley, oats, rye, maize, sorghum, rice, and millet) are sown in spring and reach maturity in the summer or autumn of the same year. After harvesting sorghum, new tillers (secondary shoots) may grow, allowing for two or sometimes three harvests per year. However, when sorghum is harvested too early or when soil moisture is insufficient, its stems and leaves tend to accumulate hydrocyanic acid. Feeding livestock with such fresh green fodder can cause poisoning. Therefore, early-harvested sorghum should be slightly wilted or dried before feeding to animals. If sorghum is cultivated specifically for green fodder, it should be fertilized with 60–90 kg of nitrogen per hectare and irrigated after cutting. This accelerates regrowth and ensures higher productivity.



Conclusion. Sorghum grain is used for producing alcohol and starch. The stems of sweet varieties yield syrup (molasses), while broom-type varieties are used for making household brooms and various brushes. The stalks of sweet sorghum contain 10–12% cane sugar and 1.2–2.0% glucose, and the extracted syrup is widely utilized in the canning industry. Sorghum also holds great agro-technical importance, as it is tolerant to drought and soil salinity. It can be cultivated as a secondary crop and, being a row-crop plant, can be effectively included in crop rotations. White sorghum is one of the most important cereal crops used for food, feed, and industrial purposes. Under the conditions of Uzbekistan, it is especially valuable as a drought- and salt-tolerant crop. In saline soil regions such as the Republic of Karakalpakstan, Khorezm, Bukhara, Navoi, Syrdarya, and Jizzakh provinces, white sorghum produces higher yields than maize and barley. Historically, sorghum grain was one of the main food crops for the peoples of Central Asia, including Uzbekistan, up to the Second World War and the 1950s. The grain is used to prepare the traditional dish *go'ja*. For livestock, sorghum grain is a valuable feed component and serves as an important raw material for the production of compound feed, starch, and alcohol. In Africa, India, and East Asia, white sorghum still remains a major food crop today.

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