

## BIOLOGY AND CROP MANAGEMENT PRACTICES FOR SORGHUM

<sup>1</sup>J.B.Khudaykulov, <sup>2</sup>B.M.Kholmurzaev, <sup>3</sup>Z.Sh.Hamdami

<sup>1</sup>Professor, Tashkent state agrarian university

<sup>2</sup>PhD on Agricultural sciences, Tashkent state agrarian university

<sup>3</sup>Master's student, Tashkent state agrarian university

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**Abstract.** Relationship to environmental factors, relationship with mineral nutrition, soil and salinization, crop management practices for sorghum were described in this thesis

**Keywords:** sorghum, biology, seed, growth, environmental factors, nutrition, soil, crop rotation, fertilizers, sowing, cultivation, harvesting.

### Biology. Relationship to environmental factors

**Heat requirements.** Sorghum comes from areas with a hot climate and therefore has increased requirements for heat. Sorghum seeds germinate actively at a temperature of 15°C in the soil. When sowing sorghum at 10 - 12°C, the "sowing - seedlings" period lasts more than 2 weeks. The minimum germination of sorghum seeds is 8 - 10°, but the emergence of a sprout to the surface occurs in the field at 18°C. Plants are particularly sensitive to cold in the flowering phase, when even at below zero 1°C the plants die, the seedlings die at below zero 2°C – below zero 3°C°. With a short-term exposure to below zero temperature (-3°) on ripening seeds, their germination decreases by 7 - 8%.



The heat regime after emergence of shoots determines the growth rate and the onset of the development phase, as well as the duration of the entire vegetation period. Requirements for heat vary depending on the phase of development, variety and growing conditions. The optimum temperature for the growth and development of sorghum plants is 27 - 30°.

Sorghum is a more thermophilic crop in comparison with corn, however, in the period from germination to tillering, until a powerful root system has been created, high temperatures act on it depressingly. In the phase of the beginning of heading out, sorghum plants tolerate temperatures of 40 - 45° well. When the temperature is increased to 50°, the browning and dying of the tissues is observed by 30%, and at 55 - 60° – by 90%.

According to Tajik scientists, productive photosynthesis in corn plants ceases at 36°, and in sorghum this process also occurs at 44°.

**Moisture requirements.** Sorghum is one of the plants that can tolerate strong soil and air droughts. High drought tolerance is associated not only with the power of the root system, but also depends on the characteristics of the stomatal apparatus. It has been experimentally established that the work of the sorghum stomata is restored along with the turgor of the leaves even after a two-week drought (in the corn, the stomatal apparatus is damaged after a seven-day drought). The presence of dense epidermis and wax on the stems and leaves reduces the evaporation of moisture from the surface of plants. Sorghum plants suspend their growth during prolonged drought and continue it while improving the water regime. In dry time, sorghum leaves usually coagulate into a tube, which contributes to the economical consumption of moisture in the process of transpiration and its productive use during a long drought. Sorghum forms more dry matter per unit of water consumed compared to other cereals. This is also due to the peculiarities of photosynthesis of a merchanTable plant passing through  $C_4$  – the path with the formation of four carbon products of photosynthesis (malate, aspartate) from carbon dioxide and water, unlike other less drought-tolerant crops that produce photosynthesis along the  $C_3$  – path with the formation of three carbon compounds (phosphoglyceric acid).

The sorghum consumes water during the day (according to the experiments of G.Shchekun, 37) to 95% of the total daily use. After the plant has completed the formation of the above-ground part and the stage of heading begins, the water consumption during the day decreases, and at night it increases somewhat due to the opening of the flowers, which consumes a large amount of moisture.

The intensity of transpiration increases micronutrients containing zinc, boron, cobalt, molybdenum, regulating the stomatal function and affecting the overall metabolism.

Despite the high drought resistance, sorghum plants are very responsive to the improvement of the water regime, which is very important for the irrigated lands of Uzbekistan. With sufficient moisture, sorghum grows 5 times faster than with a moisture deficit, at which it can stop its growth.

Thus, sorghum crop is able to withstand soil and air drought and economically consume moisture during its shortage, but on the other hand, it responds well to irrigation, which allows it to be widely and effectively used for cultivation on rainfed and irrigated lands.

#### **Relationship with mineral nutrition, soil and salinization**

Sorghum crop is not demanding on soils and grows on all types of soils of the Republic of Uzbekistan. The crop is responsive to the application of mineral fertilizers. Nitrogen fertilizers have the greatest effect, especially in combination with vegetative irrigation. Phosphorus increases sorghum yield slightly. The greatest accumulation of the aerial mass and roots occurs with the joint introduction of phosphorus and nitrogen. In the experiments of D. Edenbaev, carried out on a programmed harvest of Uzbek 18 silage sorghum variety under irrigated conditions in Karakalpakstan, the best result was 1138.2 kg of biomass and 307.9 quintal of dry matter from 1 hectare, when 330 kg of nitrogen and 185 kg of  $P_2O_5$  were applied per hectare.

Sorghum tolerates a high concentration of soil solution and is the most valuable insurance forage and grain crops in conditions of salinity and lack of water availability.

Sorghum can be cultivated for green fodder on soils, where the salt concentration is 0.6-0.8%, and when grown for grain – 0.6%. Usually, adult plants tolerate salinization better than seedlings.

**Varieties.** Daulet, Karabash, Uzbekiston Pakanasi, Tashkentskoe Belozernoye, Uzbekiston-5, Uzbek - 18, Ns Jin.

### **Crop Management Practices for Sorghum**

**Crop rotation.** Sorghum can be sown after any crop. But mostly sown after cereals, legumes, potatoes, root crops, and cotton. It can be sown again after winter crops.

**Fertilizers.** In the cultivation of sorghum, organic and mineral fertilizers are used. In the autumn, 15 to 20 tons of rotted manure are plowed up. Mineral fertilizers are applied in 120-150 kg of nitrogen, 100-120 kg of phosphorus and 50-60 kg of potassium. Part of phosphate fertilizers (50-60 kg) is applied in the fall under plowing. The rest of the phosphate fertilizers and other fertilizers are applied during the sowing and growing season. During the growing season, sorghum feeds twice. The first top dressing is carried out after mass shoots before tillering, with 60 - 70 kg of nitrogen, 30 - 40 kg of phosphorus and 20 - 30 kg of potassium being introduced. The second feeding is carried out in the formation of 8 - 10 pieces of leaves. With this feeding 60 - 70 kg of nitrogen, 30 - 40 kg of phosphorus and 20 - 30 kg of potassium are also introduced. The rate of fertilizers and their ratio depend on the cultivation of sorghum. If sorghum is cultivated to produce grain, the rate of phosphorus increases, and nitrogen decreases.

**Soil preparation.** After emergence, sorghum grows slowly. Therefore, sorghum should be sown on clean fields. In the autumn, the soil is tilled 27-30 cm depth of 27-30 cm with a plough. On meadow soils, the depth of plowing depends on the occurrence of groundwater. On saline soils, the leaching should be done, then plowed. Early spring spears are harrowed to preserve moisture in the soil. Before sowing, arable land is cultivated 1-2 times to a depth of 10 - 12 cm and then harrowed. As a result, the soil surface will be in a loose state, and the weeds will be destroyed. Before sowing, milling is carried out.



**Sowing.** Seed panicles keep in a ventilated area. 7-10 days before sowing, panicles are threshed, cleaned and sorted by size. Before sowing on warm air, they warm up. As a result, the seeds actively germinate, which ultimately increases the yield. On experiments of the plant growing department of Tashkent State Agrarian University, 778 quintal per hectare of biomass was obtained by heating of sorghum seeds in the sun, 698 quintal per hectare obtained without heating.

According to GOST, seed purity should be 90 - 95%, germination – not less than 80 - 85%. Sorghum seeds are etched before sowing. Seeds are sown when the soil is heated to 13-15°. In the southern regions of Uzbekistan, sorghum is sown (Surkhandaria, Kashkadarya) in late March – early April, and In Karakalpakstan and Khorezm – at the beginning of May. Sorghum is sown in the central regions of the Republic in the second decade of April. But sugar and broom varieties of sorghum can be sown somewhat earlier. They have filmy seeds, and less problems in germination and protection of seedlings.

Sorghum is sown with a row spacing of 60, 70, 90 cm. Tall and late-maturing varieties must have a density of 60 - 80 thousand plants when grown for grain. Low stem and early ripe varieties have a greater density. The distance between the plants in a row can be 15-20 cm, but one or two plants in the nest. The density of standing depends on soil fertility. On fertile soils, the density of standing is higher.

For the grain seed, rate is 8 - 12 kg / ha. Depending on the density of the soil, the depth of sowing on light soils is 4-5 cm, on heavy soils 3-4 cm. The depth of sowing depends on the soil moisture. With earlier sowing with sufficient moisture, the depth of sowing is 3–4 cm, with late terms of sowing and lower soil moisture, the depth of sowing is 5–6 cm.

**Crop cultivation.** Crop cultivation includes the fight against the crust, processing between the rows, thinning, fertilizing and watering. Before and after germination, the skin is crusted, weeds are harrowed or a rotary hoe is used.

The shoots of sorghum the first 30 - 35 days grow very slowly and the aisles are clogged with weeds. Therefore, after the emergence of mass shoots in a short period of weed, weed management is carried out.

During the growing season, 2-3 cultivations are carried out. The first cultivation is carried out at the formation of 4-5 leaves on a plant, then thinning is carried out (in modern technologies they try not to thin out). After 10–15 days after the first cultivation, the second cultivation is carried out, and after another 10–15 days, the third cultivation is made. Prior to the first watering, the sorghum aisle is processed to a depth of 5–6 cm. For subsequent treatments, the extreme legs of the cultivators are processed to a depth of 6–8 cm, the middle legs are processed to 10–12 cm. They leave 10 cm of protection zone. Row spacings are cultivated with cultivators KPH - 4,2, NKU - 4,6, KPK - 4, and KPH - 2,8A. Inter-row cultivations are carried out together with fertilizers installation on the cultivator for fertilizer. Weeds are managed by herbicides 2,4D.

Late-maturing sorghum varieties are watered 5-6 times during the growing season. The first watering is carried out in 25-30 days after emergence of shoots. Subsequent watering is carried out every 17 - 20 days. With intensive growth and the emergence of panicles, sorghum is demanding of water. Sorghum is often watered during these phases. Early and medium maturity varieties are watered 3-4 times during the growing season. Before the emergence of panicles, the rate of irrigation is 600–800 m<sup>3</sup>, in subsequent irrigations, 800 - 1000 m<sup>3</sup> / ha each.



**Harvesting.** When cultivated for grain, sorghum is harvested when fully matured. Low-growing varieties are harvested with the help of a device for grain combines; for tall varieties, only panicles are cut by combines. They are dried and threshed on combines or conventional threshers. After threshing, the grain is dried and stored at 12–14% moisture in bags or in bulk with a layer of 1.5 m is stored in warehouses. Seed panicles do not thresh.

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