

**ECOBIOLOGICAL PROPERTIES OF SUNFLOWER (*HELIANTHUS ANNUUS* L.):  
GROWTH DYNAMICS, ENVIRONMENTAL INTERACTIONS, AND  
AGRICULTURAL SIGNIFICANCE**

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Sunflower (*Helianthus annuus* L.) is an annual plant belonging to the Asteraceae family and is one of the primary oilseed crops. Its origin is North America. The wild sunflower was brought to Europe by the Spanish in 1510. Initially, it was cultivated as an ornamental plant. The plant has a well-developed taproot, an erect and rough stem that branches at the upper part and can reach up to 4 meters in height. The leaves are simple, large, alternately arranged, and covered with coarse hairs. The inflorescence is a capitulum (head) with a diameter of 35–40 cm. The central flowers of the head are tubular and bisexual, while the peripheral flowers are reddish-yellow and ligulate. Sunflower undergoes cross-pollination. The fruit is an achene, four-sided, and varies in colour from white to grey and black.

Sunflower seeds are classified into three groups based on their size, oil content, and kernel yield:

- Oilseed Sunflower: Small seeds, with 1000 seeds weighing 35–80 g, containing 53–63% oil.
- Confectionery Sunflower: Large seeds, with 1000 seeds weighing 100–170 g, containing 20–35% oil. The stalks can also be used for silage.
- Intermediate Sunflower: Seeds with average characteristics between the oilseed and confectionery types.

Sunflower seeds germinate in 10–15 days at a temperature of 4–6°C. The seedlings can withstand short-term frosts at -6°C. Sunflower is a thermophilic, light-demanding, short-day, drought-tolerant, and moisture-loving plant. It does not develop well in shaded areas. The growth period lasts 80–140 days.

Regarding nutrient requirements, for the production of 1 ton of seeds and stalk biomass, the following amounts are needed:

- Nitrogen: 50–60 kg
- Phosphorus: 20–25 kg
- Potassium: 120–160 kg

Sunflower is mainly cultivated for edible oil production. Silage can be obtained from silage varieties, and meal is produced from the residues. The cake left after oil extraction serves as a high-quality feed for livestock [1].

Water is distributed in the furrows, taking into account weather conditions. After 26–28 days during the tillering period, a star-shaped shape appears at the growth point of the plant. The

appearance of a star-shaped shape at the growth point is explained by the appearance of a flower cluster, that is, a basket. During this period, a second cultivation is carried out at a depth of 10-12 cm. and at the same time, the remaining 40 per cent of the nitrogen fertilizer rate is applied. During the second feeding period, it is advisable to irrigate at the rate of 650-700 cubic meters per hectare of land.

In mid-ripening sunflower varieties, the period of basket formation occurs 30-40 days after germination, and the flowering process occurs after 55-60 days. These are considered delicate periods of the plant, during which it is highly sensitive to nutrients and moisture. That is, 45 per cent of the total moisture absorbed during the growth period is required. Taking this into account, irrigation is required at a rate of 750-800 m<sup>3</sup> per hectare, once during the flowering period, and once after flowering until ripening. In addition, it is of great importance for the sunflower kernels to be saturated and the oil content in the seed to be high, and for the pollination and fertilization processes to occur normally during the flowering period. As experiments have shown, if the seed is planted earlier than the specified dates, as mentioned above, the plants will have different heights due to the fact that the shoots do not germinate at the same time. At the same time, fungal diseases appear due to high humidity and low temperatures. If planted later than the specified time, the flowering period of the plant will coincide with the very hot days of the month of Cancer [2].

The most favourable temperature for the normal course of the photosynthetic process in sunflower crops is 25-26 degrees. Daily temperatures above 30 degrees negatively affect the viability of the pollinator. In addition, sunflowers are pollinated and fertilized by 95% of bees, and 5% by harmful insects and butterflies. The flowering process (pollination and fertilization) of mid-season sunflower varieties takes 11-12 days. Placing one bee hive per hectare with the beginning of the flowering period of sunflowers tomorrow will increase productivity by 12-14%. If the area where sunflowers are grown is too large, the existing bees may not be able to pollinate them. Bee hives placed in the field should be no closer than 150 meters from each other. Placing bee hives opposite each other at the beginning and end of the rows gives good results. After 30-35 days from the flowering period, the seeds begin to ripen physiologically, and after 35-40 days, the back of the basket turns yellow, and after 8-10 days, the sunflower is fully ripe. Harvesting is allowed when the moisture content of the seeds is 10-12% [3].

Seed selection and preparation for planting. It is recommended to purchase sunflower seeds from the originator organizations based on documents confirming the seed quality. Seeds of local Alaton and Samarkand white sunflowers are selected in the sunflower field during the ripening period based on the size of the seed baskets, the uniformity of seeds in the seed basket, the absence of diseases and other signs. The seed baskets of this sunflower are dried in a dry and cool place. The dried seeds are removed from the seed baskets and cleaned of plant debris and empty seeds.

Preparing the land for planting. Land preparation for planting begins with clearing the remains of previous crops. Along with organic fertilizers (cattle, sheep and chicken manure), 70% of the annual norm of phosphorus and potassium fertilizers is applied, and the soil is loosened to a depth of 25–30 cm. In the spring, when the soil is levelled, it is levelled. Additional agrotechnical measures are carried out depending on the condition of the soil. After levelling and creating soft soil, furrows 70 cm wide are made.

Sowing time. In the southern regions of our republic, it is recommended to sow the main crop in the first and second of March, and in the central regions - in the third decade of March - the first decade of April. In the summer, sowing by June 15 in the southern regions and by June 5-10 in the central regions gives good results.

Planting rate and scheme. Depending on the size of the seeds, it is recommended to plant 6-9 kg per 10 hectares, in a seedling thickness of 70x30 cm. Sunflower is sown in early spring when the soil temperature reaches 8–12°C and as a follow-up crop after winter wheat and barley. The land is levelled before sowing. Before ploughing, manure (20 t/ha), nitrogen, phosphorus and potassium fertilizers are applied. For sowing, seeds of localized varieties are sown in wide rows and dotted lines to a depth of 5–8 cm. In irrigated areas, the seedling density should be 60 thousand seedlings/ha (5–8 kg of seeds are used for pistachios per 1 ha of area, and 35–40 kg for silage) [4].

Sunflower seeds are treated against pests and diseases before sowing. Planters used for corn are used for sowing. Rows are cultivated 2–3 times during the growing season. The maturity of sunflowers can be determined by the yellow-brown colour of the basket. The crop is harvested with a special device in grain combines.

For good growth and development of sunflowers, it is very important to loosen the rows between crops, carry out timely weeding (when the 3rd-4th leaflets are formed), and remove weeds.

Although sunflower is a drought-tolerant plant, it is recommended to water two to three times in addition to seed water to produce a high yield. Sunflowers are better pollinated if bee hives are placed in the field during the flowering period. They require a lot of water during the flowering period. The irrigation rate is 600–800 m<sup>3</sup>/ha. Sunflowers grow best in soils rich in organic matter. The remaining 30 per cent of the phosphorus fertilizer is applied before planting. The first feeding in sunflower fields is given after the seedlings have fully emerged at the rate of 30 kg of pure nitrogen per 10 ha, and the second feeding is given at the rate of 50 kg at the beginning of the flowering period.

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