INTERNATIONAL JOURNAL OF
INTEGRATIVE AND
MODERN MEDICINE

Effect of soil water deficiency on photosynthetic net productivity of sunflower (helianthus annuus l.) Varieties

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Abstract: The article presents data obtained on the basis of field experiments on determining the net photosynthesis productivity of sunflower varieties, which determine their productivity under different moisture conditions. When comparing varieties, the highest photosynthesis productivity was recorded in Diyor and Dilbar varieties under limited moisture conditions, and the lowest in Navruz and Sur varieties.

Keywords: sunflower, varieties, water exchange, optimal moisture, limited moisture, net photosynthesis productivity.

Introduction

In recent years, the shortage of water resources has become one of the main problems in sunflower cultivation worldwide. In arid and semi-arid regions, water availability has become the primary limiting factor in meeting the population's demand for food. Therefore, it is necessary to continue research and create new sunflower varieties using physiological and biochemical studies [1].

In recent years, great attention has been paid to using sunflower plants to address the problem of oil shortage. Today, ensuring global food security is one of the most pressing priorities. For this reason, it is important to study foreign sunflower collection samples, determine their physiological and biochemical characteristics, examine the interrelation of morpho-economic traits, create high-yielding, stress-tolerant promising varieties, and carry out extensive research on cultivating sunflower under various soil and climatic conditions. Testing sunflower varieties in different ecological regions and identifying their adaptation mechanisms are among the essential tasks.

The cultivated type of sunflower is divided into oilseed and ornamental subspecies. Varieties belonging to H. annuus are classified into three subspecies based on seed size, oil content, and kernel ratio.

- Confectionary sunflower—the stem is thick, the plant height reaches up to 4 m, leaves and heads are large, with a diameter of up to 45 cm. Seeds are long (11–23 mm) and wide (7.5–12 mm). The kernel occupies half of the seed, and 1000 seeds weigh 100–170 g.
- Oilseed sunflower—the plant height is 1.5–2.5 m, branches frequently, heads are numerous with a diameter of 14–20 cm. Seed length is 7–13 mm, width 4–7 mm. The kernel completely fills the seed; hull comprises 40–43 %. The weight of 1000 seeds is 35–80 g.
- Intermediate sunflower—occupies a transitional position between the two subspecies, combining certain traits of both [2].

Sunflower is a one-year crop. Its root system is taproot-type, penetrating deeper than 3 meters, making the plant resistant to drought. The stem is upright, woody, covered with fine hairs, and filled with spongy parenchyma, reaching 1–3 m. Varieties cultivated for oil production are non-branching. Branching genotypes with recessive traits are used in heterosis breeding. Leaves are large, petiolate, heart-shaped or oval, 20–40 cm long, with serrated edges and pubescence. A plant typically forms 15–50 leaves, and each leaf requires about 3 days to form. Under optimal conditions, sunflower plants enter the generative phase after producing a genetically determined number of leaves, which must be considered in breeding mid- and early-maturing varieties [3,4].

The assimilating leaf surface area has great importance for plant growth, development, and yield formation. Along with other factors, water regime significantly affects leaf area formation. Approximately 95% of plant dry matter consists of organic compounds produced through photosynthesis. Most of these organic substances are used for the formation of reproductive organs. Thus, yield directly depends on net photosynthetic productivity, leaf area, assimilation period duration, respiration costs, and external/internal factors [5,6].

Sunflower (H. annuus) is one of the widely distributed crops in the world and is rich in nutritional and biologically active substances. Scientific sources describe its broad applicability in various food industries [7,8].

Research Object and Methods

The study utilized sunflower varieties Dilbar, Alomat, Sur, Diyor, Vniimk-888, Jahongir, and Navro‘z. Field experiments were conducted under optimal and limited soil moisture conditions. Net photosynthetic productivity was determined during the budding, flowering, and ripening phases using A. Nichiporovich’s method [9].

Results and Discussion

Net photosynthetic productivity of sunflower varieties varied significantly depending on soil moisture levels and growth phases. All varieties showed higher photosynthetic productivity at 70% soil moisture, indicating active photosynthesis under optimal conditions. At 50% moisture, productivity decreased due to reduced water supply.

During the budding phase, photosynthesis occurred at a moderate level. In the flowering phase, the highest values were recorded, as plants undergo maximum growth and metabolic activity during this period. In the ripening phase, net photosynthetic productivity slightly decreased due to energy expenditure on seed formation.

For example, in the Diyor variety under 70% moisture, net photosynthetic productivity was 6.21 $g/m^2/day$ during budding, 7.43 during flowering, and 7.31 during ripening. Under 50% moisture, these values decreased to 5.32, 7.03, and 6.85 $g/m^2/day$. The Dilbar variety also showed high stability under moderate moisture conditions.

The Alomat variety demonstrated 5.82, 6.97, and 5.68 $g/m^2/day$ under 70% moisture and slightly lower values under 50% moisture. The Vniimk-888 and Jahongir varieties showed noticeable reductions under moisture stress, while the Navro‘zand So‘r varieties exhibited higher sensitivity to drought.

Across growth phases, the flowering stage was the most active for photosynthesis, with values ranging from 6.5 to 7.4 $g/m^2/day$ under 70% moisture. Budding values ranged from 4.7 to 6.2 $g/m^2/day$, and ripening values from 5.2 to 7.3 $g/m^2/day$. The increase in productivity under adequate moisture is associated with full functioning of leaf cells, higher chlorophyll content, and efficient gas exchange.

On average, 70% moisture levels increased net photosynthetic productivity by 0.8–1.2 $g/m^2/day$ compared to 50% moisture, confirming the essential role of water in photosynthesis.

Among the studied varieties, Diyor and Dilbar exhibited the highest productivity under optimal moisture (7.36–7.43 $g/m^2/day$ during flowering). The lowest productivity was observed in Navro‘z and So‘r, indicating their sensitivity to moisture deficit. Alomat and Vniimk-888 showed moderate stability.

Conclusion

Overall, soil moisture had a strong influence on the net photosynthetic productivity of sunflower varieties. Optimal moisture (70%) ensured the highest productivity, while water deficit significantly reduced photosynthesis. The flowering phase was the most active stage for photosynthesis, budding was moderate, and ripening showed a slight decline. Ensuring adequate moisture especially during the flowering phase is a critical factor in increasing sunflower yield.

REFERENCES.

1. Rahimova Gulnoza Yomgirovna. (2025). ECOBIOLOGICAL PROPERTIES OF SUNFLOWER (HELIANTHUS ANNUUS L.): GROWTH DYNAMICS, ENVIRONMENTAL INTERACTIONS, AND AGRICULTURAL SIGNIFICANCE. Innovate Conferences, 27-30.
2. Yomgirovna, R. G. (2024). Role of Medicinal Plants in Nature and Human Life. EUROPEAN JOURNAL OF MODERN MEDICINE AND PRACTICE, 4(5), 140-143. 8. Yomģirovna, R. G. (2023).
3. CHIGITDA SODIR BO 'LADIGAN FIZIOLOGIK VA BIOKIMYOVIY JARAYONLAR. JOURNAL OF HEALTHCARE AND LIFE-SCIENCE RESEARCH, 3(4), 273-277. 9.
4. Yomģirovna, R. G. (2024). NOAN'ANAVIY AGRORUDALARNI QISHLOQ XO'JALIGIDA FOYDALANISHNING ILMIY ASOSLARI. TA'LIM VA RIVOJLANISH TAHLILI ONLAYN ILMIY JURNALI, 4(3), 240-244.
5. Yomg'irovna, R. G. (2024). QISHLOQ XO 'JALIGI MAHSULOTLARINING ERTA PISHISHI VA UNUMDORLIGINI OSHIRISH UCHUN BENTONIT GILLARINI GEOBIOFAOLLASHTIRUVCHILAR SIFATIDA QO 'LLASH. ОБРАЗОВАНИЕ НАУКА И ИННОВАЦИОННЫЕ ИДЕИ В МИРЕ, 39(3), 229-234.
6. Yomg'irovna, R. G. . (2025). KUNGABOQAR O'SIMLIGI.KUNGABOQAR NAVLARI. *TA'LIM VA RIVOJLANISH TAHLILI ONLAYN ILMIY JURNALI*, *5*(3), 128–131.
7. Yomģirovna, R. G. (2024). BENTONITNING QISHLOQ XO 'JALIGIDA QO 'LLASHNING ILMIY ASOSLAR. ОБРАЗОВАНИЕ НАУКА И ИННОВАЦИОННЫЕ ИДЕИ В МИРЕ, 39(3), 219-228.
8. Rahimova, G. (2024). Climate change and coastal erosion: Examining natural processes and human influences. In E3S Web of Conferences (Vol. 587, p. 04006). EDP Sciences.
9. Yomg'irovna, R. G. (2025). Planting Times and Yield Indicators of Various Sunflower Varieties . *International Journal of Biological Engineering and Agriculture* , *4*(4), 42–45.
10. Yomg'irovna, R. G. (2025). Dilbar Sunflower Variety: Agronomic Characteristics, Chemical Composition and Medicinal Importance. International Journal of Pediatrics and Genetics , 3(10), 33–35. Retrieved from.
11. Fatemi A, Moaveni1 P., Daneshian J, Mozafari H, and M. Ghaffari Magnesium Nanoparticles Improve Grain Yield, Oil Percentage, Physiological, and Biochemical Traits of Sunflower (Helianthus annuus L.) under Drought Stress. // J. Agr. Sci. Tech. 2022. Vol. №24(3). P. 665-678.
12. Худайқулов Ж.Б., Атабаева Х.Н. Кунгабоқар етиштириш. // "Агробанк" К92. Тошкент. "Тасвир" 2021. Б. 56 б.
13. Абдукаримов Д.Т. Хусусий селекция. // Дарслик. Тошкент. 2007. 509 б.
14. Борисоник, З.Б. Подсолнечник / З.Б. Борисоник, И.Д. Ткалич, А.И. Науменко и др. – Киев: Урожай, 1985. – 160 с.
15. Кенжаев Ю., Орипов Р. Сидерат экинларнинг ғўза фотосинтез маҳсулдорлигига таъсири // Ўзбекистон Республикаси қишлоқ хўжалигида сув ва ресурс тежовчи агротехнологиялар: Илм. амал. конф. мақл. тўп. – Тошкент, 2008. –Б. 249-250.
16. Гаврилова, В.А. Генетика культурных растений / В.А. Гаврилова, И.Н. Анисимова / Подсолнечник. – СПб., 2003. – 209 с.
17. Shuangshuang Guo, Yan Ge and Kriskamol Na Jom A review of phytochemistry, metabolite changes, and medicinal uses of the common sunfower seed and sprouts (Helianthus annuus L.) // Chemistry Central Journal. 2017. P. 12-29.

18. Посыпанов, Г.С. Растениеводство / Г.С. Посыпанов, В.Е. Долгодворов и др.–М.: Колос, 2006.–612 с.