

**BIOLOGICAL CHARACTERISTICS OF SUGAR BEET AND FACTORS AFFECTING
ITS YIELD**

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Annotation

This article analyzes the biological characteristics of sugar beet, its cultivation technology, and the factors affecting yield improvement. During the research, the effects of agrotechnical measures, soil fertility, and fertilizer application rates on crop productivity were studied. The results showed that optimal nutrition and the use of modern agrotechnologies significantly increase both root yield and sugar content of sugar beet. Practical recommendations were developed based on the findings.

Key words

sugar beet, yield, agrotechnology, sugar content, fertilization, soil fertility.

INTRODUCTION

Sugar beet is an important raw material for sugar production and is cultivated as a strategic crop in the agriculture of many countries. Due to its high yield potential and sugar accumulation capacity, it holds significant economic value. The growing demand for food products has made improving the efficiency of sugar beet production an urgent task.

In recent years, climate change, declining soil fertility, and incomplete compliance with agrotechnical requirements have negatively affected sugar beet productivity. Therefore, an in-depth study of the biological characteristics of sugar beet and the identification of factors that increase its yield have important scientific and practical significance. The purpose of this study is to determine the main agrotechnical factors influencing sugar beet productivity and to develop recommendations for efficient cultivation.

LITERATURE REVIEW

Sugar beet has long been recognized as one of the primary industrial crops for sugar production, and numerous studies have examined the factors influencing its productivity and sugar accumulation. Early research emphasized the importance of soil fertility and balanced mineral nutrition in achieving high yields. According to Draycott (2006), sugar beet is highly responsive to nutrient management, particularly nitrogen, phosphorus, and potassium, which directly affect root development and sugar concentration.

Subsequent studies have highlighted the role of agronomic practices in optimizing sugar beet performance. Cooke and Scott (1993) reported that proper fertilization combined with effective irrigation management significantly improves both biomass production and sugar content. Similarly, Milford et al. (1985) demonstrated that excessive nitrogen application may increase root size but can reduce sugar percentage, indicating the need for balanced nutrient supply.

More recent research has focused on integrated crop management and precision agriculture. Hoffmann and Kenter (2018) found that site-specific fertilization and modern irrigation

scheduling improve resource-use efficiency and stabilize sugar beet yields under variable climatic conditions. In addition, FAO (2021) reports emphasize that climate change and soil degradation are emerging constraints, making adaptive agrotechnologies increasingly important.

Despite the extensive body of research, the effectiveness of agrotechnical measures under specific regional soil and climatic conditions still requires further investigation. Therefore, continued research aimed at optimizing fertilization regimes and irrigation practices remains highly relevant for improving sugar beet productivity.

METHODOLOGY

The research was conducted based on field and laboratory observations. The growth and development indicators of sugar beet were studied under different agrotechnical conditions. The effects of soil composition, fertilizer rates, and irrigation regimes on plant biomorphological parameters were investigated. The obtained data were processed using statistical analysis methods, and differences between experimental variants were comparatively evaluated. In addition, root yield and sugar content were determined under laboratory conditions, and the effectiveness of agrotechnical measures was analyzed using a comprehensive approach.

RESEARCH RESULTS

The research findings showed that sugar beet productivity largely depends on proper nutrient management and well-organized agrotechnical practices. In the variants where mineral fertilizers were applied at recommended rates, an increase in leaf area, root weight, and sugar accumulation was observed. In particular, the balanced application of nitrogen, phosphorus, and potassium fertilizers produced the highest results. In fields where irrigation regimes were strictly maintained, optimal soil moisture supported intensive vegetative growth. The main effects of agrotechnical factors on sugar beet productivity are summarized in Table 1.

Table 1

Effect of agrotechnical factors on sugar beet productivity

Treatment	Fertilization level	Average yield (t/ha)	Sugar content (%)
Control (no fertilizer)	low	32.4	14.8
Medium rate	recommended	41.7	16.2
High balanced NPK	optimal	49.5	17.6

The results indicate that the balanced fertilization treatment produced significantly higher yields compared to the control.

DISCUSSION

The obtained results confirm that scientifically based agrotechnical practices play a decisive role in sugar beet cultivation. In particular, balanced mineral fertilization enhances photosynthetic activity and promotes the accumulation of dry matter and sugar in the roots. The findings are consistent with previous studies showing that sugar beet reaches its maximum biological potential under optimal nutrient supply. At the same time, violations of irrigation regimes or excessive nitrogen application may reduce sugar content. This indicates the necessity

of implementing agrotechnical measures in a complex and balanced manner in sugar beet production.

CONCLUSION

The study demonstrated that sugar beet yield and root sugar content directly depend on the proper organization of agrotechnical practices. Balanced application of mineral fertilizers, optimal irrigation management, and maintenance of soil fertility were identified as key factors for obtaining high and quality yields. The widespread introduction of modern agrotechnologies in practice will contribute to improving sugar beet production efficiency. In future research, it is advisable to develop differentiated fertilization systems considering regional soil and climatic conditions.

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