The Importance of Agrotechnical Measures in the Cultivation of Grape (Vitis vinifera L.)

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Abstract: This article examines the effects of agrotechnical measures—particularly the application of organic and mineral fertilizers—on yield and quality indicators in the cultivation of grape (Vitis vinifera L.) varieties, including application rates, timing, and efficiency. It also provides information on the biological characteristics of grapevines, their root system, propagation methods, classification of grape varieties, and soil management practices in vineyards. The research findings offer practical recommendations for farms, viticulture clusters, and scientific institutions to ensure sustainable, environmentally friendly, and highly profitable grape production.

Keywords: Grape (Vitis vinifera L.), agrotechnical measures, soil cultivation, drip irrigation, fertilization system, organic and mineral fertilizers, pest control, yield, quality indicators, Andijon qora, Qora janjal, Qora kaltak, Sohibi, Pushti toyfi, statistical analysis, comparative methods.

Introduction:

Viticulture in the Republic of Uzbekistan has a long-standing tradition and plays an important role in the country’s economy and food security. Favorable soil and climatic conditions, along with the relatively low incidence of pests and diseases, make it possible to produce high-quality, environmentally friendly grapes and grape products (table grapes, raisins, and juice) at low cost.

As noted by the President of the Republic of Uzbekistan, Sh.M. Mirziyoyev, agriculture is a key sector that feeds the population. Currently, the intensive development of

viticulture, increasing productivity, and strengthening export potential are urgent tasks. In 2025, Uzbekistan produced 1.983 million tons of grapes, which is a 7.6% increase compared to 2024. The Samarkand region is the leading producer with over 696 thousand tons, followed by the Bukhara and Fergana regions.

Relevance and necessity of agrotechnical measures: Globally, vineyard areas cover approximately 7–8 million hectares, with total production approaching 80 million tons. Uzbekistan is among the leading countries in grape production. In recent years, new varieties have been developed, cluster-based production systems have been introduced, and intensive vineyards have been established. However, improving agrotechnical practices—especially fertilization systems based on biological characteristics—can increase yield by 20–40%, reduce water consumption by 30–40%, and improve product quality.

According to the Development Strategy of the Republic of Uzbekistan for 2022–2026, tasks have been set to develop agriculture on a scientific basis and to double the income of farmers and dehkan farms. Therefore, determining optimal rates and timing of modern agrotechnical measures in grape production is of both theoretical and practical importance.

Research Objective:

To scientifically study the effects of agrotechnical practices, particularly the fertilization system, on the yield and quality indicators of grape (Vitis vinifera L.) cultivation, to verify them through experiments, and to develop practical recommendations.

Research Tasks:

1. To analyze the importance of agrotechnical practices and fertilization systems in viticulture;
2. To study the characteristics and properties of different organic and mineral fertilizers;

3. To determine the effects of these practices on yield and quality based on experimental data;
4. To analyze the economic efficiency of the agrotechnical system;
5. To develop practical recommendations based on the obtained results.

Research Object:

Grape varieties such as Andijon Qorasi, Qora Janjal, Qora Kaltak, Sohibi, and Pushti Toyfi, as well as their cultivation agro-technologies.

Research Subject:

The effects of agrotechnical practices and fertilization on the growth, yield, and quality of grapes.

Research Methods:

Observation, comparative analysis, field experiments, statistical and graphical methods, economic calculations, and laboratory analyses.

Practical Significance of the Study:

The results of this study can be applied in farms and agricultural clusters to ensure water- and resource-efficient production, environmentally friendly products, and sustainable high yields. The introduction of intensive agrotechnologies can significantly increase productivity and strengthen export potential.

Main Part and Results:

The history of viticulture in Central Asia spans thousands of years, with grape cultivation in this region dating back to the 4th century BC. Today, the development of viticulture is being driven by cluster systems, family-based farming, and intensive vineyards equipped with drip irrigation.

In the Republic, vineyard areas cover approximately 120,000–124,000 hectares, of which more than 100,000 hectares are fruit-bearing. In 2025, the total grape production amounted to 1,983,039 tons, which is a 7.6% increase compared to 2024. By increasing

average yields by 1.5–2 times, it is possible to fully supply the domestic market and expand exports.

Grape varieties differ in their agro-biological characteristics, such as growth vigor, ripening period, cluster weight, and nutrient requirements. In modern intensive vineyards, a balanced fertilization system significantly improves both yield and product quality.

Main Agrotechnical Measures and Their Effects:

Soil cultivation: Deep autumn plowing (40–60 cm) and spring cultivation improve the root system and increase the absorption of water and nutrients.

Planting schemes and timing: Planting is carried out in early spring (March–April) or in autumn. Intensive planting schemes of 3×2 m or 3×2.5 m facilitate mechanization and increase productivity.

Irrigation regime: Drip irrigation is the most efficient method, saving 30–50% of water. During the growing season, irrigation is applied 5–9 times depending on the variety and climatic conditions.

Plant care: Green operations (tying shoots, thinning, leaf removal) improve sunlight penetration and air circulation, helping to prevent diseases.

Pest and disease control: Integrated methods (biological and chemical) are used. Timely measures are taken against oidium, mildew, and other pests and diseases.

Fertilization System and Its Importance:

Grapevines are highly demanding in terms of nutrients. Proper fertilization can increase yield by 25–40%, while also improving sugar content, color, and storage life of grapes. Organic fertilizers (manure, compost) improve soil fertility, whereas mineral fertilizers provide rapid nutrient availability. Fertigation (application of liquid fertilizers through drip irrigation systems) reduces nutrient losses.

The table below presents the main agro-biological characteristics of selected grape varieties and recommended agrotechnical elements (planting scheme, fertilization norms).

Fertilization rates are generalized average values for grey and light grey soils

Table 1

№	Variety	Planting scheme (m)	Fertilization norms (N:P:K kg/ha + organic)	Irrigation (times/season)	Ripening period	Cluster weight (g)	Yield (c/ha)
1	Andijon Qorasi	3×2.5	N-120 : P-90 : K-60 + 20–30 t manure (once every 3 years)	6–8 (drip irrigation)	Aug 5–10	200–250	170–200
2	Qora Janjal	3×2	N-150 : P-100 : K-80 + 25–40 t manure (every 2–3 years)	7–9	Aug 20–25	350–450	220–280
3	Qora Kaltak	3×2	N-130 : P-95 : K-70 + 20–35 t manure	5–7	Sept 20–25	250–350	210–260
4	Sohibi	3×2.5	N-110 : P-85 : K-55 + 15–25 t manure	6–8	Late August	450–500	170–200
5	Pushti Toyfi	3×3	N-140 : P-110 : K-75 + 30–40 t	5–7	Late July – early August	650–750	160–300

			manure (every 2 years)				

The table shows that grape varieties differ significantly in fertilization requirements depending on their growth vigor and yield potential. High-yielding varieties with large clusters (Qora Janjal, Pushti Toyfi) are more demanding in terms of nitrogen, phosphorus, and potassium, and therefore higher fertilizer rates are recommended. For example, the nitrogen rate for Qora Janjal is set at 150 kg/ha, which ensures strong vegetative growth and the formation of large clusters.

The Pushti Toyfi variety requires the highest amount of organic fertilizer (30–40 t/ha every 2 years) due to its high yield potential and large cluster size. In contrast, Andijon Qorasi and Sohibi varieties are less demanding and require lower fertilizer rates.

Organic fertilizer (manure) is essential for all varieties, as it increases soil humus content, enhances microbial activity, and improves the efficiency of mineral fertilizers by 15–25%. The combination of drip irrigation and fertigation ensures direct delivery of nutrients to the root zone, reducing nutrient losses by 20–30%.

Fertilization rates should always be determined based on soil analysis. In grey and light grey soils, phosphorus and potassium deficiencies are common; therefore, basal fertilization (P and K) in spring and split applications of nitrogen during the growing season are considered the most effective method. Proper fertilization not only increases yield but also improves sugar content, color, taste, and storage life of grapes.

Conclusion:

In irrigated vineyards, the integrated application of modern agrotechnical practices—such as deep soil cultivation, optimal planting schemes, balanced fertilization, drip irrigation, and integrated plant protection—ensures high economic and ecological efficiency in grape production. Scientific studies show that when these practices are

properly implemented, it is possible to obtain additional yield, improve water and nutrient use efficiency, and enhance product quality and competitiveness.

It is recommended for farmers and agricultural clusters to determine fertilization rates based on soil analysis, taking into account the soil-climatic conditions of each variety and region, and to widely introduce intensive technologies. As a result, the domestic market will be fully supplied, export volumes will increase, and the income of rural populations will grow steadily.

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