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USING MODERN GEODETIC INSTRUMENTS IN LAND LEVELING WORK

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Annotation. This article discusses how, nowadays, our country is developing, and land development and construction work are advancing more and more each day. These works are built precisely based on geodetic work. To ensure that the work is strong and reliable, the article highlights the importance of using highly accurate calculations and modern geodetic project work, as well as eliminating irregularities that hinder irrigation and agrotechnical measures while leveling the field without disturbing its slope.

Keywords: land fund, land and water resources, irrigation, national report, modern geodetic instruments, ecology, environment, balance.

Annotatsiya. Ushbu maqolada hozirgi kunda Respublikamiz rivojlanib, yer tuzish va qurilish ishlari kundan kunga yuksak darajada rivojlanmoqda. Mazkur ishlar esa aynan geodezik ishlar asosida barpo qilinmoqda. Ishlarni mustaxkam va ishonchli bo‘lishi uchun o‘ta aniq hisob-kitoblar va zamonaviy geodezik loyiha ishlaridan foydalanish va dalani tekislashda maydon nishabligini saqlab qolgan holda sug‘orish va agrotexnik tadbirlariga to‘sqinlik qiladigan notekisliklarni yo‘qotish masalasi yoritib berilgan.

Kalit so‘zlar: yer fondi, yer va suv resurslari, sugorish, milliy hisobot, zamonaviy geodezik asboblar, ekologiya, atrof-muhit, muvozanat.

Аннотация. В данной статье рассматривается современное состояние развития нашей Республики, а также развитие земельных и строительных работ с каждым днем продвигается на высоком уровне. Эти работы строятся на основе геодезических работ. Освещен вопрос использования высокоточных расчетов и современных геодезических проектных работ для обеспечения устойчивости и надежности работ, устранения неровностей, затрудняющих проведение поливных и агротехнических мероприятий при сохранении уклона поля при планировке поля.

Ключевые слова: земельный фонд, земельно-водные ресурсы, орошение, национальный доклад, современные геодезические приборы, экология, окружающая среда, баланс.

Introduction: After gaining independence, Uzbekistan has been carrying out promising reforms in the development of agriculture. Based on the decree of the President of the Republic of Uzbekistan No. PF-5742 dated June 17, 2019, 'On measures to ensure the effective use of land and water resources in agriculture,' scientific topographic and geodetic work is being conducted in managing land cadastre and improving the ameliorative condition of lands, making rational and efficient use of land and water resources, and enhancing the ameliorative state of the lands.

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In today's global economic development conditions, one of the most modern and innovative technological methods to increase the productivity of irrigated lands is popularizing the practice of leveling farmland with laser leveling in agriculture. The flatness of an irrigated field's surface is one of the key factors that ensures efficient use of land, water, fertilizers, and energy resources, higher crop yields, and economic stability. Nowadays, in developed countries, laser-controlled land levelers are used for leveling fields where agricultural production takes place. Leveling fields is one of the main measures aimed at boosting irrigated farming practices and achieving higher and better-quality crop yields. It has been proven worldwide that leveling irrigated lands is one of the most effective reclamation measures, and in leading countries with developed agriculture, a lot of importance is given to land leveling. Leveling irrigated fields is considered an important part of a set of measures to improve the reclamation condition of the land. It allows for more efficient use of irrigation water, fertilizers, and machinery.

The unevenness of irrigation fields causes water wastage during irrigation and leads to a rise in groundwater levels. By leveling the land, it becomes possible to increase the efficiency of water use for crops and use water more wisely. On leveled fields, water spreads evenly, ensuring uniform soil moisture, less water is used for irrigation, irrigation time is reduced, which increases the productivity of workers, and allows for the comprehensive mechanization of farming. When seeds are sown on leveled fields, they are planted at the same depth with good quality; the emerging seedlings absorb water evenly, and the soil is irrigated at the same time. This allows for simultaneous treatment of the spaces between rows, resulting in uniform crop growth and increased yield.

Field studies conducted show that in uneven areas, the irrigation rate exceeds the rate planned in the project. In low-lying areas, not only does water seep into the soil and get wasted, but it also floods the grass roots, creates thick crusts, and disrupts the soil's air and heat balance. If the land isn't leveled, it becomes necessary to increase channels and temporary irrigation networks, the efficiency of irrigation workers drops sharply, irrigation costs go up, and it also hinders the effective implementation of improved irrigation technology.

Research methodology and object: The country's farming is based on irrigation. That's why water, like land, is considered the most essential resource. Most of the agricultural products, such as cotton, rice, tobacco, vegetables, melons, corn, wheat, barley, and fodder, are grown in irrigated areas. About 95 percent of the total agricultural output comes from irrigated lands. Land and water play a very important role in meeting the demand of industry for agricultural raw materials and the population's need for food. The more rationally and efficiently land and water are used, the more products can be produced, which in turn increases the level of demand fulfillment mentioned above. But when using land as the main resource, it is appropriate to take some of its characteristics into account; nowadays, all farms pay special attention to making full and effective use of the lands where crops are being planted.

Leveling land with a laser level refers to a method of leveling a field using special equipment with laser levels so that the difference between the highest and lowest spots on the surface doesn't exceed ±3 cm. This modern technology, applied in the country's agriculture, hasn't become widespread yet. That's why it's important to study the technology in depth, test it, develop it, and apply it more broadly in practice. According to research carried out by scientists in our country, several advantages of laser leveling technologies have been identified, and they are as follows:

- saving 20–25% of irrigation water on average;
- reducing soil salinization;
- decreasing irrigation time, labor, and energy costs;
- uniform emergence of crops;

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- proper soil moisture;
- increasing wheat and cotton yields by 4–7 quintals per hectare;
- getting additional profit from the increased crop yields.

Of course, through such achievements, the reclamation condition of agricultural land improves and productivity rises.

Modern technologies play a special role in engineering-geodetic measurements, designing, and construction works. They start directly before the construction work and are one of the main factors that ensure the reliability and high accuracy of geodetic measurements as well as the quality of the site's slope. It is important that measurement methods and the direct use of tools meet the standards to ensure the reliability and accuracy of site slope measurements.



Figure 1. Leica Nova MS50modern electronic total station



Figure 2. Leica NA720 modern digital level

A modern geodetic instrument for measuring field slopes is a device that combines the latest achievements in electronics, precision mechanics, optics, materials science, and other sciences. In particular, using GRS Glonass (the Earth's satellite navigation system) opens up many possibilities.

Modern digital levels have a body that is resistant to various mechanical shocks and protected from dust and moisture, allowing them to be used in complex field conditions or in high-dust crop fields without worrying about the instruments breaking down. When planning leveling work, the main condition is that the balance of soil cutting and filling volumes for the area to be leveled is calculated in a computer program. Before calculating the soil cutting and filling balance, the average slope values of rows and columns are computed in the computer using the following formula 1.

$$i=\frac{(A_1-A_n)}{L} \qquad (1)$$

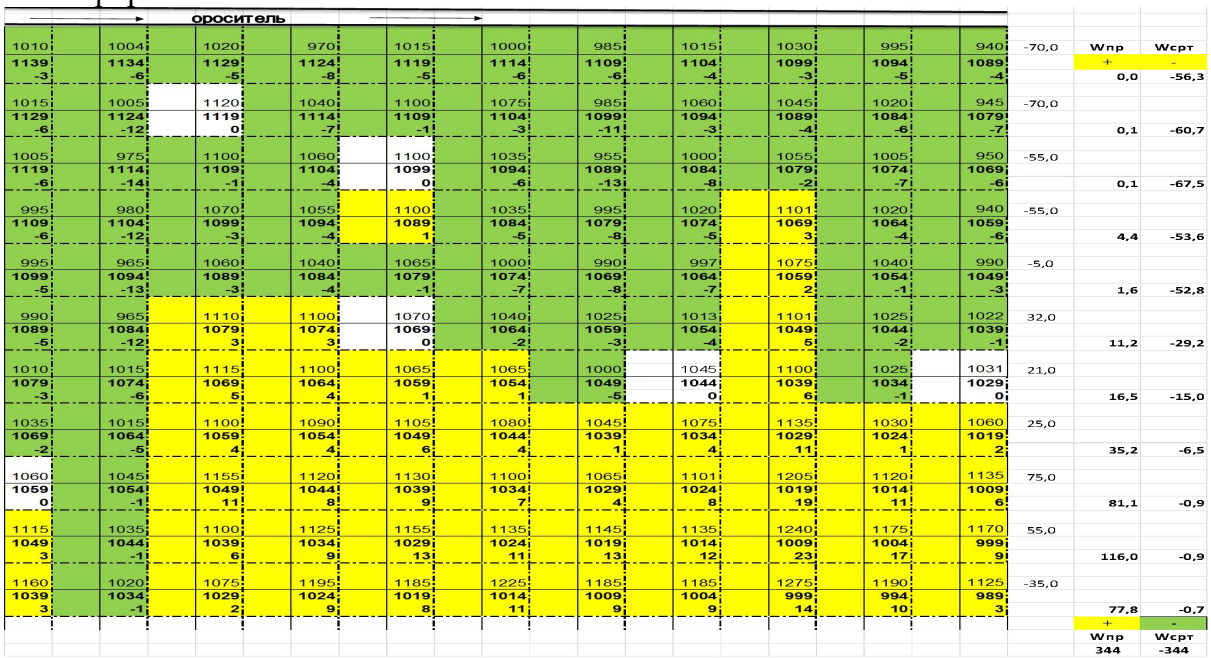
Here: i – the average slope of the first column;
A1 – the natural elevation of the starting point of the first column;
An – the natural elevation of the ending point of the first column;
L – the length of the first column.
The overall average slope of the field across all columns is found using the following formula 2.

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$$i_{\check{y}p} = \frac{i_1 + i_2 + \ldots + i_n}{n} \quad (2)$$

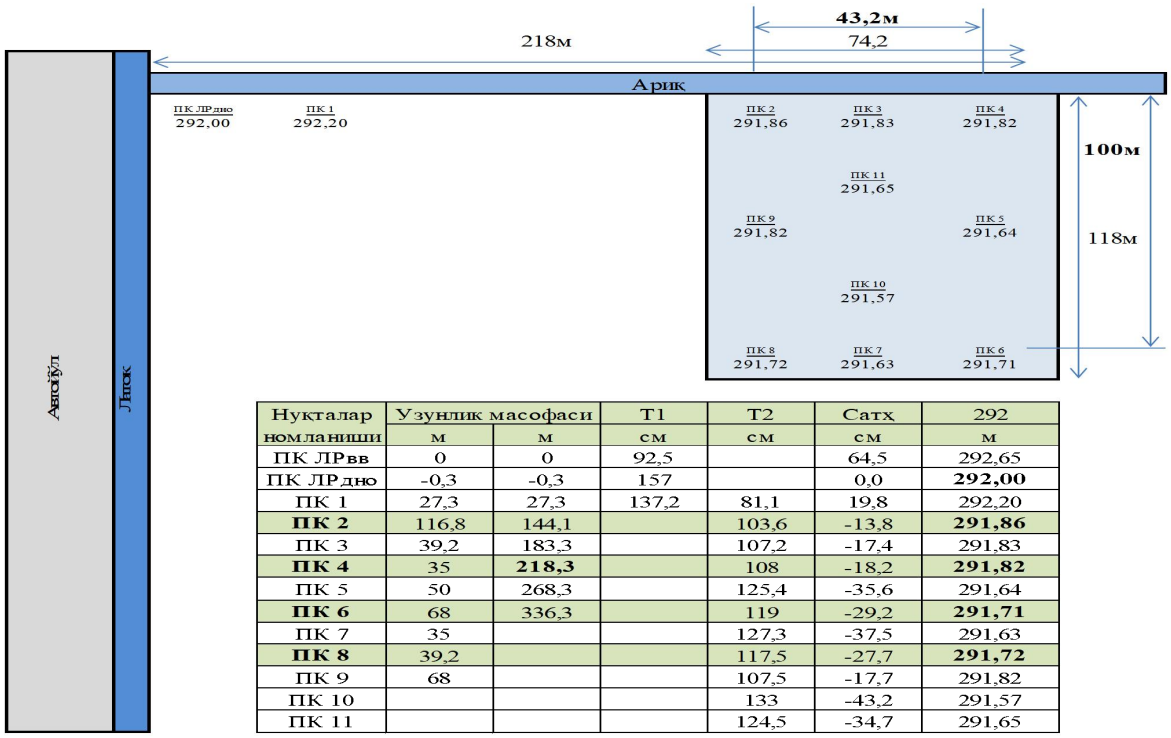
Here: i1 – the average slope of the first column; in – the average slope of all columns; n – the number of columns.

In the same way, the average slope of the rows by area is determined. Figure 3. Land leveling project of 1 hectare of field at the Jizzakh Experimental Station of PSUYEAITI using laser equipment.



In addition, geodetic survey work was carried out on the first test site using laser levels to determine the flatness of the area. The measurement results showed that the average slope of the study area was i-0.0015 (see Figure 4).

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Нукталар номланиши	Узунлик масофаси		T1	T2	Сатх	292
	м	м	см	см	см	м
ПК ЛРвв	0	0	92,5		64,5	292,65
ПК ЛРдно	-0,3	-0,3	157		0,0	**292,00**
ПК 1	27,3	27,3	137,2	81,1	19,8	292,20
ПК 2	116,8	144,1		103,6	-13,8	**291,86**
ПК 3	39,2	183,3		107,2	-17,4	291,83
ПК 4	35	**218,3**		108	-18,2	**291,82**
ПК 5	50	268,3		125,4	-35,6	291,64
ПК 6	68	336,3		119	-29,2	**291,71**
ПК 7	35			127,3	-37,5	291,63
ПК 8	39,2			117,5	-27,7	**291,72**
ПК 9	68			107,5	-17,7	291,82
ПК 10				133	-43,2	291,57
ПК 11				124,5	-34,7	291,65

Figure 4. Results of the geodetic survey of the experimental field.

A digital level adapted for setting benchmarks is a digital surveying tool that greatly improves the quality and reliability of measurements in the field. The main advantage of a digital level is that it allows automatic measurements along a special leveling staff marked with barcodes. The barcode, without repeating anywhere along the length of the staff, makes it possible to accurately determine the height in the field from the lower part of the level to where the horizontal tube is set. Unlike an optical level, the accuracy of measurements doesn't depend on the operator's eyesight or environmental conditions; instead, you just need to align it with the staff and press the start measurement button.

A digital level used in leveling can be applied even when visibility is insufficient—such as in the evening, in fog, in poorly lit areas, and even in conditions where terrain or natural obstacles make it impossible to fully observe the staff. The digital level has a processor with memory, allowing it to calculate readings and differences, as well as record measurements. Since all measurements are recorded digitally, the chance of observer error is zero, which in turn increases work efficiency and reliability. The digital level also allows field measurements and calculation data to be saved as files, which makes it possible to view them on the screen at any time or transfer them to a computer for further processing.

In conclusion, the main goal of leveling fields in agriculture is to eliminate unevenness that hinders irrigation and mechanized agricultural practices while maintaining the slope of the land. This is because a level field helps make efficient use of irrigation water and ensures uniform moisture across the field. Since the seeds are planted at the same depth, the crops grow evenly and yield higher.

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