Efficiency of land preparation methods for planting

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Abstract. The work discusses the components of the aggregate intended for the current leveling of crop fields, basic leveling scoop and front disc softener working bodies were used. In order to form a plane, this is required when leveling the fields of the crop with such working bodies, the leveler aggregate is formed in the transition from one to two. This will prevent further condensation of the soil, resulting in providing the plain with the required level of agrotechnics of the crop areas. This requires additional softening of the crop areas before planting after such leveling. These experiments were carried out on average, sandy areas of the Bukhara region's irrigated mechanical composition. Conducting experiments deals with the issues such as the technological process of working with a drive mounted on a ground leveler, the structure of the soil pile before the junction, the bulk weight of the field drive layer, the hardness, the aggregate composition of the soil, the plane of the field surface and the measurement of the resistance of the aggregate to gravity. The soil pile cross-profile has been found to vary at different speeds of the leveling aggregate, decreasing high speeds of the cross-sectional profile, owing to which the soil pile cross-sectional surface changes, substantiating the fact that high speeds of the aggregate intensive loading place the soil in front of the junction. At small speeds, the above process occurs relatively slowly, and there is no blockage of the incisions to the disc softeners.

1 Introduction

Irrigated fertile lands amount to more than 3.8 million hectares in the republic yielding 98% of agricultural products in the country, whereas irrigated cotton and grain-growing areas are divided into three zones by their characteristics, natural and soil-climatic conditions, mechanical soil composition, cultivation technology, equipment and agro-technical requirements. The Bukhara region is in the third climatic zone, including difficult-to-cultivate and variously saline lands, making up a large part of the total cotton area, where autumn saline washing occurs for the seeds to germinate normally in natural humidity, whose soil composition has gray soil, mineral saline meadow, meadow-swamp soils at an unstable depth of mineral groundwater whose salinity and depth vary. Besides the Bukhara region, there are Central Fergana lands below the second zone, arable lands in Tashkent, Jizzakh, Samarkand, Syrdarya, Khorezm, Kashkadarya, and Surkhandarya regions [4–7].

Quality leveling of irrigated lands in all the agricultural product-growing districts of the Republic is of primary and urgent importance. As a result of the improvement in the working conditions of irrigation workers and skinners, labor productivity has increased; all this provides the high agricultural yield of the leveled land harvested by agricultural machines, efficient use, improved quality of agricultural work, and the evenly moistened soil during irrigation. As a result of the improvement in the working conditions of irrigation workers and skinners, labor productivity has increased. Quality leveling of irrigated lands in all the agricultural product-growing districts of the Republic is of primary and urgent importance. As a result of the improvement in the working conditions of irrigation workers and skinners, labor productivity has increased; all this contributes to the increase in the efficiency of agricultural production and the high yield. When using the existing planners R-2.8A, R-4, PA-3, PPA-3.1, the field level that meets the established requirements is ensured by the fact that the unit moves 3-4 times or more in a row [3]. This leads to the destruction of the sowing background and reduces the quality of subsequent mechanization.

Analysis of the literature and studies have shown that Akhmedzhanov M.A., Samsonova N.P., Bratyshev I.P., Kuzina E.N., Babadzhanov I.A. enough research has been done to improve the efficiency of long-wheelbase straighteners. Therefore, in this study, it is proposed to justify the speed and coverage of basic planners and install a spherical disk device for softening the soil on the front side of the planner bucket while improving the working bodies of the planner and the technological process of its operation. The device consists of a longitudinal beam and spherical disks located along the right and left axes, and the disks are placed along the right and left axes so that the shell on the opposite side is outside. The disc device installed on the base leveller reduces the overall resistance of the machine due to

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loosening the soil, and the operation of the bucket on loosened soil improves the smoothness of the leveller and the quality of the levelling. The novelty of this technical solution is protected by the patent of the Agency for Intellectual Property of the Republic of Uzbekistan for the utility model FAR 01235. This work is aimed at justifying the dimensions of this device, which ensures high-quality levelling of sown areas [2].

2 Materials and methods

This is because most of the irrigated land is small land with a length of 100–150 meters, which is 20–25% of the total area. In such small areas, the productivity of all agricultural machinery will decrease and the quality of work performed in the field will decrease. As a result of repeated turning of the aggregates, the impact of tractor wheels on the soil changes negatively, leading to excessive compaction of agrotechnical norms and reduced plant growth and development.

Irrigated crop fields are mainly three of the following unevenness. We can say that the low-elevations formed from the soil Chuck, the washing of the Earth's Shure, the ungulates formed as a result of irrigation during the period of growth of plants, the hares and lowlands arising from the overthrowing of the earth, as well as the low-elevations, dongles formed during the plowing of the turning areas of the field and the In the current conditions, it has been achieved to increase the yield of agricultural crops by leveling the uneven part of the irrigated lands. In order to enrich the humus layer at the soil level, to save water spent during irrigation, to wash the saline lands qualitatively, to increase labor productivity in irrigation, to reduce the cost of products, to solve the problem of preventing water and irrigation erosion processes in the soil, our mature scientists conducted their scientific research work.

To achieve the set goals, agricultural national enterprises have to hire skillful personnel to manage modern foreign agricultural and irrigating technologies, to correctly manage the work and program systems, to improve the ameliorative condition of lands and soil fertility. Due to inability to improve water conservation and land reclamation without quality leveling, one must choose leveling machines basing on such criteria as the relative field flatness, timely and effective organization of leveling work [15–18]. With the area relative flatness of around 60%, there are such benefits of widespread use of land levelers as 2–2.5-time water consumption reduction, 4-time irrigation productivity increase, simultaneous soil irrigation, soil salinization prevention, salt release reduction in the surface layer, between rows quality processing, taking agro-technical measures with high quality and speed, crop yield increase, improved mechanics working conditions.

To provide high-quality sown areas, one must perform current or major leveling in a timely manner, using "stacking" and "planting" to maintain a fertile soil layer. There is a 4–5 center increase in cotton yields per hectare planted by the "plantation" method [20–22], and irrigated farming produced more than 90% of the yield because of sufficient water resources in agriculture, energy-saving technique of leveling agricultural lands using improved disc softener base levelers, allowing performing simultaneous softening and leveling operations saving up to 20% of irrigation water. In disc-smoothing base levelers, the surface area of flattened fields is uniform without high-lows, where the water is evenly distributed and the crop area soil is evenly moistened [1–3], when the current and operational leveling of lands in irrigated areas is 25–30% of the total land area of farms before planting in autumn and spring with long base P-2,8A, P-4, PA-3, PPA-3,1. Although these land graders are simple in appearance, their performance is technologically very complex, their efficiency depends on the area size, irregularities, etc., despite their low maneuverability, large metal capacity disadaptation to supply other agricultural machinery, high power consumption during operation.

Leveling enhances ameliorative condition of arable lands, owing to which productivity increases, water consumption decreases, agricultural machinery productivity increases, working conditions improve [8–13], but the problem of low energy consumption and high yields needs to be addressed forcing to use efficiently the equipment power, improve the work quality, minimize the negative effects. Recognizing the importance of this problem, the development of modern agro-industry in the Republic of Uzbekistan must be based on leasing, farming, farmers' and peasant associations, general mechanization, use of intensive and industrial cultivation methods, low-capacity energy and mechanization of working machines for farms and lease contracts, to establish importation from abroad [14]. The development of disk softeners for the base leveling and substantiation of their parameters. Analytical expressions describing the process of interaction of the working part with the soil, as well as theoretical analysis of the diameter of the working body, the radius of curvature are described.

Targeted research is being carried out around the world to develop resource-saving technologies for land leveling and new models of equipment for sowing seeds of agricultural crops, to develop the scientific and technical basis for improving existing machines to ensure resource efficiency.

In the agricultural production of the country, special attention is paid to reducing labor and energy consumption, saving resources, growing agricultural crops on the basis of advanced technologies and the development and application of high-efficiency agricultural machinery. Quality leveling of irrigated lands in all the agricultural products growing districts of the Republic is of primary and urgent importance. In the leveled land, agricultural machines work with high yields, the land is used efficiently, the quality of agricultural work is improved, during irrigation, the soil is moistened evenly, as a result of the improvement of the working conditions of irrigation workers and mexanizators, labor productivity is increased; all this contributes to the increase in the efficiency of agricultural production and the high yield Quality leveling of irrigated lands in all the agricultural products

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If the irrigated lands are leveled at the required level, the water given to the soil is moistened evenly, the irrigation norm changes to the positive side. The volume of work associated with the construction of irrigation facilities is reduced, agricultural work is allowed to be improved, less labor is spent on irrigation, productivity is increased.

3 Procedure of research

Analysis of the research shows that for a given operating condition, the speed of movement of soil particles on the working surface of the disc and its performance depends on the speed of movement of the unit, the radius of curvature of the disc, its diameter and angle of installation.

It is known that disk hoists mounted on the base leveling device are installed at an angle not only to the direction of movement, but also to the vertical. But their research did not take this into account.

From the above analysis and the results of scientific research, it can be seen that the agrotechnical and energy performance of machines and devices equipped with spherical disk working bodies depends on their diameter, radius of curvature of the working surface, direction of movement and installation angles relative to vertical , depending on the transverse and longitudinal distances between them and the operating speed of the unit, research on this work should be carried out taking into account these factors. However, it should be noted that in previous studies, the installation of the softening disc working body on the base levelers is located outside the shell opposite the two right and left axes, and the movement of the disc together with the leveling process during leveling depending on Insufficient attention has been paid to factors such as changes in the depth of the sinkhole, and due to the soil and climatic conditions of the country, no previous research has been conducted on the development of spherical disc softeners for base levelers and substantiation of its, parameters although researchers have done a lot of work to substantiate the technology of rational operation of base levelers, this research shows that excessive compaction and hardening of the soil surface as a result of multiple passes of levelers, increase the efficiency of the unit.

The technological processing of the working body of the soft disk with a softener mounted on a base leveler due to the soil pile formed in front of the shovel, moving by rotating along the axis of the disc, allows softening soils to a certain depth using the discs by moving the aggregate, placing the discs in front of the leveling shovel opposite each other inside the shell, with the soil pile evenly distributed across the shovel width exerting a positive effect on the leveling of the leveled area. Soil lumps rub against each other, rotating around the discs, being crushed improving the aggregate soil composition of the planting layer by varying the leveling unit speed from 0.69 to 2.08 m/s, enhancing working processes. The change in the cross-sectional profile of the soil aggregate at different speeds of the leveling aggregate occurs when the cross-sectional profile decreases at high velocities due to the intensive loading of the soil in front of the bucket at high speeds of the unit, whereas at low speeds, the above process is relatively slow, soil discs softening is improved without lumps clogging. The pile top formed by filling the loosened soil shovel top is relatively wide, and the soil pile is wider compared to the large speeds of the leveling aggregate at low speeds, but at high speeds, when the humidity between the soil discs is insufficient, there is disturbed rotation intensity of discs without smooth movement of the soil pile, which requires a separate study of the position of the disks relative to each other and the diameter of the disks relatively this position [23].

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Leveling of the Earth's surface is also important in the field of combating soil salinity, since the more flat the field is, the better the soil's gravel is washed with 2–2.5-time water consumption reduction compared to that of an uneven terrain. Leveling the field prevents the surface of the groundwater from rising, the salinity of the soil rising, and finally allows the aggregates to work qualitatively, with high yields. The working yield of the water can also increase.

It should be noted that the surface (relief) of the dive is considered to be an important economic asset, since it affects the speed of walking of agricultural machines, aggregates, and, consequently, the effect of their use. Uneven swings in the field cause the tractor to shake out of place, rapid absorption of walking parts, and excessive consumption of engine power. In addition, the working conditions of the tractor deteriorate and the quality of work decreases, which leads to an increase in the cost of use.

Based on the research work carried out by mature scientists and scientific results, that is, it was noted that the following requirements for irrigated areas would lead to an improvement in the land reclamation situation:

1. 36–45 present the physical soil forming process, in terms of mechanical composition of the average and heavy slope of the soil in the direction of the longitudinal slope, 0.002–0.007 divided, irrigation ditches in the direction of the transverse slope, not more than 0.003–0.004;
2. The surface leveling accuracy of irrigated areas should not be more than 5 cm;
3. When leveling the field, do not allow the soil to become denser by pressing, starting the leveling work

after the soil moisture has fallen to 15–16 present and leveling the field in one pass, in some cases (where there is a complex relief) leveling in two passes;

4. Depending on the type of lowland, the machine must first walk in the direction of the slope or cross each other, and then walk in the direction of the irrigation; if the slope is less than 100 meters, the machine must walk in the direction of the height of the;

5. Soil at the turning places of the dive, not allowing dust to fall out.

The result of the research analysis showed that the yield of agricultural crops on the land with clippings in the form of a layer of soil thicker than 10 cm is reduced. But the reduction in the yield of crops is even greater, as a result of the fact that the soil is not evenly moistened on uneven land.

Timely and qualitative implementation of the following measures to improve the efficiency of irrigated lands creates the opportunity to obtain a high yield from agricultural crops:

- Full provision of irrigated land with trench networks;
- Increase the efficiency of using trenches;
- Repair of open and closed trenches, timely organization of cleaning work;
- Application of modern irrigation technologies;
- Timely, qualitative conduct of salt washing works;
- Strict irrigation standard;
- Perform land leveling work qualitatively;
- Consistent implementation of measures against wind and water erosion.

In conclusion, it can be said that in order to reduce the cost of using techniques in the cultivation of technical crops and agricultural products grown in the Republic, it is recommended to widely use the above information in the process of qualitative leveling of lands.

4 Conclusion

Application of the disk device on a long ground leveler leads to improved ecological and physical properties of the natural structure of the soil, increased soil fertility, allowing reducing the agricultural work, leveling processes, production costs in mechanized and improved agriculture, improved work quality performed on leveling irrigated lands, reduced irrigation cost. Soil composition improves plant development and increases productivity as a result of the positive impact of the leveler on the soil ecology, whose soft disk drive device mounted on the base leveler, prepared using the above theoretical research and analysis, shows high leveling efficiency and low energy consumption, which is directly related to the quality of leveling, leading to water savings in the self-irrigation process. It can be said that quality leveling of soils improves soil composition and increases productivity. This, in turn, will lead to a higher level of agricultural development.

References

1. *Following documents which are approved by council of Ministers and regional authorities. The state Resolution on wisely using water resources and improving ameliorative state of irrigating lands during 2013–2017 years*
2. *Governmental documents on construction, reconstruction fixing works in the ameliorative systems and buildings* (Tashkent, 2015)
3. Yu.A. Shevnnin, G.G. Burmiysky, *Ways to improve the efficiency of land-planning machines in construction and agriculture* (Tashkent, 1990)
4. *Contemporary scientific and practical conferences on "Modern problems of agriculture and water management"* (Tashkent, 1996)
5. N. Rakhimov, R. Muradov, *Manual on laser leveling and soil softening* (Tashkent, 2012)
6. I. Khasanov, A. Muratov, IOP Conf. Ser.: Mater. Sci. and Eng. **883(1)**, 012217 (2020)
7. *The issue of mechanization and electrification of agriculture*, Iss. VII (Fan, Tashkent, 1970), pp. 106–111
8. Kh.Kh. Olimov, A.A. Juraev, IOP Conf. Ser.: Mater. Sci. and Eng. **883(1)**, 012171 (2020)
9. J. Kuchqorov, B. Turaev, N. Murodov, Int. J. of Critical Rev. **7(12)**, 198–201 (2020)
10. D. Ermatova, S. Imomov, F. Matmurodov, IOP Conf. Ser.: Earth Environ. Sci. **614**, 012132 (2020)
11. R. Vafoev, S. Vafoev, K. Sabirov, S. Akhmedov, S. Imomov, IOP Conf. Ser.: Earth Environ. Sci. **614(1)**, 012093 (2020)
12. I. Marupov, S. Imomov, D. Ermatova, J. Majitov, N. Kholikova, V. Tagaev, I. Nuritov, IOP Conf. Ser.: Earth Environ. Sci. **614(1)**, 012153 (2020)
13. L. Sharipov, S. Imomov, J. Majitov, O. Komilov, M. Sharipov, F. Pulatova, O. Abdisamatov, IOP Conf. Ser.: Earth Environ. Sci. **614(1)**, 012035 (2020)
14. S. Imomov, E. Shodiev, V. Tagaev, T. Qayumov, IOP Conf. Ser.: Mater. Sci. Eng. **883**, 012124 (2020)
15. M.P. Kuz'min, V.V. Kondrat'ev, L.M. Larionov, M.Y. Kuz'mina, N.N. Ivanchik, Possibility of Preparing Alloys of the Al–Si System Using Amorphous Microsilica, Metallurgist **61(1-2)**, 86–91 (2017)
16. I. Khasanov, J. Kuchkarov, Kh. Nuriddinov, IOP Conf. Ser.: Mater. Sci. and Eng. **883(1)**, 012174 (2020)
17. Kh.Kh. Olimov, I.S. Khasanov, S.J. Imomov, E3S Web of Conf. **264(1)**, 04070 (2021)
18. V.E. Gozbenko, A.P. Khomenko, S.K. Kargapoltsev, N.V. Minaev, Creating of the alternative lubricants and practice of their use, Int. J. of Appl. Eng. Res. **12(22)**, 12369–12372 (2017)
19. I. Khasanov, A. Muratov, IOP Conf. Ser.: Mater. Sci. and Eng. **883(1)**, 012217 (2020)

20. Kh.Kh Olimov, A.A. Juraev, M.Z. Ochilov, IOP Conf. Ser.: Mater. Sci. and Eng. **883(1)**, 012170 (2020)
21. H. Muratov, N. Imomova, Z. Ergashev, M. Sultonov, IOP Conf. Ser.: Mater. Sci. and Eng. **883(1)**, 012130 (2020)
22. V.A. Ershov, V.V., Kondratiev A.I. Karlina, A.D. Kolosov, I.A. Sysoev, Selection of control system parameters for production of nanostructures concentrates, J. of Phys.: Conf. Ser. **1118(1)**, 012014 (2018), DOI: 10.1088/1742-6596/1118/1/012014
23. F. Khamidov, S. Imomov, O. Abdisamatov, M. Sarimsaqov, G. Ibragimova, K. Kurbonova, J. Critical Rev. **7(11)**, 1021–1023 (2020)