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Abstract. This article presents information on the development and implementation of a small-sized vegetable-growing tractor designed for use in greenhouses and household plots. The tractor features adjustable wheel track width adaptable to crop row spacing and a high ground clearance suitable for vegetable cultivation conditions.

Keywords: small-sized tractor, wheel track, ground clearance, agrotechnical gap, adaptation, vegetable farming, row spacing, household farming, aggregation, implementation.

ТЕХНИЧЕСКИЕ ТРЕБОВАНИЯ К МАЛОГАБАРИТНЫМ ТРАКТОРАМ

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Аннотация. В данной статье представлены сведения о разработке и внедрении малогабаритного овощеводческого трактора, предназначенного для использования в теплицах и на приусадебных участках. Трактор характеризуется регулируемой колеёй, адаптируемой к междурядьям сельскохозяйственных культур, и высоким дорожным просветом, обеспечивающим эффективную работу в условиях овощеводства.

Ключевые слова: малогабаритный трактор, колея, дорожный просвет, агротехнический зазор, адаптация, овощеводство, междурядья, приусадебные хозяйства, агрегатирование, внедрение.

КИЧИК ЎЛЧАМЛИ ТРАКТОРГА ҚЎЙИЛГАН ТЕХНИК ТАЛАБЛАР

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Аннотация. Ушбу мақолада иссиқхоналар ва аҳоли томорқа ер майдонларида ишлатиш учун филдираклар колеяси ўсимлик қаторларига мосланувчан, баланд клиренсга эга кичик ўлчамли сабзавотчилик тракторини ишлаб чиқиш ва жорий этишга оид маълумотлар келтирилган.

Калит сўзлар: кичик ўлчамли трактор, колея, клиренс, агротехник тирқиш, мослаштириш, сабзавотчилик, қатор оралари, томорқа хўжаликлари, агрегатлаш, жорий этиш.

Introduction. In recent years, scientific research has been actively conducted worldwide on the development of a new generation of small-sized vegetable-growing tractors with adjustable front and rear axle track width and high maneuverability. These tractors are designed to ensure agrotechnical passability and efficient performance of agricultural operations such as sowing vegetable and potato crops, cultivating row spaces, maintaining plants, and harvesting. Within this research direction, one of the key objectives is to develop structural designs of front axles, drive bridges, and steering mechanisms with adjustable transverse base and agrotechnical clearance, suitable for small-sized

tractors.

In greenhouses and small household farms, the diversity of field plot sizes and the variability of crop row spacing present specific challenges. Among vegetable crops, chili peppers, eggplants, tomatoes, and potatoes are characterized by relatively taller plant heights. Particularly for potato cultivation, tuber formation during the vegetation period requires repeated and gradual ridging to ensure optimal yield.

Small-sized tractors are widely used in small-scale household farms. They can be equipped with ploughs and active working tools for soil preparation before sowing, ridge formation, seeding, inter-row cultivation, and transportation of trailers. The use of small-sized tractors for soil loosening, depending on soil conditions, increases labor productivity by 5-10 times compared to manual operations and by 5-15 times in transportation tasks.

The performance efficiency and quality-energy indicators of machine-tractor aggregates based on small-sized tractors largely depend on the operator's involvement in the work process, control operations, movement trajectory maintenance, engine control, and several other factors.

Foreign experience in small-sized tractor manufacturing demonstrates a wide variety of models and brands, with engine power ranging from 5 to 15 kW. Therefore, based on the analysis of the operational experience of small-sized tractors in vegetable and potato cultivation on limited land plots - in particular, the experimental practices of the Research Institute of Vegetable, Melon and Potato Crops - the main agrotechnological processes that small-sized tractors must perform have been identified.

Based on the above-mentioned analysis and the practical experience of using small-sized tractors in the farms of the Republic, the main agrotechnical, technical, and technological requirements for tractors intended for use in small-scale farmer and household plots are as follows:

- the ability to plough soil to a depth of 18–20 cm and loosen soil up to 20 cm; harrow the soil surface at a depth of 6–8 cm;
- perform rotary tillage (rotary cultivation) at a depth of 6–12 cm and disc tillage at a depth of 10–15 cm;
- apply mineral and organic fertilizers and perform combined field operations;
- protect crops against agricultural pests; perform potato cultivation and harvesting operations (planting, hoeing, forming irrigation furrows, digging tubers, transporting the yield, etc.);
- perform vegetable crop cultivation (planting, cultivation, forming irrigation ridges, and other related tasks).

The small-sized tractor must be equipped with the corresponding working implements and attachments necessary to perform the above agrotechnical processes for the cultivation and harvesting of vegetable and potato crops.

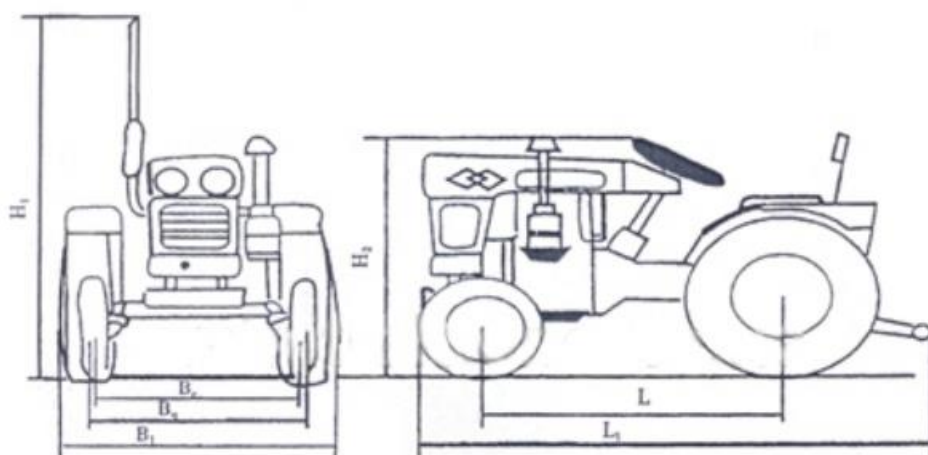


Figure 1. Overall dimensions of the small-sized tractor

Depending on the assigned tasks, the size of the land plot, and certain objective factors that may slightly influence the selection of machinery - such as terrain and soil structure - the appropriate agricultural machinery is selected (Figure 1).

Abroad, in agricultural production, along with large-sized standard tractors with normal wheel track width, narrow-track and short-wheelbase compact tractors are also widely used. Due to their small overall dimensions, such tractors are more effective for operations in crop production (viticulture, horticulture), livestock farming, mountain agriculture, as well as for performing various tasks in small-contour and confined areas of municipal services.

The main technical specifications of currently used and imported small-sized tractors are presented in Table 1.

Table 1

Main technical specifications of modern small-sized tractors used in vegetable farming

№	Name, designation, and unit of measurement	Model of wheeled tractor							
		Soliz S20 (India)	Soliz S26 (India)	Zubr C221 (China)	Zubr C201 (China)	ChIMG AN 160 (China)	ChIMG AN 220 (China)	ChIMG AN TL254 (China)	ЧИМГА H LD254 (China)
1	Traction class (kN)	2,0	3,0	2,0	2,0	2,0	2,0	3,0	3,0
2	Wheel formula	4K4	4K4	4K2	4K2	4K2	4K2	4K4	4K4
3	Track width, cm:								
	Front- B_1	885	835	120,130, 140 - 170	120,130, 140 - 170	100,0	100,0	140,0	120,0
	Rear - B_2	835	835	120,130,140 - 170	120,130, 140 - 170	100,0	100,0	130,0	120,0
4	Wheelbase, L , mm	1500	1420	1450	1450	1200	1200	1500	1500
5	Agrotechnical clearance, A_m , mm	240	240	350	350	290	290	290	280
6	Mass, m_T , kg,	995	970	600-650	600	550	600	1400	1300

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7	Rated power, N_e , кW (h.p.)	14,7 (20)	19,1 (26)	16,2 (22)	14,7 (20)	11,8 (16)	16,2 (22)	18,4 (25)	18,4 (25)
8	Number of cylinders	3	3	1	1	1	1	3	3

According to the data presented in Table 1, the adjustment of the track width of small-sized tractors is carried out mainly by changing the installation position of the wheel discs in different configurations. However, since the agrotechnical clearance of these tractors ranges from approximately 280 to 350 mm, it is insufficient for performing inter-row cultivation of vegetable crops. In addition, to adapt such tractors for vegetable rows with a spacing of 60 cm, it becomes necessary to install an additional attachment on the rear axle, as well as to replace the final drives and mount a front driving axle with increased agrotechnical clearance.

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