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A Device for Guiding of Bodies of Irregular Shape.

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FSBEE HE Penza SAU.

ABSTRACT

The article deals with the problem of guiding bodies of irregular shape (IS). The technical solution of the problem is offered by the authors. The technological scheme of rotor planting machine with guiding device is presented. The research results of physical-mechanical properties of parent roots of sugar beet and constructive-regime parameters of the developed device are presented in the article.

Keywords: guiding, roots, device.

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INTRODUCTION

In the engineering practice there are problems in the design of the devices for coating of irregularly shaped bodies, as well as in guiding of bodies of irregular shapes.

A great number of devices for guiding of bodies of irregular shapes (IS) can deal only with those bodies which are initially guided and accurately positioned.

The difficulty of designing mechanisms for guiding of IS bodies is due to necessity to possess a number of criterion: placing all IS bodies to the desired position, the reliability of bodies' passing in the mechanism of guiding and their output to the tray, exceptions of their possible damage in the process of their guiding, ensuring the required efficiency.

There are a large number of designs of mechanisms of guiding, and this fact complicates their study. Their classification is based on the method guiding of the IS bodies.

Guiding of IS bodies is the process of automatically turning them in the desired position during the motion in the mechanism of guiding. To turn the IS bodies to the required position, on the one hand, there considered the peculiarities of their shape or shift their center of gravity relative to the axis of symmetry, on the other hand, as well as the shape of guiding link is also used.

Depending on the choice of a particular shape peculiarity of the IS bodies and the shape of the guiding link there are methods of guiding: attaching the bodies to the hook; the ceasing of the body into the gap; the ceasing of the body in a shaped cutout on the profile of the work piece; the body turn on the shaped sponges and other supports; according to the placement of the center of gravity of the body; the ceasing of the body to the tube; a special case of guiding, for example, guiding of the bodies according to their electrical properties (in particular, guiding of the selenium washers).

One of these methods of guiding of IS bodies according to the centre of gravity, is applicable to guiding of the fruit crops while planting to the soil, for example, parent sugar beets.

RESEARCH METHODOLOGY

To solve this problem in FSBEE HE Penza SAU, there designed, developed, tested and implemented a device for guiding of parent sugar beets during planting [4].

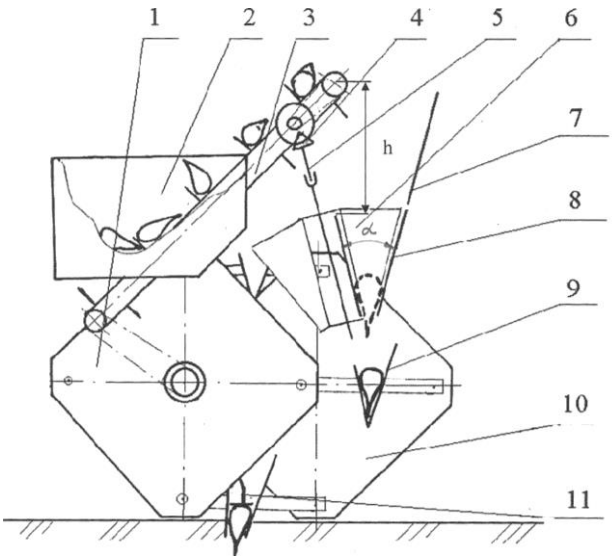

Figure 1: a leading planting disc –1, a hopper – 2, a supply conveyor – 3, the bevel gear – 4, shaft of leading scraper conveyor – 5, scraper conveyor – 6, the impact-absorbing board – 7, the guiding surfaces – 8,planting cone– 9, led planting disc– 10, the ejector – 11.

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The device is installed on the rotary planting unit (figure 1). The planting unit consists of a leading planting disc1, a hopper 2, a supply conveyor 3, the bevel gear 4, shaft of leading scraper conveyor, scraper conveyor 6, the shock-absorbing board 7, the guiding surfaces 8 planting conus 9, led planting disc 10 and the ejector 11. The technological process of the planting proceeds is as follows":a supply conveyor 3 selects the planting material of sugar beets from the hopper 2.With a certain height they fall into a V-shaped groove 8, which is formed by the guiding surfaces.

To absorb the impact, a special board is used 7. After getting into groove, planting material oriented tail down and is kept at the level of the plane of maximum diameter.

Scrapers 6 of the conveyor passing between the guiding surfaces take plantings and transport them to the output of the V-shaped groove. After leaving the guiding device the planting material under the action of gravity moved to the planting cones 9 without changing the position of the axis (tail down). Planting cones 9 are mounted on the leading planting disc1 and led planting disc10, which during rotation cause the cone to make a plane-parallel movement in a vertical surface. Cones go down to the surface of the field and enter the soil which is the prepared by loosening units. By the moment the cones reach the bottom, the ejectors 11 enter the cones, keep the roots and move apart the movable flaps of planting cones which move from the soil and move for the new planting material. Planting discs, the supply conveyor and the guiding device have a strict cyclical mode, due to the sleeve-roller chains and bevel gear 4.

Rotary planting device with the guiding device [5, 6] (figure 1) is mounted on the base planting machine PM – 2.8 (figure 2).

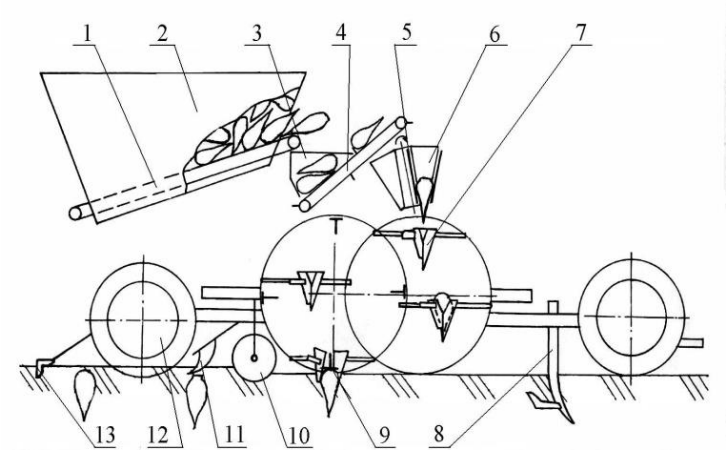

Figure 2: Functional diagram of the machine GAP a 2.8 with guiding surfaces: 1 – conveyor hopper; 2 – bunker; 3 – tray-drive; 4 –conveyor-feeder; 5 – guiding surfaces; 6 – drag conveyor; 7 – cone of the planter; 8 ripper;9 – pusher; 10 – gauge wheel; 11 – coverer; 12 – roller wheel; 13 – loop.

RESULTS

The results of studies of parent root crops of sugar show that their dimensional characteristic ranges: diameter from 50 to 98 mm; length 140 to 240 mm; the taper angle from 18° to 23°; distance from center of gravity to the surface of the maximum diameter is from 17 to 33 mm.

Root mass varies from 150 to 850 g, the average mass is equal 418,3 g, volume weight of one root crop is 1116 g/dm^2. The coefficient of static friction varies from 0.71 to 0.47 for different surfaces. Distance along the axis of the root crop of sugar beet from the center of gravity to the surface of the maximum diameter S depending on the length L and mass M is defined by the expressions: S=18,5212+0,0446 L; S=25,0484+0,0038 m and tends to increase.

The analysis of research data allowed to state that the camber angle of guiding surfaces α = 21...22°, the linear velocity of the feeding conveyor v =0,3...0,4 m/s, height of root vegetables falling from the feeding conveyor into the guiding device h=55...70 cm, the maximum frequency of the delivering roots is up to 90 units per minute, the necessity of installing additional funnel at planting cone is reasoned, this served as the basis

for reasoning geometric and kinematic parameters of planting machine with guiding device, the operating velocity of planting machine is 3.6 km/h in compliance with agro-technical requirements.

CONCLUSION

The use of rotary planting device with guiding device increases sugar beet seeds yields up to 6%. Energy costs for production of 1 kg of seeds are reduced from 13.8 to 12.6 MJ.

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