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Adaptive Peanut Harvester Stripper Design

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ABSTRACT: The technology used for harvesting peanuts in the modern conditions of agricultural production in the Central Asian republics does not allow the maximum mechanization of this process with obtaining high-quality peanuts in a short time. The results of field experiments, practical conclusions are drawn. The developed technology and machine for harvesting peanuts, which is based on the patent of the Republic of Uzbekistan, takes into account new forms of management. Farms received practical advice on how to harvest the required quality crop in a short time. On the whole, they will be acceptable for other Central Asian republics as well.

Keywords: peanut harvester, peanut harvesting technology, peanut damageability.

When growing peanuts, such operations as sowing, cultivation, fertilization, chemical protection are performed by machines used in the cultivation of other crops. But the peculiar structure of the bushes, the location of peanut fruits and the soil and climatic conditions of Central Asia do not allow the use of the harvesting technology adopted in many countries of the peanut crop producers.

The harvesting of peanuts is the final link in the complex chain of their production.

Harvesting of peanuts begins when the beans are well done, easy to separate from the rhizomes, and the seeds from the valves. Also, during this period, there is a partial yellowing of the leaves, a darkening of the inner side of the pods and the presence of a characteristic seed color for the variety. Delay in harvesting is fraught with seedlings of already ripe fruits, due to favorable growing conditions, and crop losses. In the case of late autumn harvesting and in damp weather, the beans are dried at a temperature of no more than + 40 ° C on special flooring in a layer 5-7 cm thick with constant stirring. The moisture content of beans before storage should be no higher than 8%.

In the process of harvesting, the plants are removed from the soil, shaken off with special machines, and one swath of 4-6 rows is formed. For the selection and hulling of beans, grain combines equipped with special devices are used.

When designing machines, first of all, it is necessary to take into account the biological characteristics of an agricultural crop.

At present, there are no industrial crops of peanuts in the republics of the Central Asian region. There is modern experience in the cultivation of peanuts on farms and, therefore, the possibility of industrial cultivation.

Common peanuts, or groundnuts, are an annual herb. According to the structure of the bush, the following forms are distinguished: bush (erect stem), semi-bush and creeping along the ground. Peanuts are beans of various sizes and shapes. The pod shell is straw-yellow, friable, brittle, of varying thickness, smooth on the inside, reticulate on the outside, with more or less prominent longitudinal veins. There are 1–6 seeds in a pod, but more often 2–3 seeds. Seeds are round or oblong-oval. The seed coat is light pink, light and dark red, black and purple, rarely variegated. The beans are formed underground [1].

The purpose of the research is to develop an effective harvesting technology, increase the level of mechanization and reduce the harvest time due to the use of peanut harvesters that meet the requirements of agricultural technology and soil and climatic conditions. This is achieved by designing machines that meet the above requirements.

Materials and methods. More and more attention is paid today not only to the creation of modern, satisfying the interests of farmers and private producers of small-scale production of peanut harvesters manufactured in the Republic of Uzbekistan, but also to the technology of their use.

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For the soil and climatic conditions of the Central Asian region, it is important to create early ripening varieties of peanuts. In African countries, the growing season for different varieties of peanuts ranges from 110 to 160 days. But for the regions of the Central Asian region, varieties with a growing season of 100–110 days are needed. For mechanized harvesting, varieties of bush or semi-bush forms are required, with a compact arrangement of beans at the base of the bush and their relatively strong attachment to the rhizomes. The main parameters of the ideal variety of peanuts for the Central Asian region: high yield - over 4 t / ha, early ripening - 100-110 days from germination to harvest maturity, adaptability to mechanized cultivation and harvesting.

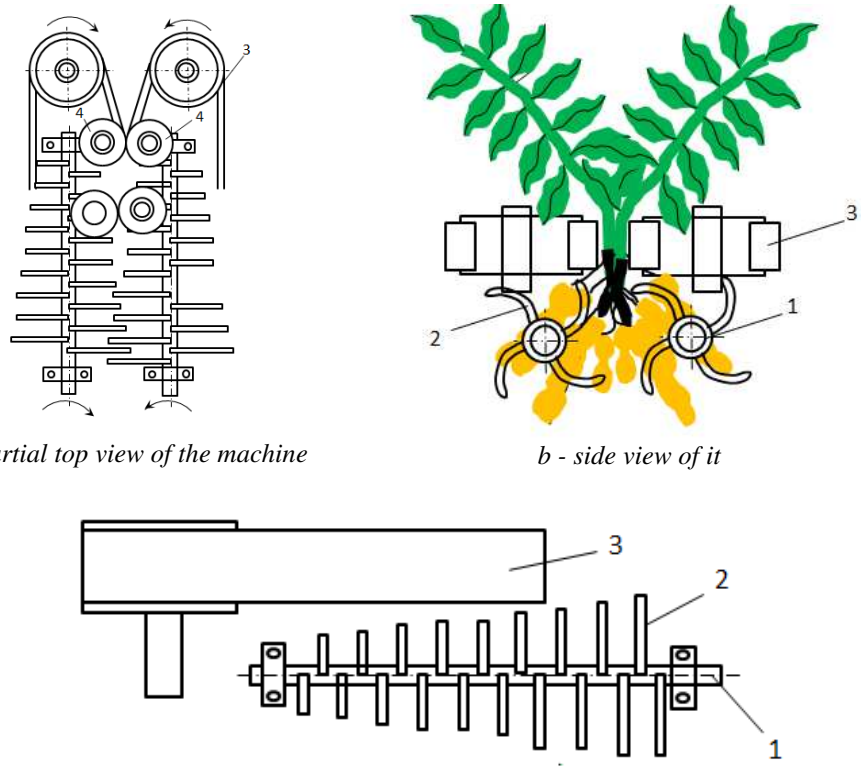
The most important problem in the implementation of any technology is to reduce labor costs, energy and resource conservation with a simultaneous increase in the yield of cultivated crops and, as a consequence, reduce the cost of production. Many scientists and specialists in agricultural mechanization have established that the use of saving technologies will reduce the number of machine passes through the field, preserve soil fertility, and minimize environmental pollution from fuel combustion products. So, as modern agricultural enterprises are the largest consumers of all resources, including labor and energy. Crop production remains the most energy-intensive branch of agriculture, accounting for 70% of all costs, including more than 40% for operations related to harvesting.

According to the operations performed by the harvesting machines, there are two options for machine harvesting technologies:

- direct combining (digging, lifting, separating beans from rhizomes, cleaning, collecting in a bunker);
- separate harvesting (removing the plant from the soil, shaking the bushes, laying in a swath, drying in the field, harvesting operations are performed by various machines).

The first attempts to directly combine the harvest of peanuts began in the USSR in the 40s. In 1937, I. T. Tyuterev filed an application for obtaining an inventor's certificate for a machine for harvesting peanuts and other similar crops. In the proposed harvester, to separate the beans from the roots, drums with spring teeth are used, located under the lifting belts along the latter. In order to separate the beans from the roots layer by layer, the ends of the teeth of the drums are placed along the generatrix of the cone.

The machine contains plowshares or knives (not shown in the drawing), which are used for cutting peanut bushes in the ground, as well as a pulling conveyor in the form of paired endless belts 3 and a device for breaking beans from the roots (Fig. 1.) ...



a - partial top view of the machine

b - side view of it

c - herfrontview

Rice. 1. Peanut Harvesting Machine

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The last device consists of drums 1 with spring teeth 2, the ends of which are placed along the forming cones. The drums rotate towards each other, their teeth are bent ours in relation to the direction of rotation of the drums. The drums are located under the top-lifting belts 3 along the latter.

Peanut bushes, cut by plowshares or knives walking in the soil, are captured by the top-lifting conveyor belts and pulled out of the soil along with the beans. For better clamping of the bushes by the conveyor belts, their inner branches are pressed against each other by rollers 4. The peanut bushes are fed back by the pulling belts in the direction of the machine. In this case, the roots of peanuts fall between the drums 1, the teeth of which break off the beans. Since the teeth at the front end of the drums are shorter and their length gradually increases towards the rear end, the beans located in the periphery of the root system are first shaved, and then, as the bush moves towards the end of the drums, the beans are cut off. located inside the root system. Thus, when the bush passes between the drums, the beans are completely separated from the roots of the peanuts in layers.

All the working bodies of the machine are driven from the tractor cardan shaft using the appropriate transmission [2 IT Tyuterev Machine for harvesting peanuts and similar crops USSR Inventor's Certificate No. 255 dated 08/31/1940].

US patent 4,607703 dated July 26, 1986, issued in the name of a citizen of Chinese Taipei Kuo Ming Wang, is called "Harvesting of peanuts and a method of harvesting." The patent harvester for peanuts includes a self-propelled chassis 1 on a caterpillar track, plant row separators 2, stem straighteners 3, peanut diggers, a plant feeder 4, an inclined conveyor 5, a horizontal conveyor 6, a peanut picker 7 and a bag 8 for collecting separated peanuts (fig. 2).

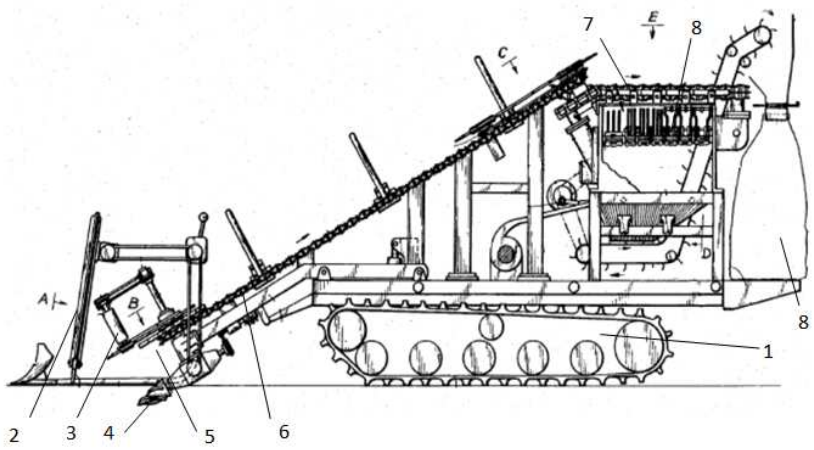

Fig. 2. Peanut Harvester Design

1 - self-propelled crawler chassis; 2 - separators of rows of plants; 3 - stem straighteners; peanut diggers; 4 - plant feeder; 5 - inclined conveyor; 6 - horizontal conveyor; 7 - device for removing peanuts; 8 - bag;

The dug out peanut plants are transported by an inclined conveyor and fed to a horizontal conveyor that holds the stalks, the peanut beans on the roots are combed, the peanut beans separated from the roots are sieved, cleaned and collected in bags.

Wang's car does not fundamentally differ from Tuterev's car. The design of the harvester is complex, there are many rotating and moving mechanisms and parts that affect the trouble-free operation and maintenance, besides, it is metal-intensive.

The Chinese company SHUNYU produced a single-row peanut harvester brand 4HLB-2A is made according to the principle of operation does not differ from the proposed above patents and the technical characteristics of which are given below (Fig. 3.).

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Fig. 3. SHUNYU 4HLB-2A Peanut Harvester

Modelbrand	4HLB-2A	
Models	Crawler	
Motorpower (kw)	kw	36
Enginespeed (rpmn)	rpm	2600
dimensions	mm	4630x2095x2470
Theweight	Kg	2440
Workspeed	km / h	0-3.6
Hourlyproductivity	m2 / h	≤0,23
Unitfuelconsumption	kg / m2	≤48
Capturewidth	Mm	500-550
Numberofprocessedrows		1

The proposed Chinese-made peanut picking machine has the following disadvantages: low productivity and very expensive.

Results and discussion.

The analysis of the above machine designs and the technologies used do not allow the entire grown crop to be efficiently harvested in the conditions of the Central Asian region in a short time.

In the republics of the Central Asian region, peanuts are grown in row spacings of 60 and 70 cm.All machines, including seeding machines, inter-row cultivators and grubbing machines (digging in peanuts) are adjusted for row spacings of 60 and 70 cm.

Taking into account the above factors, a trailed version of a peanut harvesting machine has been developed at the Namangan Civil Engineering Institute. The machine is two-row and is aggregated to tractors of the class

1.2 kN, adjustable for row spacing 60 and 70 cm.

The walnut harvester includes: a ploughshare digger 1, an endless belt 2, a top-lifting device installed on the driving and driven pulleys 2, a stripper 3 and a box-shaped hopper 4 for separating peanut beans (Fig. 4).

The peanut harvester works in the following order: the peanut beans with a rake, extracted from the soil with the help of a share 1, is clamped between the belts of the picking apparatus 2, the tops with peanut beans rises along the picking apparatus and when the picking device moves smoothly enters the combing device installed at an angle of 30□ to the picking to the apparatus, as they slide between the rubber plates of the combing device, the beans break off the connection with the roots under the action of the compressive and expansive forces of the rubber plates fixed on the

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steel plates 5 and 6 and are torn off from the rhizomes and falls down under their own weight and fall into the receiving hopper 4.

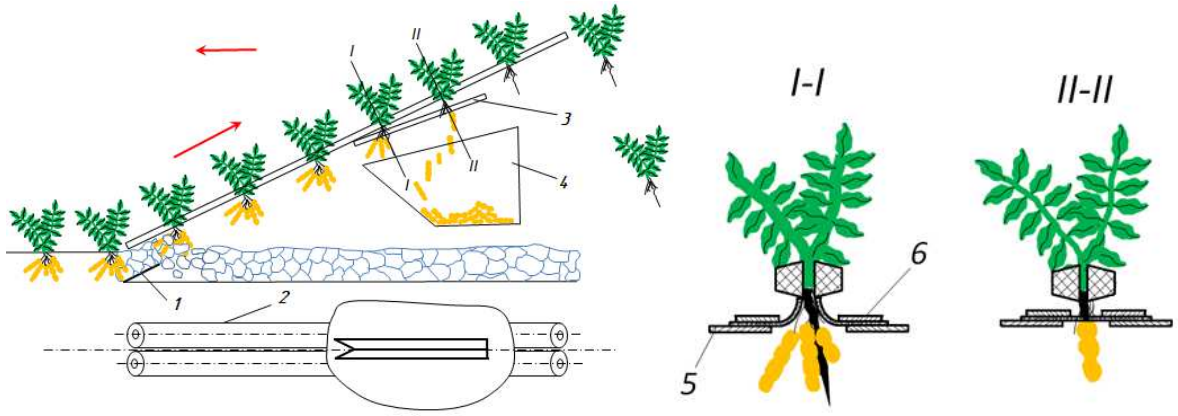

Fig. 4. Schematic diagram of the machine

Experiments carried out at the Namangan Civil Engineering Institute have shown that the peanut harvester created by the scientists of this institute makes it possible to collect 95-97% of the total crop in a short time. The harvested mass of peanuts is not damaged, the productivity of the machine is twice that of a Chinese combine. These indicators meet the requirements of farmers and private peanut producers in the Central Asian region.

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