

## Development of a Unit for Pre-sowing Strip Milling of Soil, Laying of a Drip Irrigation Hose and The Possibility of Sowing Seeds

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### Abstract

The article presents the results of a study on the design and operation process of a combined unit for pre-sowing strip milling of soil, laying of a drip irrigation hose and the possibility of sowing seeds. The proposed design of the machine is aggregated by row tractors of class 1,4 and 2, simultaneously performs operations of pre-sowing milling tillage with the formation of a ridge, laying a hose of a new design for drip irrigation, compacting the ridge and sowing seeds using various designs of seeders. The unit is designed to perform technological processes for both spring and post-harvest re-sowing, sweat functions it replaces the processes of harrowing and alignment soil. The unit can be used in two versions: preparation of a comb for sowing with the laying of a drip irrigation hose and simultaneously, sowing of seeds. The unit performs its function with traditional basic tillage and with innovative non-tillage. It can perform five operations with one pass, thereby being considered energy-resource-saving.

### Introduction

In modern technologies of soil processing and planting, the implementation of energy and resource-efficient processes is envisaged. There are technologies for plowing the soil of the main cultivation of the soil without turning over and overrunning [1-2]. The next one is based on energy conservation. At the same time, this method is used to observe weed invasion of the field when processing the soil. In world practice, this technology involves the use of herbicides against weeds in large quantities. This, in turn, leads to an increase in energy and resource consumption, complicates the work of planting pre-sowing in the spring [3]. Modern seed planting technologies aim to reduce seed consumption, ensure accurate planting and simultaneous germination of seedlings.

In agriculture, the possibilities of using combined aggregates are being used as one of the main methods of using energy-resource-efficient technologies and techniques. In these methods, it is carried out to simultaneously perform several operations on one pass of the aggregate in the cultivation and planting of the soil. At the moment, in the conditions of Uzbekistan, in the application of traditional and innovative planting modern technologies, double sanding and molting activities are carried out in order to eliminate weeds and soil layers. This leads to the fact that the aggregate compacts the soil, works several agricultural techniques and chop tractors [11].

In the following years, the practice of planting pink, based on advanced experiments, is on a wide network. The implementation of push-ups in Uzbekistan conditions in the autumn and spring seasons was tested in experiments. Its main disadvantage is that the top of the stem dries out under the influence of the rays of the hoof, during the sowing, the seed falls into dry soil and requires the

provision of seed water. In this regard, innovative irrigation methods including the use of drip irrigation are proving expedient [1-4]. However, in the current technology, drip pipes are being implemented with longitudinal placement in a wide range of plants. Although the water economy in this method is up to 50%, the inability of processing machines to enter the field between the rows negatively affects productivity.

Based on the experiments carried out, it is determined that the placement of drip cuttings near the plant on the stem and the implementation of irrigation will allow processing between the rows and, therefore, to prevent a negative impact on productivity. From our experiments in cotton production with this technology, it was found that yields are doubled and irrigation water consumption is reduced to 70%.

The main goal of our scientific research is to actively process the soil before planting to form a pushcut, place drip irrigation pipes next to the seeds planted on the pushcut, and create a combined machine structure for planting completely seeds.

## Materials and methods

*Analysis of the current state of the problem.* The innovative planting that is currently in place and in use has received tillage technologies that allow the ground to be applied even when it is cultivated in the fall without overturning and overturning. In particular, soil grafting (ridge tillage) is not treated until planting in the soil in the technology of cultivation. 1/3 of the soil layer is treated with working weapons that clean the arrowhead or furrows, the pods are formed and planting is carried out. The planting height is carried out on cuttings of 10-15 cm. Herbicides are used in the fight against weeds and are carried out in combination with cultivation. In strip tillage (strip tillage) Technology, 30% of the soil surface, such as pitch tillage, is treated with milling machines, with disc working organs, or with passive softeners. According to the procedure, planting is usually carried out along with this process. Herbicides are used in the fight against weeds and are carried out in combination with cultivation.

*Tasks to be solved* - active tillage, loosening of the soil at the required level and destruction of weeds together with the process of compaction and leveling, which are carried out before sowing; sealing drip irrigation hoses to a certain depth simultaneously with the formation and compaction of the ridge; sowing seeds makes it possible to sharply reduce the amount of cultivation; targeted and uniform moistening and fertilization of the soil.

## Results of studies performed

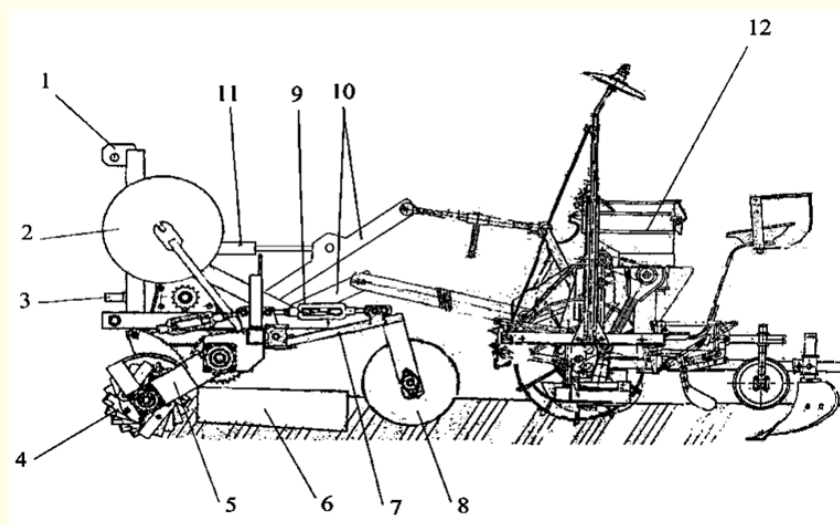
Depending on the soil climatic conditions of Uzbekistan, even when traditional and innovative technologies of basic cultivation were applied to the soil, a combined machine structure was created that allowed planting and processing (figure 1).

The machine consists of two parts: 1) the section of longitudinal placement of the stem forming and drip sludge pipe next to the row of seeds planted on the stem, having treated the soil with a milling machine; 2) the section of planting. In the case of planting technical crops in a wide range of rows (60 and 90 cm), various types of ecchichs are used - in rows and precision planting machines. In the proposed combination aggregate, the preparation and planting parts for the purpose of using different types of planters are located separately. By aggregation to chop tractors of different classes, the machine can be used in two different cases:

1. Prepare ridge before planting with only the first part and place a drip slaughter pipe;
2. Prepare ridge, place drip irrigation pipes on the pushta and plant biratola seeds.

Both cases carry out spring planting and post-harvest replanting processes.

The front part of the machine hangs on the tractor at three points, the reducer of the milling machine is connected to the power supply valve of the tractor. The ejector is connected from three points through the suspension device 10 (Figure 1) of the front of the machine, in the suspension connector the ejector has a 9 adjustment device with respect to the horizon [7].



1-milling frame; 2 - drip irrigation pipe winding Shaft; 3-milling extension reducer shaft; 4 - blade drum milling machine; 5 - blade drum bracket; 6 - ridge formwork sheath; 7 - pusher spool bracket; 8 - ridge spool; 9-clamping spool; 10-suspension device for planters (seeder); 11 - planters suspension gear hydraulic cylinder; planters 12 (seeder).

**Figure 1:** Planting tool strip milling, completely placing a drip irrigation pipe and planting a possible combined aggregate [6-7].

The machine aggregated to the tractor works as follows: when the tractor starts, the milling machine 1 is first started, the machine is lowered and the soil is processed and planted. Milling 1 (Figure 1) actively processes the soil, using a sheath 6 installed on it, a push is formed. Through a special device (not shown in the picture) from drip irrigation pipe winding Shaft 2, the pipe is buried on the pusher to a certain depth of 2-3 cm, and the top is closed. The formed ridge is compacted by the pushta compactor shaft 7, which is mounted on the bracket. After him, the wheels of the moving planter 12 are dragged, resting on the bottom of the pusher, with which the smoothness of movement is ensured. When sowing seeds, rowed or precision seeding machines can be used [7].

Since the rotary motion of the milling machine is directed in the direction of the line speed by the action of the aggregate, its resistance to creep is reduced. For this reason, analysis of the forces acting on the milling can help determine the resistance of the machine to creep. The drag resistance of the mounting planters are accepted from the description of their russet.

*Analysis of the forces acting on the working bodies of the milling machine.* Milling knives have a longitudinal axis located perpendicular to the movement of the aggregate, so the elementary forces acting on them can be brought to one common equal acting force  $R_{xz}$  [11]. This force is placed under a certain angle  $\psi$  relative to the vertical plane on the longitudinal axis perpendicular to the aggregate motion (Figure 2 a).

The  $\psi$  angle and  $R_{xz}$  Force values vary depending on the rotation angle of the milling drum to be within the beat of the beat of the  $\phi = \omega t$  (figure 2 b). The  $R_{xz}$  force value increases as soil shear occurs from the beginning of knife's entry into the soil, then the resistance decreases in a bottleneck curve as the blade moves from bottom to top as it passes through the vertical plane of the drum axis [11]. The increase in  $R_{xz}$  strength is of the angle of rotation of the drum, respectively. Will be in the range of values 15-250. Between these angles, the resistance of the drum to drag is reduced as a result of the action of the force  $R_{xz}$  due to forced rotations of the drum. Drag resistance increases when the drum's number of spins is  $160 \text{ min}^{-1}$ .

The  $R_{xz}$  force can be broken down into its organizers  $R_x$  and  $R_z$ . The horizontal organizer  $R_x = R_{xz} \cos \psi$  is oriented in the direction of the aggregate and reduces the drag resistance of the machine, which makes it possible to work with tractors of the 0.9-1.2 class of the tractor.

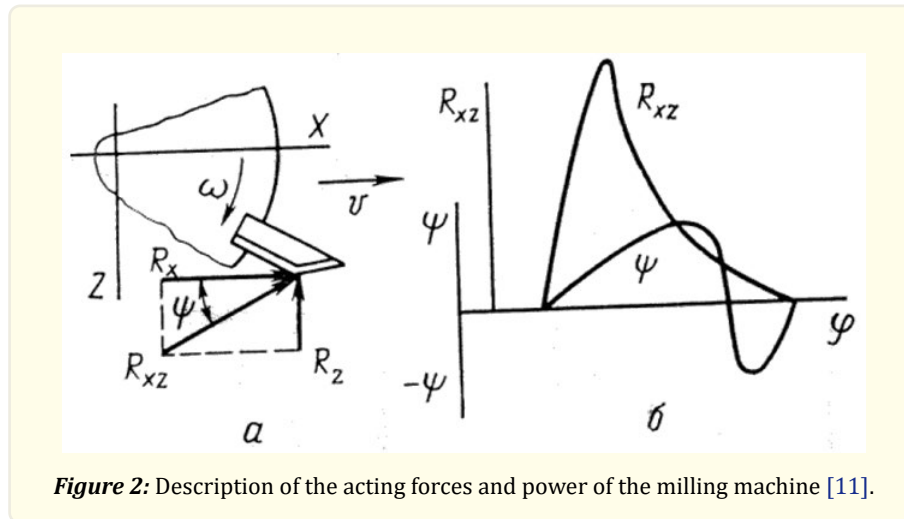


Figure 2: Description of the acting forces and power of the milling machine [11].

A is a scheme of forces acting on the blade; B is a graph of change depending on the  $R_{xz}$  force and the angle of rotation of the blade of the angle  $\psi$ .

In the vertical direction of the vertical organizing  $R_z = R_{xz} \tan \psi$ , The Machine resists the deepening of the working organs into the soil, while in the downward direction it helps to deepen. As a result of all the values obtained, it was found that the change in angle is from  $+12$  to  $-15^\circ$ . The  $R_z$  force has positive values in the upward direction and negative values in the downward direction.

The resistance values of rotational blades can be determined from the following simplified formula:

$$R_x = k_k \delta b, \quad (1)$$

here  $k_k$  – coefficient of comparative resistance to shearing,  $N/m^2$ ;  $\delta$  – Wrinkle thickness, m;  $b$  – Wrinkle width, m.

The comparative resistance of shearing depends on the mechanical composition of the soil (plant residues are also taken into account) and its condition, the dimensions of the shearing (the layer being transferred to the blade) and the rate of shearing, that is, the number of drum rotations. In the case of a small layer transfer from the data obtained, the specific resistance is large, while in the case of a thick layer transfer, the specific resistance is reduced. In this case, the transfer of a thick layer relative to a thin layer causes the soil to become less crumbling.

The power required for milling work is determined approximately as follows:

$$N = N_m + N_k + N_{up}, \quad (2)$$

here  $N_m$  – the power of the machine to move across the field, kWt;  $N_k$  – power to scrape the soil (soil deformation), kWt;  $N_{up}$  – power for ironing scraps, kWt.

The first constituent is defined from the following formula:

$$N_m \approx 10^{-2} f G v, \quad (3)$$

here  $G$  – mass of engine,  $kg$ ;  $v$  – speed of engine's movement,  $m/s$ ;  $f$  – rolling coefficient,  $f = 0,15...0,2$ .

The second Constituent is calculated from the following formula:

$$N_k = 10^{-4} k_k \delta b a z n / 6, \quad (4)$$

here  $a$  – soil processing depth,  $7-12 \text{ sm}$ ;  $z$  – total number of knives;  $n$  – milling cutter's drum number of turns,  $160-200 \text{ minutes}^{-1}$ .

The third organizer is defined as follows:

$$N_{ir} = 510^{-4} k_o G_T u_b, \quad (5)$$

here  $G_T$  – the mass of the soil being ironed in one second,  $kg$ ;  $k_o$  – the coefficient of soil irradiation depending on The Shape of the working organ;  $u_b$  – drum spinning speed,  $m/s$ .

The power consumption for soil treatment with a milling cutter is estimated by the comparative power efficiency, that is, by the power consumption per unit of workload (for example,  $dm^3$ ).

From the analysis of the above forces, it can be seen that with a decrease in the transmission of the soil layer to the blade and an increase in the speed of advanced movement, the comparative work increases sharply, so that the rate of milling is relatively small -  $1,1...1,4 \text{ m/s}$  ( $4...5 \text{ km/h}$ ). In such an order of work, the height of the pusher at the desired level is formed from the volume of the soil being ironed. Resistance to compaction of the pink formed from this is reduced.

*Analysis of the resistance forces acting on the rigde formation.* The force of resistance acting on the ridge formation is equal to the sum of the resistance of the ground receiving shroud, the two side capers and the upper straight parts:

$$P_x = R_{1x} + 2R_{3x} + R_{nx} + R_{hx} + R_{2x}, \quad (6)$$

here  $R_{1x}$  – horizontal organizer of resistance to irradiated soil in shroud;  $R_{3x}$  – horizontal organizer of soil resistance to side limbers;  $R_{nx}$  – soil crushers front edge resistance forces horizontal organizers;  $R_{hx}$  – horizontal organizer of resistance force to low edges of formwork crushers;  $R_{2x}$  – formation of the soil counterweight to the upper roof part horizontal organizer.

These resistance force values are determined analytically and in field conditions based on the results of dynamometric tenzometry experiments [8].

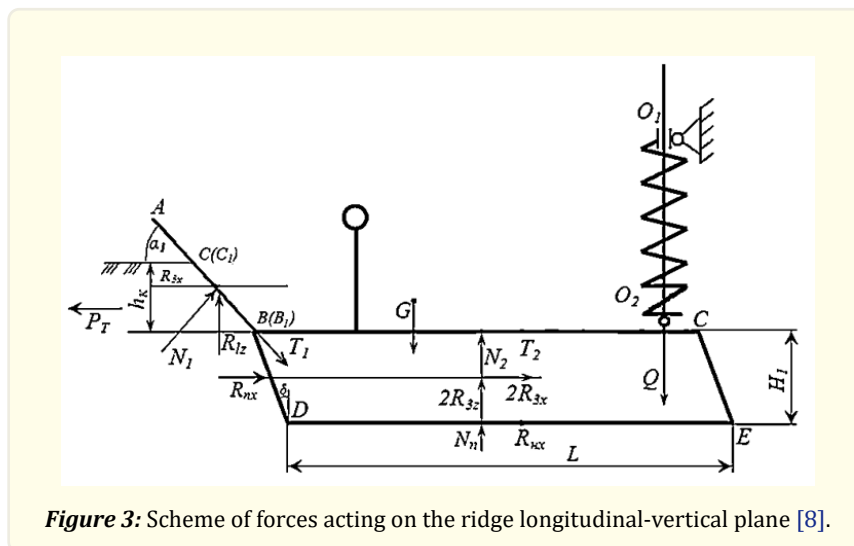


Figure 3: Scheme of forces acting on the ridge longitudinal-vertical plane [8].



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