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# WORKING WIDTH AND SPEED OF THE HARROW DEPENDING ON SOIL RESISTIVITY

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**Annotation**

Pre-sowing leveling of fields before sowing is one of the most important methods of agricultural technology that contribute to increasing the yield of agricultural crops in the area of irrigated agriculture. One of the ways to solve this problem is to increase the productivity of levelers by rationally choosing the speed of movement and the width of the gripper of the unit.

**Keywords:** Working speed, gripping width, traction resistance, optimal speed, speed of movement.

Leveling the fields before planting is one of the most important agronomic techniques to help increase crop yields in irrigated agriculture. This allows efficient use of water, fertilizers and mechanization equipment. Flattened fields create the best conditions for plant growth and development. When planting in poorly leveled fields, the exact location of plants is not ensured, it is difficult to get good and friendly seedlings, the quality of watering and post-irrigation treatments deteriorates, the effectiveness of fertilization decreases.

It is known that the leveling of cotton fields before planting is carried out in a very short agro-technical period. In order to implement this agrotechnical technique in a timely manner, it is necessary to use a large number of leveling aggregates or judicious use of existing units.

One way to solve this problem is to increase the operating speed of these leveling machines and the working width of the machine by choosing wisely.

The speed of operation of agricultural units is selected, first of all, on the basis of the conditions necessary for the implementation of the technological process. For some operations, the pressure of the bench mass must be slowly distributed to the soil (or compaction), the unit must greatly reduce weight and speed of movement, and in other cases, especially cotton fields during leveling before planting, minimum soil density is required. To do this, you need to reduce the time of contact of the machine with the ground. This is achieved by increasing the operating speed of the units.

The performance of a mobile agricultural unit can be determined by its working width and speed of movement or by the engine power and the specific resistance of the unit / 1,2 /:

W= 0,1BV (1)

$$W=\frac{27N_e}{K_v}\varepsilon_{N_e}\eta_{\text{тр}} \qquad (2)$$

Where:

W = hourly productivity, ha / h;
B = working width of the unit, m;
Ne = effective motor power in kW;
V = operating speed of the unit, m / s;
Kv = unit resistivity, N \ m;
$\varepsilon_{N_e}$ = utilization factor of effective engine power;
$\eta_{\text{тр}}$ = efficiency of the tractor.

The working width of the "B" hole is a complex function of a number of independent variables and the speed of movement / 47 /:

$$B=F\ (Kv\ Ne\ \eta_{\text{тр}} V) \qquad (3)$$

The specific resistance of the tool Kv, depending on the speed of movement, is one of the influencing factors on its width of capture and the speed of the unit.

The specific resistance of the leveler, depending on the speed of movement, can be expressed as:

Kv = Kn + α (Vp –Vn) (4)

where Kн is the specific resistance of the equalizer at low speeds, N \ m;

Vp - increased speed of movement, m / s;

Vн - reduced speed of movement, m / s;

A - coefficient of proportionality, taking into account changes in resistivity depending on the speed of movement.

When the unit is operating, all the effective power developed by the engine is not completely spent on useful work. The power balance of the seedbed leveler can be presented as follows. (!!!)

Ne = Nf + Nm + Nn + Nb + Ncr (5)

Where: Nf = friction force of gears, kW:

Nm = power consumed for rolling, kW;

Nn = power expended to overcome the rise, kW;

Nb = power dissipated, kW;

Ncr = power consumed for weighing agricultural machinery, kW.

If the components of the tractor's power balance are expressed in terms of maximum effective power, speed, transmission efficiency, displacement coefficient, tractor weight and equalizer traction resistance, then (5) can be written as / 24 /

$$N_e = N_e\,(1\text{-}\eta_{тр}) + \frac{vP_f}{270}\cos\alpha \pm \frac{R}{270}\sin\alpha + Ne\,\eta_{mδ} + \frac{KBV}{270} \quad (6)$$

Where: rolling resistance, n / m;

d - slip coefficient,%

R is the total resistance of gravity, n / m;

The slip coefficient can be determined by the following expression / 47, 55 /

ph = ms1 + d (7)

where: m1 is the coefficient of viscosity weight utilization, ie. the ratio of traction resistance to the weight of the tractor propeller on the moving part;

c, d are constant coefficients for the area prepared for planting. You can take C = 0.2 and d = 3.

As you know / 47, 48 /, the mechanical efficiency of an agricultural unit is the efficiency of a tractor - the efficiency of moving tools is:

nc = nTP • nT (8)

where: the overall efficiency of the system

nTP = Tractor efficiency

nT = Tool efficiency

The efficiency of the tractor depending on the speed of movement is a complex function that takes into account the losses in the electrical transmission of the flywheel, the losses in the self-movement of the tractor and the losses in displacement. Given the general characteristics of many aggregates and the inconvenience of determining tractor efficiency, we are limited to determining the equalizer efficiency.

The components of the total resistance of a seed mixture can be divided into two groups. Components (the shear resistance of a leveler) represent useless or "dead" resistances. The components R and Rpr (the strength of the reaction of the soil to deformation and the strength of the resistance of the prism of gravity) are the useful resistances. Here, the efficiency of the equalizer can be expressed in terms of the following relationship:

$$\eta_{т} = \frac{R+R_{пр}}{R_{f}+R+R_{пр}} \qquad (9)$$

In this case, the overall efficiency of the system:

$$\eta_{c} = \eta_{тр}\left(\frac{R+R_{пр}}{R_{f}+R+R_{пр}}\right) \qquad (10)$$

Delivery 4; Solving 2 and 1 and 2 of 6 and 10 together, we obtain the formula for determining the width of the plane:

$$B = \frac{\theta 270 N_{e}\left\{\varepsilon - \left[1-\eta_{т}\left(\frac{R+R_{пр}}{R_{f}+R+R_{пр}}\right)\right]\right\} - R_{f} V}{V + \frac{270 N_{e} \eta_{т}\left(\frac{R+R_{пр}}{R_{f}+R+R_{пр}}\right)\left(C+\frac{d}{V}\right)}{c_{сц}}\left[K_{н}+a(V_{п}-V_{н})\right]} \qquad (11)$$

Where: is the utilization factor of the working width.

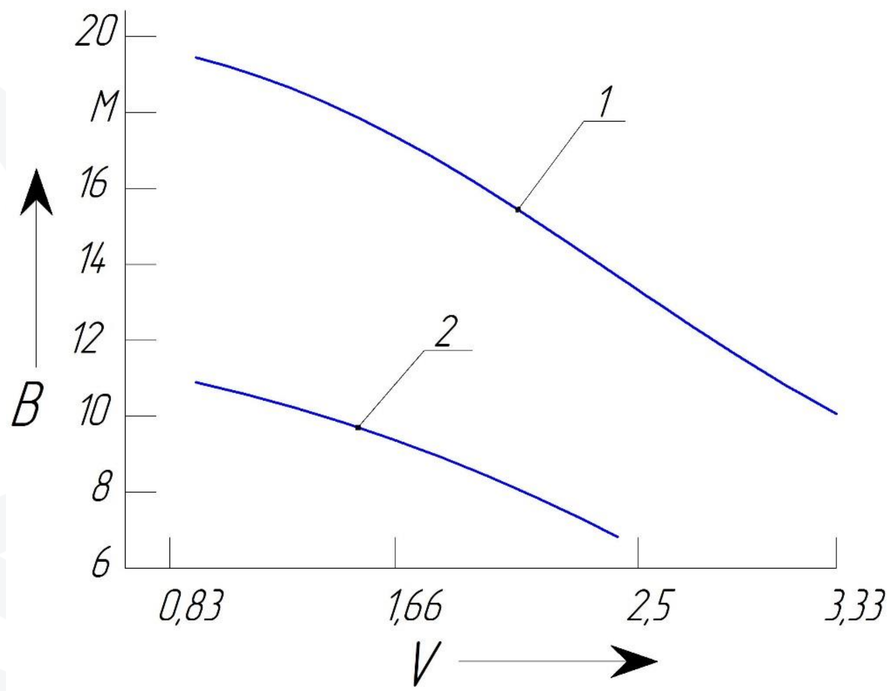
During operation, the pre-sowing leveler should overlap the previous aisle of the machine by 40-50 cm, without the formation of inter-joint unevenness. From here

$$\theta=\frac{[B-(0,4...0,5)]}{B} \quad \text{or} \quad 0,93....0,96$$

The resulting equations make it possible to determine analytically the width of the leveler

An analytical study of the established functional relationship in order to determine the most optimal speed leads to a higher-order equation.

More simply and with satisfactory accuracy, this problem is solved by the graphic-analytical method. To do this, initially, setting sequentially the values of the speed of movement according to equation 11, we determine the working width of the equalizer.

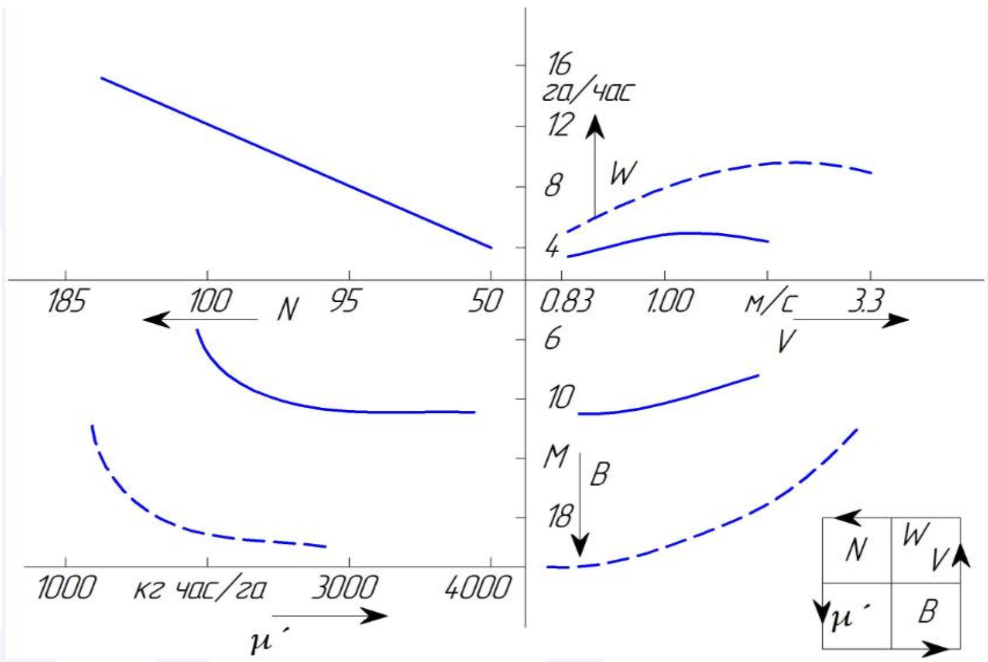



Pic. Diagram of the change in the working width of the leveler depending on the travel speed.

For Class 1 - 5 tractors; For 2nd to 4th grade tractors.

As can be seen from the graph (Pic. 1), the working width of the leveler before planting decreases with increasing speed of movement. But because of the large volume and metal consumption, it makes no sense to use wide-angle levelers.

For more complete use of tractor power and ease of use, the working speed should be increased with a smaller working width. As the speed of movement increases, productivity increases accordingly, so that the specific consumption of metal per hectare of treated area decreases. This reduces excessive consolidation of the soil. The resulting graphical dependencies allow you to set the speed modes for each value of the working width and determine the theoretical efficiency and determine W = 0.1BV according to the generally accepted formula, taking into account formula (11). Figure 2 shows the nomogram, according to which it is possible to determine the maximum speed and width of the work for the received power tractor, thus ensuring maximum productivity.




Pic 2. Nomogram to determine the working width, speed and performance of the seed rope:

_ _ _ _ _ _ _ A seed grower in a machine with a 5th grade tractor

The __________ seed claws are connected by a Class 4 tractor

The upper left quadrant of the nomogram shows the change in maximum productivity depending on the tractor power, in the first upper quadrant - the maximum productivity depends on the unit speed, on the lower right - the working width. the unit on the speed at which maximum productivity is provided, on the lower left - the dependence of the specific metal consumption from the working width and unit weight (μ`).

From the above we can draw the following conclusions:

1. The width of the nail holder on which the seed is planted depends mainly on the speed of movement and the specific resistance of the nail. This is directly proportional to the motor power and inversely proportional to the speed of movement and the specific resistance of the nail.
2. Before planting, the width of the leveling drlzhnv cover should be 12 m, the speed of movement should be 2.8-3.0 m / s.

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