PREPARING GERMINATION BEDS WITH A HARROW

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Abstract. *Labour efficiency depends primarily on the degree of mechanization in agriculture, as the use of agricultural machinery and equipment has the effect of increasing labour productivity, relieving physical labour, and reducing production costs substantially, thus contributing to increased agricultural productions. Machines in agriculture, as in other areas of activity, are fixed funds whose use leads to a significant increase in labour productivity, to a reduction in living labour expenses. The specific nature of the use of land as the main means of production in agriculture as a particular influence on the use of agricultural machinery. Agricultural machines need to correspond to the following requirements from the points of view of their structure and use: ensure qualitative working indices corresponding to the requirements of modern agriculture; execute at the same time as many as possible technological work operations; be multifunctional, i.e., to allow different working equipment to be attached to the base machine; be highly reliable; be able to execute high precision works without any loss of materials or crops; ensure the mechanization of all operations in the technological processes of production with high operating coefficients and at low production costs. Agricultural machines are fundamentally different from the machines used in other branches of the economy, especially those used in the manufacturing industry, because they work with live organisms (plants), with non-homogeneous materials in which different physical, chemical, and biological processes occur. This requires something specific only to agricultural machines, namely, that technological processes executed by them to create optimal conditions for plant development, according to agro-biological requirements for agricultural production purposes.*

Keywords*: agricultural machinery, germination bed, mechanization, agriculture*

INTRODUCTION

The germination bed is the layer 5-10 cm thick from the soil surface prepared through soil works (especially with a harrow, a cultivator, a roller, or a combine) in order to create optimal conditions for sowing, seed sprouting, rising, and plant growing. [ILEA R., ANIȘOARA DUMA COPCEA, R. MILOȘ, 2017, MIHUȚ C., ANIȘOARA DUMA-COPCEA, 2018]

The preparation of the germination bed is required for the following reasons:

Land levelling, by shredding soil clods and filling soil in concave areas. Ploughing alone does not leave the soil sufficiently shredded and levelled so that it can be sowed. [POPA D., ILEA R., BUNGESCU S., ALEXANDRA BECHERESCU, 2015, POPA D., ILEA R., BUNGESCU S., ALEXANDRA BECHERESCU, 2015]

In autumn fields for winter sowing and spring ploughing, the preparation of the germination bed is a must because ploughed surface is uneven, and large clods prevent the sowing. [MIHUȚ C. 2014, MIHUȚ C., ADALBERT OKRÖS, OLIMPIA IORDĂNESCU, 2012]

The most cloddy and uneven ploughed lands are on clayey soils, worked in inappropriate humidity, on set ground, on land with many uneven vegetal debris, in droughty autumn conditions. [MIHUȚ A., PAȘCALĂU C., CASIANA MIHUȚ, MIRCOV V.D, 2018]

Restoring normal soil aeration by increasing or decreasing aeration rate. Summer fields, under the influence of rains, snow, and other causes set, decrease their porosity, which makes it necessary to restore normal aeration with a coulter harrow, a disc harrow, a cultivator, or a

roller. [NIȚĂ LUCIAN-DUMITRU, 2007, NIȚĂ L., D ȚĂRĂU, GH ROGOBETE, GH DAVID, D DICU, SIMONA NIȚĂ, 2018, NITA L., ADIA GROZAV, GHEORGHE ROGOBETE, 2019]

Autumn fields, especially in drought periods and on lands that have been cultivated with seed clover and Sudan grass or are weeded with wheatgrass, have too high porosities with many free spaces between the clods, which makes necessary the use of a roller. [OKROS A., ADRIAN BORCEAN, MIRCOV VLAD DRAGOSLAV, MIHUȚ CASIANA, BOTOȘ FLORENTINA NICOLETA, 2018, OKROS A., POP GEORGETA, 2014]

The goal. Creating complex aggregates to perform more works on a single pass. Aggregates for three to five works on a single pass can be created. These aggregates are energetically advantageous and good quality agricultural works during optimal agrotechnical periods can be executed. [LATO A.M., OANA SUCIU, CRISTINA PETRESCU, BRIGITHA VLAICU, MATILDA RADULESCU, ADINA BERBECEA, ISIDORA RADULOV, IAROSLAV LATO, 2016, K. I. LATO , M. POPA , A. LATO, M. CORCHES, I. RADULOV, A. BERBECEA , F. CRISTA, 2019]

The objectives pursued in this paper are: weeds must be destroyed, which means cutting them, detaching them from the soil and not only covering them with a thin layer of soil where they can regenerate.

The method used for this work was harrowing, which makes the soil surface mobilized, aerated, shredded, levelled, and set. Harrowing is executed at depths of 3-12 cm, i.e., over a superficial soil layer. But there are also heavy harrows (with disks) that mobilize the soil deeper (15-18 cm).

MATERIAL AND METHODS

In the experiments, a John Deere tractor with a 60 hp engine in good condition has been used, with a number of 1,760 hours of operation. The tractor was equipped with a fuel consumption measurement apparatus, as well as with two weights of 47.5 kg each, factory-mounted on the motor's wheels. The tractor weight prepared for experimentation was 3,750 kg. Adjected air pressure was kept constant during experiments at 1.2 atm (1.18 bar). Initially, the engine regulator feature was also elevated. Also, the tractor was provided with a dynamograph mounting support.

The machines in the aggregate (GD3.4 harrow, levelling blade, and 2 GCR-1.7 harrow fields) were in good condition, being checked and adjusted to the platform.

The slope angle of disc batteries from GD-3,4 harrow was 15°.

After the aggregates were checked and adjusted to the platform, 1.5 ha was worked, after which the corresponding settings were corrected. The actual experiment for the establishment of the optimal working regime was performed on a 1.5 ha plot, and the operating experiments under experimental conditions were made on a neighbouring plot of 50 ha.

This soil was a chernozem, the land had a slope of 3° oriented toward NW. the previous crop was autumn wheat. The stubble was ploughed 30 cm deep with a 150 hp + PPS 35 + GS - 1.6 tractor unit. The ploughing land remained totally devoid of weeds, and will be sown with a second crop.

Soil moisture was 15.5% (sample taken 3 cm deep in the soil) and after ploughing it was 14.76% (sample harvested 5 cm deep in the soil).

RESULTS AND DISCUSSIONS

The introduction of new complex aggregates for the preparation of the germination bed and the continuous improvement of the equipment has increased the technical and execution potential of enterprises for the mechanization of agriculture, contributing to increasing the degree of mechanization of production processes and to a substantial improvement of the quality of the agricultural work of the germination bed preparation.

a) Traction resistance of the aggregate consisting of a John Deere tractor and GD-3,4 agricultural machines + 2GCM-1.7 levelling blade was determined with the hydraulic dynamograph whose cylinder was coupled between the tractor bar and the GD-3,4 harrows.

The processing of diagrams obtained on the dynamograph paper was made through the maximum and minimum points method.

At the same time, the resistance of the tractor movement was also determined, the value of which was 690 daN.

Within each sample, the engine speed was measured by measuring the power socket speed.

b) Working speed was established by the 100 m distance timing for the four gears, with the relationship:

$V = 3.6 \times S/T$ (km/h)

where:

S = the space travelled = 100 m;

T = time in seconds.

The working speed values for each gear (used in determinations) are shown in Table 4.

c) Skidding of the motor's wheels (8) was established while determining the working speed using the electrical pulse meter for each motor wheel, both in operation and at rest. With the help of the relationship below, the skidding for the four speeds was determined (III.R, IV. î., III.Î..II.R):

$\delta = (n_s - n_g)/n_s$

where:

n_s = average number of rotations in operation;

n_g = average number of rotations at rest.

From the skidding values presented in Table 4, it is clear that they fall within the permissible limits (15-20%), the highest value being in speed IV. î.

d) Hourly fuel consumption (G) was determined while measuring the speed and skidding using the consumption apparatus, with the relationship:

$G = 3.6/t \times V \times g$ (kg/h)

where:

V = volume of fuel consumed (cm^3);

g = specific Diesel weight (g/cm^3);

t = duration of a sample (s).

There is a decrease in hourly fuel consumption at lower gears.

e) Actual power required for the aggregate (N_eF) was determined from the engine regulator characteristic, which equipped the tractor based on the hourly fuel consumption obtained in the field measurements. The values of this power for each gear in which the measurements were made are shown in Table 4. The nominal power value (N_m) was also established in the regulator characteristic.

f) Engine load (I) has been determined by reporting the values of the two powers set above N_eF and N_m, with the relationship:

$1 = N_eF/N_m \times 100$ (%)

The engine load values are shown in Table 4.

g) Traction strength (N_t) of the aggregate for each speed level was calculated separately with the relationship:

$N_t = (R_m \times V)/270$ (hp)

where:

R_{in} = resistance to ii action of the aggregate;

V = working speed for each of the four gears.

To have a clearer picture of how to use the nominal engine power, the power required for the tractor movement (N_r) was also calculated.

CONCLUSIONS

Preparing the germination bed with vertical rotor harrows and Packer rollers perform a very good quality and a high working capacity with small energy consumption.

When preparing the germination bed using disc harrows:

- Choosing the advance direction to the ploughing work for the first pass as perpendicular;
- Achieving this work through a minimum number of passes;
- Disc harrows need to be in perfect working condition, having well tight disc batteries, without axial movement, and with bearings greased and without abnormal movements;
- Working depth is determined according to agrotechnical requirements;
- Frame horizontality is carried out by correct coupling to the tractor, where hydraulic arms are equal and coupled to the tyrants in oval holes;
- Loading with additional weights for both the tractor, and the disc harrow, to achieve this work through a minimum number of passes;
- Mandatory mounting after the disc harrow of harrowing sections with adjustable coulters and heavy blades for shredding and land levelling;
- Using a more economical movement, depending on soil category;
- Turning at the end of the field to be carried out only in a transport position.

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