DETERMINATION OF SOIL REDUCTION RATIO LEVEL AFTER ITS PROCESSING IN CLASSICAL TILLAGE SYSTEM AND IN MINIMUM TILLAGE SYSTEM

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Abstract:
In the paper there are presented the results obtained after working the soil in the classical tillage system and in minimum tillage system

Keywords: ratio level, clumps, minimum tillage system

INTRODUCTION

In the modern opinions, soil structure represents one of the essential characteristics with direct influences upon all physical, mechanical and biological processes which can take place in soil.

Depending on dimensions, form and the forming and cohesion mode, the aggregates can show properties more or less favourable to water and air drift, and roots penetration. (Topa D., G. Jitareanu, 2007).

Conventional agriculture uses intensive techniques which imply high energetic inputs and contribute to soil damage, which can be observed through losses of organic substances, erosion and consolidation. All these lead mostly to negative effects upon soil, water and air quality. (Rusu T., Gus P., 2007).

Ecological mechanization technology of the main soil workings in minimum tillage system achieve this operation without furrow overturning and assure the limitation of soil work operations, improve the structure and increase the capacity of humidity maintenance. (Popescu I., 1984).

In this paper there are presented the obtained results regarding the influence of soil work method upon reduction ratio level.
MATERIAL AND METHODS

The only method for determination the reduction ratio is a proportion between the mass of soil fractions with dimensions smaller than 5 cm, which pass through a coarse sieve with the sieve meshes dimensions of 5/5 cm and the sample total mass. This method allows the determination of the soil reduction ratio, but it is very expensive.

The present research aims at the establishment of the optimal technical means of mechanization, used in small and medium nurseries, which lead to the increase of work productivity, to the raise of works quality level and the reduction of the saplings cost prize.

The aim of the research is scientifically motivated because of the necessity of introduction some equipment for the processing of soil preparation works, for getting a high level of soil reduction ratio from small and medium nurseries.

For the achievement of this aim, the following main objectives were followed:

- Determination of the influence of different soil work methods upon the reduction ratio.
- Analyses in parallel of the influence of work system upon the reduction ratio.

The reduction ratio is very important for the saplings life and plays an important role in the following growth, beginning with germination until the saplings crop; it represents the initial vital space in the seeds growth, together with humidity, heat and air.

Thus, it was drafted a fast, expedite, but precise method, which helped to the determination of the reduction ratio.

The work algorithm used for the study of soil reduction ratio was applied in two variants: a main one which helped at the determination of this parameter after soil processing with: mouldboard plough, disc harrow, combiner and scarifier and the second variant which contains additional methods for the study of soils processed with tillage cutter. It was applied this situation because the soil prepared through cutting is better and more uniform divided in comparison with other work variants used in the experiment.

In picture 1 there are chosen surfaces of light colours which show the “cutting” area of clump of the active organ of the mechanic aggregate which operate the plough and shows the best the transversal surface and the clump size.
The separation of the “light” surfaces from the “dark” ones is achieved through a digital filtration defined by the relation:

\[
\text{Img}_{\text{BW},i,j} = \begin{cases}
0, & L_{i,j} \in [0;141] \\
255, & L_{i,j} \in [142;255]
\end{cases}
\]

which has as a result a matrix defined by two Boolean colours with the values “255” (white) – “light” surfaces – and “0” (black) – “dark” surfaces – represented in figure 2.

In the following step the clumps will be indexed and their surfaces will be measured, and their indexation with random colours for a qualitative delimitation of clumps.

In the case when most clumps have smaller dimensions as in the case of countersink works, then their image will have a symmetric and bipolarized distribution towards colours of low and high intensities.

The division of images with high density from colours start with the initial filtration on 8 bits (256 grey hues) with the help of a binarized image (white and black) obtained through filtration with the 172 level. Thus, it is obtained an image on 8 bits with grey hues, but which has the borders delimited with black.
The image of clumps with blacken borders is calculated with the classification algorithm and it resulted the surfaces from picture 6 with the palette on 2 bits (white and black).

To increase the precision of determination the clumps surfaces it is applied the convex hull function which will take each clump and it will circumscribe to a convex polygon. As it can be seen in picture 7, the convex surfaces which define the clumps are more realistic as form and colour.

**RESULTS AND DISCUSSIONS**

To determine the reduction ratio level in the classical tillage system and in the minimum tillage system, there followed five repetitions, after each technical operation, taking pictures of divided soil on a surface approximately equal to 1 m². For the statistical interpretations of results it was calculated the arithmetical average (x), standard discrepancy (s), variation coefficient (S%) and the standard error of the average (Sx).

The research results, for the determination of the reduction ratio level, on the base of the described algorithm (method) are shown in the table 1, after soil processing in the classical tillage system and in the table 2 for its processing in minimum tillage system.

The graphical representation of the obtained results are shown in picture 1 for classical tillage system and in picture 2 for minimum tillage system.
Table 1
Average values obtained after the determination of the ratio level in a classical system

<table>
<thead>
<tr>
<th>Code</th>
<th>Symbol of standard surface</th>
<th>Standard surface</th>
<th>Total number of clod</th>
<th>Total surface of the clod</th>
<th>Percentage of covering</th>
<th>Extreme values of surface of the clod</th>
<th>Amplitude of variation. w</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Code</td>
<td>ni</td>
<td>mm²</td>
<td>%</td>
<td>Xmax mm²</td>
<td>Xmin mm²</td>
</tr>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Soil processed with a classical plough</td>
<td>5.00</td>
<td>764041.40</td>
<td>97</td>
<td>378034.15</td>
<td>49.96</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Soil processed with a disc harrow</td>
<td>5.00</td>
<td>774833.85</td>
<td>176</td>
<td>238170.80</td>
<td>31.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Soil processed with a harvester</td>
<td>5.00</td>
<td>773201</td>
<td>217</td>
<td>90010.05</td>
<td>11.64</td>
</tr>
</tbody>
</table>

Statistical Indexes

<table>
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<th>97</th>
<th>378034.15</th>
<th>49.96</th>
<th>108813.05</th>
<th>119.40</th>
<th>108693.65</th>
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<td>238170.80</td>
<td>31.00</td>
<td>17598.85</td>
<td>124.05</td>
<td>17474.80</td>
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<td>Soil processed with a harvester</td>
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<td>773201</td>
<td>217</td>
<td>90010.05</td>
<td>11.64</td>
<td>10317.00</td>
<td>31.70</td>
<td>10285.30</td>
</tr>
</tbody>
</table>

Soil processed with a classical plough

Soil processed with a disc harrow

Soil processed with a harvester

Statistical Indexes
Figure 8: Variation of the number of clods resulted from the soil processing in a classical system tillage

Table 2
Average values obtained after the determination of the ratio level in a minimum system

<table>
<thead>
<tr>
<th>Symbol of standard surface</th>
<th>Standard surface mm²</th>
<th>Total number of clods n</th>
<th>Total surface of the clods mm²</th>
<th>Percentage of covering %</th>
<th>Extreme values of surface of the clods</th>
<th>Amplitude of variation of surface w mm²</th>
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</thead>
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<tr>
<td>Soil processed with a paraplow</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Code</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>0.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S%</td>
<td>0.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sk</td>
<td>0.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sk</td>
<td>0.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soil processed with a rotary harrow</td>
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</tr>
<tr>
<td>Code</td>
<td>n = 5.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>0.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S%</td>
<td>0.00</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Sk</td>
<td>0.00</td>
<td></td>
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<tr>
<td>Sk</td>
<td>0.00</td>
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</tbody>
</table>

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CONCLUSIONS

Analysing the obtained results it can be concluded that the reduction ratio has its highest value within the minimum tillage system, after soil processing with rotary harrow. Within the classical tillage system, the highest values of the reduction ratio are identified after soil processing with combiner.

The paper value is given by research data collected, processed, analyzed and used for offering an original study material which, indeed, can be used by specialists in the design of the process of preparing the germinative bed, depending on the adopted work system.

Based on the analyses of the obtained results within the research presented in this paper, there can be highlighted some contributions, which are original in the field of soil processing and in the method of determining the reduction ratio in the process of preparing the terminative bed.

Originality degree results from the fact that this physical parameter can be determined extremely easily only taking pictures of the processed soil and following the planned algorithm.
BIBLIOGRAPHY


Rezumat:
DETERMINAREA GRADULUI DE MĂRUNŢIRE A SOLULUI ÎN URMA PRELUCRĂRII ÎN SISTEM CLASIC ŞI SISTEM MINIM

În lucrarea de faţă sunt prezentate rezultatele obţinute în urma prelucrării solului în sistem clasic şi în sistem minim asupra gradului de mărunţire.

Cuvinte cheie: grad de mărunţire, bulgări, sistem minim