UDC 631.316.4

ANALYSIS OF THE NEGATIVE IMPACT OF CRUST ON COTTON SEEDLINGS IN THE FIELD AND A RESOURCE-EFFICIENT CRUST SOFTENER DEVICE IN ELIMINATING THE NEGATIVE EFFECTS.

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Abstract: *This article focuses on agricultural mechanization and aims to assist farmers by softening post-rainfall silt crusts using an energy and resource efficient aggregate softener.*

Key Words:*crust, technical device , technology, softening fingers, aggregate, mechanization, aggregate, energy saving, productivity.*

INTRODUCTION

Structural soil crusts are relatively thin, dense, somewhat continuous layers of non-aggregated soil particles on the surface of tilled and exposed soils. Structural crusts develop when a sealed-over soil surface dries out after rainfall or irrigation. Water droplets striking soil aggregates and water flowing across soil breaks aggregates into individual soil particles. Fine soil particles wash, settle into and block surface pores causing the soil surface to seal over and preventing water from soaking into the soil. As the muddy soil surface dries out, it crusts over.

Structural crusts range from a few tenths to as thick as two inches. A surface crust is much more compact, hard and brittle when dry than the soil immediately beneath it, which may be loose and friable. Crusts can be described by their strength, or air-dry rupture resistance.

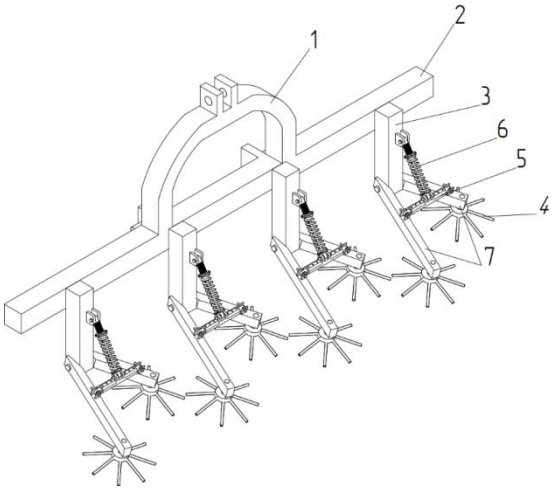
Recent rain brings another challenge for farmers, especially in fields conventionally tilled last fall or early this spring. In addition to potential soil erosion and damages to soil structure rainfall can cause, there are after effects of the rain when the soil surface starts to dry. The potential problem is soil crust. Soil crust is a product of a weak soil structure and the absence of residue or cover crop to protect soil surface from the intensity of rainfall.

MATERIALS AND METHODS

This could occur especially in intensively tilled fields where residue cover is not adequate, as well as with fine texture soils and soils with low organic matter content. These conditions could increase the potential for soil crust formation. Residue cover plays a significant role in reducing soil crust by absorbing the impact of rain drops that destroy soil surface structure. The destruction of soil structure impacts plant germination and seedling emergence for both cotton and soybean.

The proposed utility model applies to the field of agricultural mechanization, in particular the process of primary processing between rows. The structure of the new

device will consist of the following. A metal profile with a total length of 3.5 meters (1), 4 handles (2) are welded, one (3) working body is mounted on each handle. This means that when each working body processes cotton seedlings sprouted from one row, it is possible to further increase the number of rows with a total processing capacity of up to 5 rows. We determine the width of the unit depending on the power of the tractor. Tractors with 80-100 horsepower can handle up to 8 rows. The main part of the working body is mounted on small frames prepared by welding (4) with soil softening fingers (5). The softening fingers are attached to the small frame by means of rotating hinges or bearings. From the forward motion of the traction tractor, the softening fingers rotate and rub the fold (Figure 1).



1 -tie device, 2- frames, 3– column, 4– straight gear softener;

5– telescopic included support; 6– spring mechanism; 7– handle

Figure 1: Resource-efficient crust softener device.

RESULTS AND DISCUSSION

Initial data to calculate the parameters of the gear softener device: Crust softening depth h_{yu}=0,04m=4cm, the width of the cotton row protection zone b_h=0,1m=10cm, the distance from the cotton row to the tooth of the gear softener is The transverse distance l_k=0,04m=4cm, sliding coefficient K_c=0,2 and kinematic parameter λ=0,8.

We determine the angle of installation of the gear softener relative to the horizontal in the transverse-vertical plane by expression ((1)). i.e

$$\beta = arctg\frac{h_{yu}}{b_h - l_k} = arctg\frac{4}{10-4} = 33°42'. \quad (1)$$

Therefore, the angle of installation of the toothed softener with respect to the horizon in the transverse-vertical plane of the softener should be 33-34º.

We determine the depth of penetration of the gear softener into the soil according to expression (2), i.e

$$h_k \geq \sqrt{\left(b_h - l_k\right)^2 + \left(h_{yu}\right)^2} = \sqrt{\left(10-4\right)^2 + \left(4\right)^2} = 7{,}2 \text{ cm}. \quad (2)$$

Therefore, the depth of penetration of the gear softener into the soil should be at least 7 cm.

We determine the length of the gear softener tooth according to expression (3), i.e

$$l_t \geq \sqrt{(b_h - l_k)^2 + (h_{yu})^2} + l_q = \sqrt{(10-4)^2 + (4)^2} + 5 = 12{,}2 \text{ cm}. \quad (3)$$

Demak, tishli yumshatkich tishining uzunligi kamida 12 cm bo‘lishi lozim.

Tishli yumshatkichning diametrini (4) ifoda bo‘yicha aniqlaymiz, ya’ni

$$D \geq d_g + 2\left[\sqrt{(b_h - l_k)^2 + (h_{yu})^2} + l_q\right]\cos arctg\frac{h_{yu}}{b_h - l_k} =$$

$$= 8 + 2\left[\sqrt{(10-4)^2 + (4)^2} + 5\right]\cos arctg\frac{4}{10-4} = 27{,}97\ cm. \quad (4)$$

So, the diameter of the gear softener should be at least 28 cm, and the radius should be at least 14 cm.

4. Conclusion

By using this device, the quality of work can be improved by reducing the consumption of metal, energy and fuel consumed in the process of softening the coating.

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