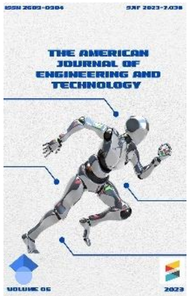
The American Journal of Engineering and Technology
(ISSN – 2689-0984)
VOLUME05 ISSUE11 Pages: 115-119
SJIF IMPACT FACTOR (2020: 5. 32)(2021: 5. 705)(2022: 6. 456) (2023: 7. 038)
OCLC– 1121105677
Crossref doi Google Scholar WorldCat MENDELEY
Publisher: The USA Journals



Journal Website: https://theamericanjournals.com/index.php/tajet

Research Article

COMBINED AGGREGATE FOR SOIL WORKING

Submission Date: November 15, 2023, Accepted Date: November 20, 2023,
Published Date: November 25, 2023
Crossrefdoi: https://doi.org/10.37547/tajet/Volume05Issue11-16

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ABSTRACT

The methods of multi-factorial experiments of combined aggregate cotton receiver intended for tillage are presented.

KEYWORDS

The installation angle of the picker in relation to the direction of movement, the diameter of the picker, the height of the picker, the movement speed of the unit, the level of soil compaction.

INTRODUCTION

The development of high-quality and productive and energy-resource-efficient tillage machines and tools is considered an important task. In this direction, the creation of a resource-efficient technology for preparing fields without cotton stalks for sowing in one pass, the development of a scheme of a combined unit that implements the technological process in a qualitative manner, and conducting targeted scientific research on the justification of the parameters of the working bodies that ensure resource efficiency in interaction with the soil are considered urgent issues. Research and development activities aimed at the development of new scientific and technical bases of combined aggregates that implement resource-efficient technologies for preparing cotton fields, especially fields with bolls or fields cleared of bolls, for seeding in one pass are being carried out. The technological workflow of a combined tillage unit is as follows: during one pass of the aggregate, the bottom of the last season's sedges is softened to a depth of 30-40 cm with deep softeners and fertilized in a ribbon-like manner, with the sedge removers, the old sedges are pushed to these softened and fertilized areas, and new sedges are formed, i.e., softened and fertilized sedges are replaced by the last season's sedges , and egats are formed instead of pushtas.

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Literature analysis and methodology. It was determined that the combined unit provides the quality of work of the agrotechnical demand level of the cotton harvester with low energy consumption, and the use of the combined unit equipped with the developed cotton harvesters in the preparation of fields for planting cotton leads to a decrease in energy and resource costs.

In order to create agrotechnically required pulses with low energy consumption, it is necessary to use a pulse receiver in the form of spherical discs with a diameter of 550 mm. An increase in the unit speed from 6.0 km/h to 8.0 km/h leads to an improvement in the quality of soil compaction and an increase in the traction resistance of the working body, while the total height of the pile and softened layer does not change.

In order to ensure that the combined aggregate collects cotton at the level of agrotechnical requirements with low energy consumption at speeds of 6-8 km/h, the diameter of the cotton pickers should be in the range of 515-570 mm and they should be installed at an angle of 28-330 with respect to the direction of movement.

Therefore, in order to find the optimal values of the parameters of the combined aggregate [1] directed to minimal tillage of the soil, using the method of mathematical planning of experiments, multifactorial experiments were conducted according to the V3 plan.Table 1 shows the factors, their conditional definition and variation intervals. They were determined based on the results of theoretical studies and one-factor experiments.

Factors, their conditional determination, range and level of variation.

Table 1

Naming of factors	Unit of measure	Designation	The interval	Level of factors		
				-1	0	+1
1. The angle of installation of the receiver relative to the direction of movement	град	X_1	10	20	30	40
2. Pink receiver diameter	мм	X_2	100	450	550	650
3. of the unit speed of movement	км/соат	X_3	1,5	5,0	6,5	8,0

When conducting multifactorial experiments, the level of soil compaction, that is, the amount of fractions

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smaller than 50 mm in size, the height of the pile formed, and the tensile strength of the softener were taken as evaluation criteria.

Experiments were conducted using a random number table and the tillage depth was set at 12 cm for all options.

RESULTS

The data obtained in the experiments were processed according to the "regression analysis" program developed in the experiment planning laboratory of the State Scientific Research Institute [2,3]. In this case, Cochran's criterion was used to assess the homogeneity of variance, Student's criterion was used to assess the value of regression coefficients, and Fisher's criterion was used to assess the adequacy of regression models [4].

The results of the experiment were processed in the indicated order, and the following regression equations were obtained that adequately describe the evaluation criteria:

a) according to the level of soil fertility (%)

$$Y_K = 78{,}833 + 0{,}986X_1 + 0{,}087X_2 + 1{,}579X_3 - 1{,}799X_1^2\,; \qquad (1)$$

б) according to the height of the resulting bush (cm)

$$Y_h = 28{,}172 + 7{,}453X_1 + 1{,}197X_2 - 1{,}100X_3 - 6{,}477X_1^2 - 2{,}027X_2^2; \qquad (2)$$

в) on the tensile strength of the softener (kN)

$$Y_P = 2{,}624 + 1{,}467X_1 + 0{,}360X_2 + 0{,}391X_3 + 0{,}480X_1^2 + 0{,}065X_3^2\,. \qquad (3)$$

From the analysis of obtained regression equations, it can be seen that all factors had a significant impact on the evaluation criteria. Increasing the angle of installation of the harrow disc led to the first increase and then decrease of soil compaction, the height of the created harrow, and the increase of the working body's resistance to traction. As its diameter increases, the level of soil compaction almost does not change, the height of the created pile first increases (up to 550 mm), then begins to decrease, and the resistance of the working body increases. Experiments were carried out at speeds of 6.0 and 8.0 km/h with diameters of 450, 550 and 650 mm. In this case, the discs were installed at an angle of 30° to the direction of movement and at a working depth of 17 cm. [5].

DISCUSSION

From these results, it can be seen that increasing the disc diameter from 450 mm to 650 mm had no significant effect on the quality of soil compaction. The height of the bush increased by 2.7-3.8 cm due to the increase in the volume of cultivated soil when the diameter of the disk increased from 450 mm to 550 mm, and it remained unchanged when it increased from 550 to 650 mm.

In the experiments, the angle of installation of the receiver with respect to the direction of movement was changed from 15° to 40° with an interval of 5°. The diameter of the pump receiver was taken as constant and equal to 550 mm, and the speed of aggregate movement was taken as 6.0 and 8.0 km/h. As the installation angle of the brush receiver increased from 15° to 40°, the quality of the soil was improved, that is, the amount of fractions larger than 100 mm and in the range of 100-50 mm decreased, and the amount of fractions smaller than 50 mm increased.

An increase in the diameter of the piston receiver from 450 mm to 650 mm led to a proportional increase in its drag resistance. Tensile resistance at a working speed of 6 km/h is 1.28 kN to 2.37 kN, and at a speed of 8.0 km/h increased from 1.83 kN to 2.55 kN. t can be explained by the fact that the volume of the soil interacting with the disk increases.

Increasing the speed from 6.0 km/h to 8.0 km/h led to a slight improvement in the soil compaction quality, that is, an increase in the amount of fractions smaller than 50 mm in size. This can be explained by the increase in the impact force applied to the soil by the working body as the speed increases. (1), (2), (3) regression equations are solved from the condition that the criterion "YK" should not be less than 80 percent, the criterion "Yh" should be at least 24 cm, and the criterion "YR" should have a minimum value, 6.0-8 of the aggregate, In the range of speeds of 0 km/h, it was found that the angle of installation of the piston in relation to the direction of movement is 28-330, and its diameter is in the range of 515-570 mm [6,7].

CONCLUSION

In order to create agrotechnically demanded husks, it is necessary to use a husk collector in the form of spherical discs with a diameter of 550 mm. Changing the angle of installation of the plow in relation to the direction of movement from 15° to 40° leads to an improvement in the quality of soil penetration and an increase in its resistance to traction. The height of the ridge and the total thickness of the softened layer increases when this angle changes from 15° to 30°, and remains unchanged at 30-40°. Increasing the speed of the aggregate from 6.0 km/h to 8.0 km/h improves the quality of soil compaction and increases the traction resistance of the working body. As the speed increased, the level of soil compaction and the resistance of the working body increased, and the height of the pile decreased.

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