ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 7, Issue 6 , June 2020

Results of Experimental Research on the Substantiation of the Parameters of the Tooth Harrow Copying the Field

Abduvahobov Dilshod, Ismatullayev Kahramon, Madrahimova Muyassarhon

PhD in Technical Sciences, PhD. Department of General Technical Sciences, Namangan Engineering and Construction Institute, Namangan, Uzbekistan
Trainee teacher, Department of General Technical Sciences, Namangan Engineering and Construction Institute, Namangan, Uzbekistan
Teacher Department of Information technology in technical systems Namangan Engineering and Construction Institute, Namangan, Uzbekistan

ABSTRACT: The article presents the results of multivariate experiments according to the Hartley-5 plan. At the same time, the length of the tooth, the angle of its sharpening, the thickness, the length of the lower pointed part and the speed of the movement of the unit were chosen as factors affecting the quality and energy performance of the tooth harrow copying the relief of the field. At the same time, it was established that at a certain speed of movement of the unit it provides tillage according to agrotechnical requirements at lower energy costs, the analysis showed that all factors had a significant impact on the evaluation criteria.

KEY WORDS:One and multi-factor experiments of tooth length, sharpening angle, thickness, length of the lower sharpened part, the width of the tooth spacing, the vertical load on the tooth, unit, tooth harrow.

I.INTRODUCTION

It is known that due to the rigid (fixed) attachment to the frame, the teeth of the harrow used in early and pre-sowing tillage are not able to adapt sufficiently to irregularities and, as a result, the field surface is not evenly treated and complete weed control is not provided. In order to prevent this in the farms, the harrowing is carried out in two tracks by harrows installed in two rows after the track. But this leads to an increase in the size of the unit, a sharp increase in energy intensity, as well as to a decrease in the maneuverability and productivity of the unit. The search and analysis of literary and patent information materials showed [1] that the noted shortcomings can be eliminated by developing a tooth harrow that copies the field topography, i.e. adaptable to uneven field surface. The developed tooth harrow [2] consists of a frame and working links connected to each other and the frame articulated. In the process, the teeth of this harrow copy the irregularities of the field surface and perform angular and vertical vibrations in the longitudinal-vertical plane. As a result, the uniformity of the depth of loosening of the soil and the quality of its crumbling are improved, seedlings of weeds are more completely destroyed.

II. SIGNIFICANCE OF THE SYSTEM

In world practice, various working bodies and machines have been developed to increase the efficiency of pre-sowing tillage. They were recommended by design organizations for the development of new machines.V.P. Kondratyuk, R.I.Baymetov, A.Tukhtakuziev, I.K. Kodirov, S.Narkulov, and R.B.Safarov and others.Machines and tools created as a result of these studies are used in agriculture and certain positive results have been achieved in this direction.In these works, studies were conducted to improve technology and technical equipment, as well as their working bodies for pre-sowing tillage. However, they have not sufficiently studied the development of a tooth harrow that copies the topography of the field[3].

III. LITERATURE SURVEY

To justify the parameters of the tooth harrow, copying the relief of the field, the results of one and multi-factor experiments are presented to study the influence of the length of the teeth of the harrow, the angle of taper, thickness,

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 7, Issue 6 , June 2020

the length of the lower pointed part, the width of the tooth spacing, the vertical load on the tooth, the vertical distance from the supporting plane of the harrow to the lower points of its attachment, as well as the speed of the unit on the quality and energy indicators of its operation.

To conduct experimental studies, a laboratory-field device of a tooth harrow was made, copying the relief of the field, working links that allowed changing the width of the inter-tooth gap, teeth with different lengths, lengths of the lower pointed part and different angles of sharpening.

Multivariate experiments were conducted according to the Hartley-5 plan. At the same time, the following factors were selected as factors affecting the quality and energy performance of the tooth harrow copying the field topography: tooth length, angle of its sharpening, thickness, length of the lower pointed part and speed of the unit (Table).

Table

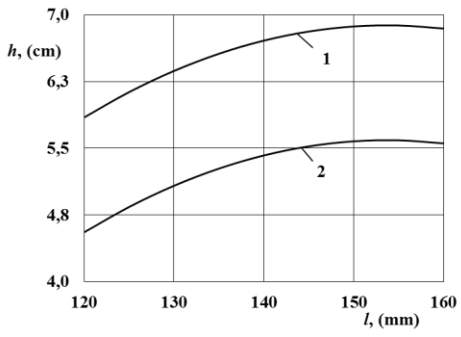
№	Name of factors	Destination	Interval of factors	Factor level		
				below	the middle	higher
1.	Harrow tooth length, mm	X_1	20	120	140	160
2.	Harrow tooth sharpening angle, mm	X_2	10	60	70	80
3.	Harrow tooth thickness, mm	X_3	2,5	17,5	20,0	22,5
4.	Length of the lower pointed part of the harrow tooth, mm	X_4	5	20	25	30
5.	Harrow assembly speed km/h	X_5	1,5	6,0	7,5	9,0

The depth of cultivation, the degree of crumbling of the soil, i.e. number of fractions less than 25 mm in size and traction resistance of the harrow.

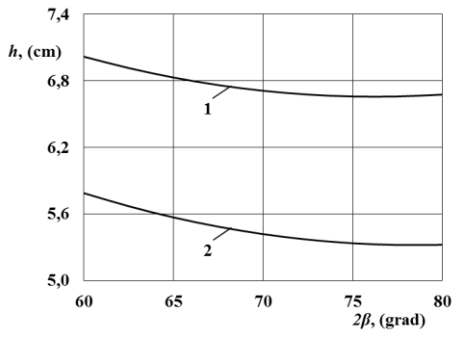
After processing the experimental results, the following regression equations were obtained that adequately describe the evaluation criteria:

- byprocessingdepth (cm)

$$Y_1=5,361+0,5X_1-0,202X_2-0,644X_3+0,646X_4-0,646X_5-0,364X_1^2+0,085X_1X_4+0,136X_2^2-$$
$$-0,027X_2X_3-0,031X_2X_5+0,186X_3^2-0,297X_4^2-0,297X_5^2; \quad (1)$$

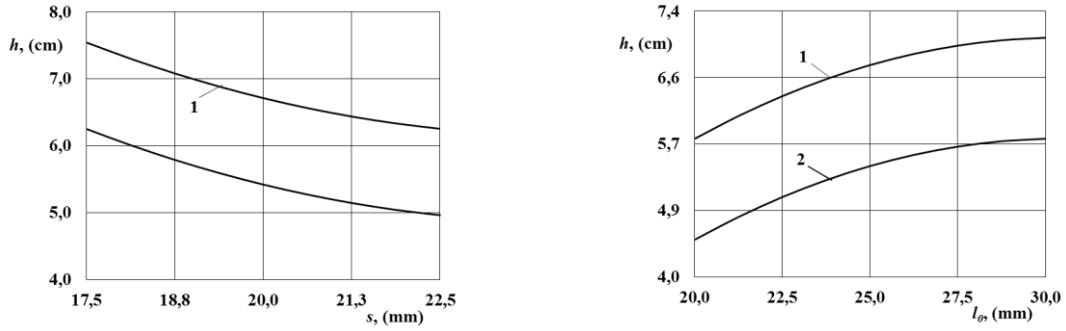


a)



b)

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 7, Issue 6 , June 2020



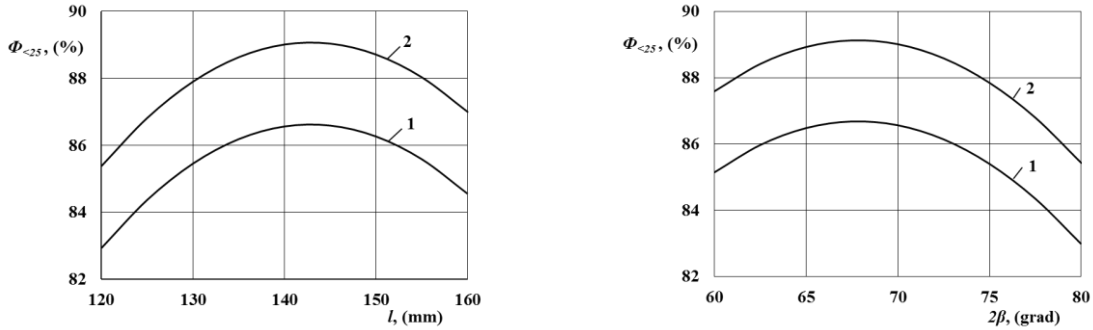
c) **d)**

1 and 2, respectively, at a unit speed of 6 and 9 km / h

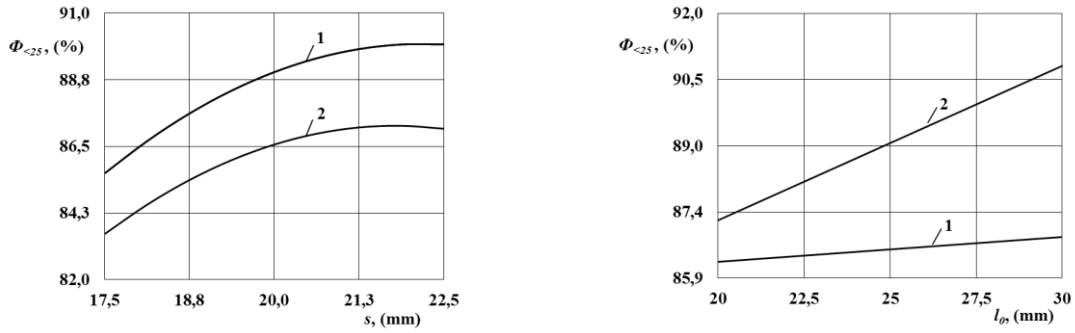
Fig. 1. Graphs of changes in the length of the teeth (a), the angle of sharpening (b) the thickness (c) and the length of the lower pointed part of the tooth (d), depending on the depth of processing of the articulated-tooth harrow

- by the degree of crumbling of the soil in the loosened layer (%)

$$Y_2=88,86+0,81X_1-1,08X_2+1,976X_3+1,0319X_4+1,224X_5-2,823X_1^2-0,383X_1X_2-2,507X_2^2+0,537X_2X_3-0,283X_2X_4-1,24X_3^2+0,733X_3X_4+1,2X_3X_5+0,746X_4X_5-1,073X_5^2; \quad (2)$$



a) **b)**



c) **d)**

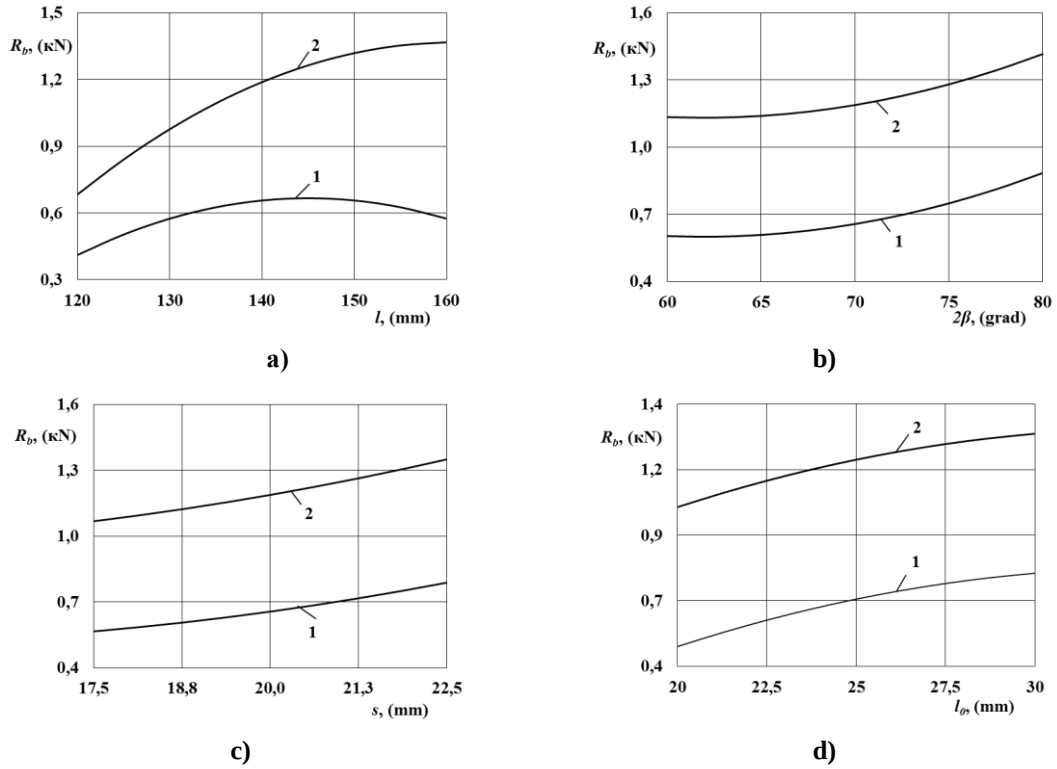
1 and 2, respectively, at a unit speed of 6 and 9 km / h

Fig. 2. Graphs of changes in the length of the teeth (a), the angle of sharpening (b) to the thickness (c) and the length of the lower pointed part of the tooth (d) of the articulated tooth harrow, depending on the degree of crumbling of the soil in the loosened layer

- tractionresistance (kN)

$$Y_3=0,803+0,212X_1+0,141X_2+0,126X_3+0,14X_4+0,266X_5-0,163X_1^2+0,046X_1X_2+0,046X_1X_3+0,15X_1X_4+0,13X_1X_5+0,087X_2^2-0,036X_2X_3+0,035X_2X_4+0,0000047X_2X_5+0,021X_3^2-0,026X_3X_4+0,015X_3X_5-0,041X_4^2+0,119X_5^2. \quad (3)$$

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 7, Issue 6 , June 2020



1 and 2, respectively, at a unit speed of 6 and 9 km / h

Fig. 3. Graphs of changes in the length of the teeth (a), the angle of sharpening (b), the thickness (c) and the length of the lower pointed part of the tooth (g), depending on the traction resistance of the articulated tooth

Analysis of the obtained regression equations showed that all factors had a significant impact on the evaluation criteria.

IV. METHODOLOGY

To conduct experimental studies, a laboratory-field device of a tooth harrow was made, copying the relief of the field, working links that allowed changing the width of the inter-tooth gap, teeth with different lengths, lengths of the lower pointed part and different angles of sharpening.
Multivariate experiments were conducted according to the Hartley-5 plan.

V. EXPERIMENTAL RESULTS

According to the agro technical requirements of criterion Y_1, i.e. processing depth should be within 4-6 cm; criterion Y_2, i.e. the degree of crumbling of the soil should be at least 80%; criterion Y_3, i.e. traction resistance of the harrow should have a minimum value. Given these conditions, the regression equations (1) - (3) were solved together using MS Excel and Planex programs. At the same time, it was found that when working at speeds of 7-9 km / h, the tooth harrow copying the topography of the field provides tillage according to agro technical requirements with less energy consumption with a tooth length of 132-140 mm and an angle of sharpening of 66-71 ° , thickness –19-22 mm, length of the lower pointed part - 20–25 mm.

VI.CONCLUSION AND FUTURE WORK

The search and analysis of literature and patent information materials made it possible to develop the design of a tooth harrow that copies the topography of the field, ensures the formation of a small crusty soil layer on the field surface and the complete destruction of weeds, which has high productivity and low energy consumption.

ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 7, Issue 6 , June 2020

REFERENCES

[1]. Rudenko N.E. “Mechanization of tillage” Moscow: Publishing House "StGAU AGRUS", 2005, pg no: 112-113.
[2]. Tukhtakuziev A., Mukhamedov J., Umurzakov A., Abduvahobov D. “No. FAP 01174.Harrow” Patent of the Republic of Uzbekistan Publ,April 2014; pg no: 88.
[3]. Abduvahobov D.A. Development and justification of the parameters of the tooth harrow, copying the relief of the field. autoref. dis. ... Doctor of Philosophy tech. Sciences IMESH, Tashkent, Aug 2018, pg no: 44