RESULTS OF EXPERIMENTAL RESEARCH OF LOOSENER OF COMBINED MACHINE

Makhamov Khojakhmat Tavashovich
candidate of technical sciences, docent .Department of "Labor Training" ,Karshi State University
Address: 180100, Uzbekistan, Karshi city, Kuchabog street, 17,Email id: qardumt@mail.ru
Turdiyev Elmurza Djurayevich
candidate of pedagogical sciences, docent ,Department of "Labor Training" ,Karshi State University
Address: 180100, Uzbekistan, Karshi city, Kuchabog street, 17,Email id: qardumt@mail.ru
Tilovov Yunus Suvonovich
candidate of technical sciences ,Department of "Labor Training" ,Karshi State University
Address: 180100, Uzbekistan, Karshi city, Kuchabog street, 17,Email id: qardumt@mail.ru
Astanova Mokhira Mukhtorovna
Teacher ,Department of "Labor Training" ,Karshi State University
Address: 180100, Uzbekistan, Karshi city, Kuchabog street, 17 ,Email id: rtoshev1993@mail.ru
Elmurodov Nuriddin Saidmurodovich
Teacher ,Department of "Labor Training" ,Karshi State University
Address: 180100, Uzbekistan, Karshi city, Kuchabog street, 17, ,Email id: elmurodov_nuriddin@mail.ru

ABSTRACT
The article presents the results of an experimental study of a combined machine softener. Experimental studies have studied the impact of softener blades on the grinding angle, opening angle, coverage width, mounting height relative to the horizontal plane, and aggregate movement speed to soil tillage depth and softener resistance to gravity. According to the results of experimental studies, the grinding angle of the softener blades should be 25-30 degrees ($\beta_п$=25-30°), opening angle 30-35 degrees ($\gamma_п$=30-35°), coverage width 20 cm ($b_п$=20 cm) and installation height 15 cm ($h_п$=15 cm) relative to the horizontal plane to ensure quality tillage at the level of soil requirements with low energy consumption.

Keywords:
Combined machine, sand, softener, right and left blades, grinding angle, opening angle, coverage width, strain gauge, strain gage, gravity resistance.
Article Received: 18 October 2020, Revised: 3 November 2020, Accepted: 24 December 2020

Introduction

In order to reduce energy and labor costs in agricultural production, the use of advanced technologies in the cultivation of agricultural crops in order to save resources, the development of high-efficiency agricultural machinery is being carried out in the country [1-4].

In particular, research work is being carried out to develop new scientific and technical bases of resource-saving technologies of basic tillage protection from wind and water erosion and the technical means of their implementation [5,8-10].

The analysis shows the need to develop technology and special weapons for tillage in the conditions of Uzbekistan [11-13]. However, the development of technology and technical means of minimal tillage, which can be carried out simultaneously with anti-erosion tillage on dry sloping lands, has not been sufficiently studied. Therefore, it is important to conduct experimental studies to substantiate the design parameters of softeners that can be used without tilting the soil against erosion on sloping soils.

Problem statement and research method

The object of the study was the softeners of the combined machine for overturning. The study of technological working processes of combined machine softeners was carried out on the basis of the literature and the results of field tests [14-15].

According to the results of theoretical research [6,7], in order to study the effect of combined machine softeners on the tillage process, special left and right blades and softeners with different grinding angles, opening angles and coverage widths were developed. The main parameters of the softener made for the studies are given in Table 1.

Experimental research was conducted in the fields of Meylisay lalmi farm of Kashkadarya region and the Scientific Research Institute of Agricultural Mechanization of Yangiyul district of Tashkent region. In experimental studies, the impact of the softening blades on the grinding angle, opening angle, coverage width, mounting height relative to the horizontal plane and aggregate movement speed on the tillage depth of the soil and the gravitational resistance of the softener were studied.

Soil compaction quality and tillage depth defined through TSt 63.04:2001 "Agricultural machinery tests. Machines and implements for surface tillage. Test program and methods" [8]. In this case, the depth of processing was determined by immersing a line with a cross-sectional area of 1 cm^2 to the bottom of the treated layer. Measurements were made to an accuracy of ±0.1 cm. At both speeds, 50 measurements were made in four repetitions.

Table 1 Basic parameters of softeners made for research

T/p	Parameters	Working bodies
1	Height of the softener, cm	63
2	Crushing angle of the softener shaft, degrees	28
3	The width of the softener shaft, cm	5
4	Length of softener shaft, cm	12
3	Crushing angle of softener blades, degrees	28
4	Opening angle of softener blades, degrees	35
5	Coverage width of softener blades, cm	20
6	Installation height of softener blades relative to the horizontal plane, cm	15

Gravity resistance of working bodies using "Г"-shaped strain gauge TSt 63.03.2001 "Agricultural machinery tests. Machine Energy Evaluation Methods "[9].

Research results and their discussion. Slopes with combined machine softeners are affected by the turning angle, opening angle, coverage width and installation height relative to the horizontal plane of the softener blades.

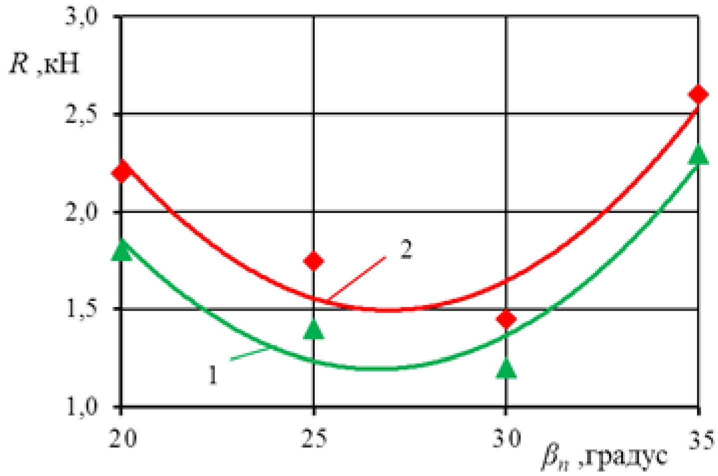
In determining the effect of the grinding angle of the softener blades on its performance, its coverage width was set at 20 cm, installation height relative to the horizontal plane was 15 cm, opening angle was set at 35 degrees and unit speed was 7 and 9 kmph. The grinding angle of the softener blades was changed from 20 degrees to 35 degrees in the range of 5 degrees.

Table 2 The results of experiments to study the effect of the grinding angle of the softener blades on its performance

Name of indicators		Speed, kmph	Crushing angle of softener blades, degrees			
			20	25	30	35
Processing depth, cm	M_{av}	7	24,1	23,9	24,2	23,5

		9	23,6	23,6	23,8	23,3
	±σ	7	0,6	0,8	0,9	0,7
		9	0,7	0,6	0,7	0,6
Gravity resistance, kN		7	1,8	1,4	1,2	2,3
		9	2,2	1,75	1,45	2,6

According to the data, the softening gravitational resistance of the blades decreased with increasing grinding angle from 20 degrees to 33 degrees, and increased with increasing from 33 degrees to 35 degrees.



1, 2 - the aggregate speed was 7 and 9 kmph, respectively

Figure 1. The resistance of the softener to gravity varies depending on the grinding angle of the blades

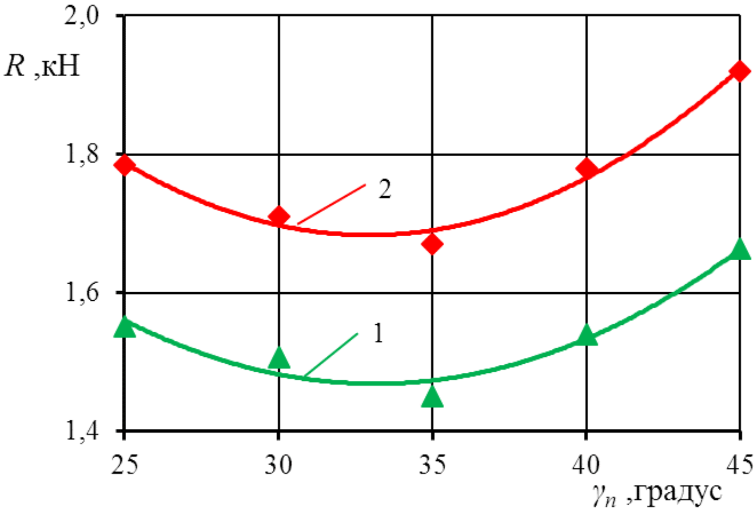
The change in the grinding angle of the softener blades in the range of 20-30 degrees did not significantly affect the machining depth. However, an increase in the angle from 30 degrees to 35 degrees resulted in a decrease in machining depth.

In determining the effect of the opening angle of the softener blades on its performance, its coverage width was set at 20 cm, the grinding angle at 28 degrees, the installation height relative to the horizontal plane at 15 cm and the unit speed at 7 and 9 kmph. The opening angle of the softener blades was changed from 25 degrees to 45 degrees in the range of 5 degrees.

Table 3 The results of experiments to study the effect of the opening angle of the softener blades on its performance

Name of indicators		Speed, kmph	Opening angle of softener blades, degrees				
			25	30	35	40	45
Processing depth, cm	M_{av}	7	23,5	23,8	24,1	23,1	23,2
		9	23,3	23,5	23,9	22,9	23,0
	±σ	7	0,7	0,6	0,5	1,1	0,8
		9	0,9	0,8	0,6	0,8	1,0
Gravity resistance, κN		7	1,55	1,51	1,45	1,54	1,66
		9	1,78	1,71	1,67	1,78	1,92

An increase in the opening angle of the softener blades from 25 degrees to 35 degrees resulted in an increase in machining depth, while an increase from 35 degrees to 45 degrees resulted in a decrease.



1, 2 - the aggregate speed was 7 and 9 kmph, respectively

Figure 2. The resistance of the softener to gravity varies depending on the opening angle of the blades

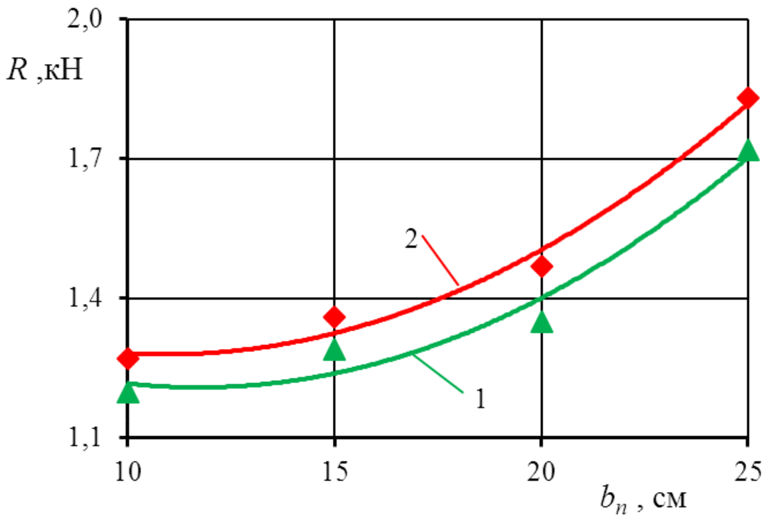
It can be seen from the data that the gravitational resistance of the softener changed in the form of a sunken parabola depending on the opening angle of the blades, i.e. it decreased in the 25-35 degree angle range and increased in the 35-45 degree angle range.

In experimental studies to study the effect of softener blade coverage on its performance, the coverage width of softener blades varied from 10 cm to 25 cm at 5 cm intervals. At the same time, the speed of the unit was set at 7 and 9 kmph, and the opening angle of the softener blades was taken as 35 degrees, the angle of grinding was 28 degrees, and the installation height relative to the horizontal plane was 15 cm.

Table 4 Results of experiments to determine the coverage width of softener blades

The coverage of the softener blades is wide, cm	Aggregate speed, kmph	Processing depth, cm		Gravity resistance, кN
		M_{av}	$\pm\sigma$	
10	7	24,6	0,5	1,2
	9	24,4	0,6	1,27
15	7	24,2	0,7	1,29
	9	23,8	0,9	1,36
20	7	23,6	0,8	1,35
	9	23,2	0,9	1,47
25	7	22,9	0,6	1,74
	9	22,4	0,7	1,83

According to Table 4, an increase in the coverage width of the blades by 10–15 cm did not significantly affect the processing depth. As the coverage width of the blades increased from 15 cm to 25 cm, the machining depth decreased.



1, 2 - the aggregate speed was 7 and 9 kmph, respectively

Figure 3. The resistance of the softener to gravity varies depending on the coverage width of the blades

As shown in Fig. 3, the tensile resistance of the softener also increases as the coverage width of the blades increases by 10–25 cm. However, an increase in speed from 7 kmph to 9 kmph also led to an increase in the gravity resistance of the softener. The main reason for this is that as the speed increases, the impact of the softener on the ground and the inertial forces acting on the softener by the soil increase.

In experimental studies to study the effect of softening blades on the performance of the installation height relative to the horizontal plane, the installation height of the blades relative to the horizontal plane varied from 9 cm to 18 cm in the range of 3 cm. In this case, its crushing angle, opening angle and coverage width were unchanged and were 28 degrees, 35 degrees and 20 cm, respectively. The speed of the unit was set at 7 and 9 kmph.

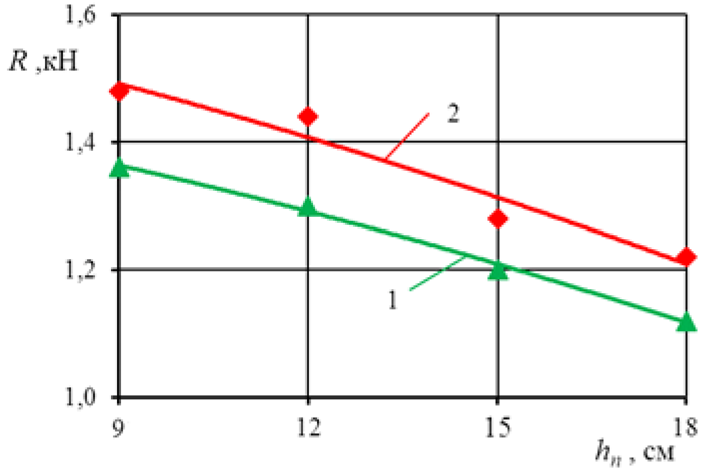
The results of the experiments are presented in Table 5 and Figure 4.

Table 5 The results of experiments to determine the mounting height of the softener blades relative to the horizontal plane

Installation height of softener blades relative to the horizontal plane, cm	Aggregate speed, kmph	Processing depth, cm		Gravity resistance кN
		M_{av}	$\pm\sigma$	
9	7	22,2	0,9	1,36
	9	22,0	1,1	1,48
12	7	23,3	0,7	1,31
	9	23,1	0,5	1,44
15	7	24,2	0,8	1,20
	9	23,9	0,6	1,28
18	7	24,4	0,9	1,12

	9	24,1	0,7	1,22

According to Table 5, an increase in the installation height of the blades relative to the horizontal plane in the range of 9–18 cm had a significant effect on the machining depth, i.e. a decrease in the installation height of the blades relative to the horizontal plane resulted in a decrease in machining depth.



1, 2 - the aggregate speed was 7 and 9 kmph, respectively

Figure 4. Variation of the softening gravity resistance depending on the mounting height of the blades relative to the horizontal plane

The results of the experiments show that the increase in the mounting height of the softener blades relative to the horizontal plane from 9 cm to 18 cm led to a decrease in the tensile strength of the softener. This is due to the increase in soil volume that affects it as the installation height of the softener blades relative to the horizontal plane decreases. An increase in speed from 7 km / h to 9 km / h resulted in an increase in the traction resistance of the softener.

Conclusion

The laws of variation of the gravitational resistance of the softener depending on the design parameters of the blades, operating conditions and soil properties were studied. It is advisable to have a grinding angle of 25-30 degrees, an opening angle of 30-35 degrees, a coverage width of 20 cm and an installation height of 15 cm relative to the horizontal plane to ensure quality tillage at the level of soil requirements with low energy consumption.

References

[1] Tovashov R.Kh., Makhamov Kh.T. Analysis of combined machines for minimal tillage of soil // International Journal of Advanced Research in Engineering and Technology - Vol. 11, Issue 8, August 2020. pp. 609-616

[2] Mahamov Kh.T., Tovashov R.Kh., Ochilov S.U. Part of the soil surface with minimal tillage analysis of lateral suction techniques and technologies / Academicia: An International Multidisciplinary Research Journal - Kurukshetra, 2020. - №10 (4). – p. 706-713

[3] Umurzakov U., Mirzaev B., Маматov F., Ravshanov H., Kurbonov S. A rationale of broach-plow's parameters of the ridge-stepped ploughing of slopes XII International Scientific Conference on Agricultural Machinery Industry IOP Conf. Series: Earth and Environmental Science 403(2019) 012163 IOP Publishing doi:10.1088/1755-1315/403/1/012163.

[4] Mirzaev B., Mamatov F., Chuyanov D., Ravshanov X., Shodmonov G., Tavashov R. and Fayzullayev X. Combined machine for preparing soil for cropping of melons and gourds XII International Scientific Conference on Agricultural Machinery

Industry. doi.org/10.1088/1755-1315/403/1/012158.

[5] Mahamov Kh.T., Tovashov R.Kh. Analysis of techniques and technologies for intra soil application of organic fertilizers preparation of soil for sowing / International Journal of Psychosocial Rehabilitation - London, 2020. - №24 (08). – p. 7977-7983.

[6] Tovashov R.Kh., Makhamov Kh.T., Tovashov B.R. Justification of Parameters of the Loosening Working Body // International Journal of Advanced Research in Science, Engineering and Technology Vol. 7, Issue 7 , July 2020. pp. 14336-14339

[7] Tovashov R.Kh. Theoretical basis of the crushing angle of the loosening working body blades of the combined machine // Инновационная наука – Уфа, 2020. - №10. – с. 23-25

[8] Mirzaev B., Mamatov F., Ergashev I., Ravshanov H., Mirzaxodjaev Sh., Kurbanov Sh., Kodirov U. and Ergashev G. Effect of fragmentation and pacing at spot ploughing on dry soils E3S Web of Conferences 97 https://doi.org/10.1051/e3sconf/201913501065.

[9] Mirzaev B., Mamatov F., Aldoshin N. and Amonov M. Anti-erosion two-stage tillage by ripper Proceeding of 7th International Conference on Trends in Agricultural Engineering 17th-20th September (Prague Czech Republic) – pp 391-396.

[10] Mamatov F., Ergashev I., Ochilov S., Pardaev X. Traction Resistance of Soil Submersibility Type "Paraplau" // Jour of Adv Research in Dynamical & Control Systems, Vol.12, 07-Special Issue, 2020. DOI: 10.5373/JARDCS/V12SP7/20202336. ISSN1943-023X.

[11] Mamatov F., Mirzaev B., Batirov Z., Toshtemirov S., Tursunov O., Bobojonov L. Justification of machine parameters for ridge forming with simultaneous application of fertilizers // CONMECHYDRO – 2020 IOP Conf. Series: Materials Science and Engineering 883(2020) 012165 IOP Publishing doi:10.1088/1757-899X/883/1/012165.

[12] Mirzaev B.S., Mamatov F.M. Protivojerozionnaja tehnologija grebnisto-stupenchatoj vspashki i plug dlja ee osushhestvlenija [Anti-erosion technology of comb-stepping plowing and plow for its implementation] // Prirodoobustrojstvo [Environmental Engineering]. Moskva, 2015. –№2. – P.81-84. [in Russian].

[13] Mamatov F.M., Mirzaev B.S., Avazov I.J. Agrotehnicheskie osnovy sozdanija protivojerozionnyh vlagosberegajushhih tehnicheskih sredstv obrabotki pochvy v uslovijah Uzbekistana [Agrotechnical foundations for the creation of anti-erosion water-saving technical equipment for soil cultivation in Uzbekistan] // Prirodoobustrojstvo [Environmental Engineering]. Moskva, 2014.– № 4. – P.86-88. [in Russian].

[14] Mamatov F.M., Mirzaev B.S., Avazov I.J., Buranova Sh.U., Mardonov Sh.X. K voprosu jenergosberegajushhej potivojerozionnoj differencirovannoj sistemy obrabotki pochvy [On the issue of energy-saving anti-erosion differentiated soil treatment system] // Innovacii v sel'skom hozjajstve [Innovations in agriculture]. Moskva, 2016. – № 3(18). – P.58-63. [in Russian].

[15] Mamatov F.M., Batirov Z.L., Khalilov M.S., Kholiyarov J.B. Trekhyarusnoe vnesenie udobreniy tukoprovodom-raspredelitelem glubokorykhlitelya [Three-tiered fertilizer application with a spreading funnel of a subsoil tiller]. Sel’skokhozyaystvennye mashiny i tekhnologii. 2019. Vol.13. – № 4. 48-53 [In Russian]. DOI 10.22314/2073-7599-2019-13-4-48-53.