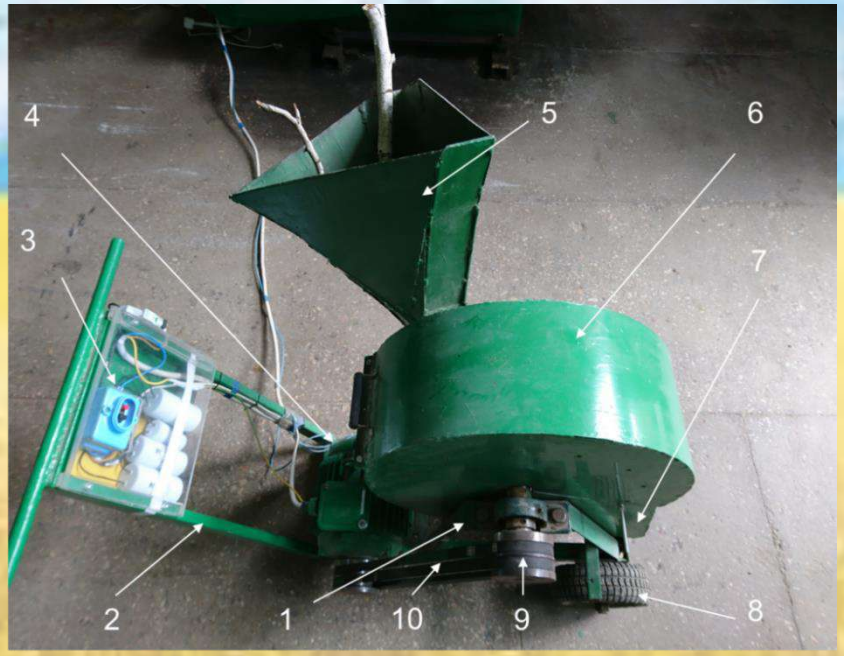
After taking into account all the advantages and eliminating the disadvantages of the analyzed structures of the above-mentioned mechanical means. Scientists and students of the Department «Agricultural Engineering and Automobile Transport» of the Faculty of engineering and technology of the Poltava State Agrarian University designed and patented the small-sized chopper of wood branches



1 - support stand; 2-chopper movement handle; 3-control panel; 4-electric motor; 5-loading tray; 6- chopping drum; 7- discharge opening; 8-rubber wheels; 9 – driven pulley; 10 – V-belt transmission;

Fig. General view of the developed chopper of tree branches

Definition the cutting angle of tree branches during the feeding

Conducted studies on the search for values of optimal parameters (the cutting angle of tree branches during the feeding and the distance of the knife protrusion from the disk plane) and their influence on the power consumption of electric motor of the chopper

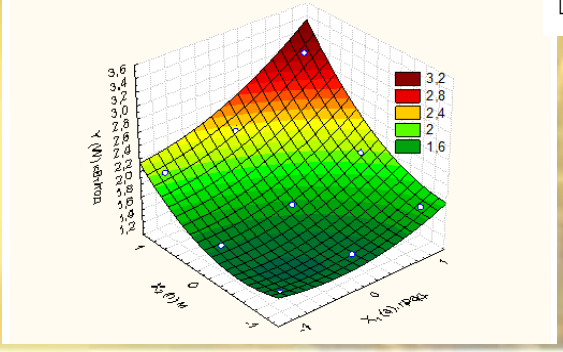
definition the distance of the knife protrusion from the disk plane

Statistical indicators of power consumption

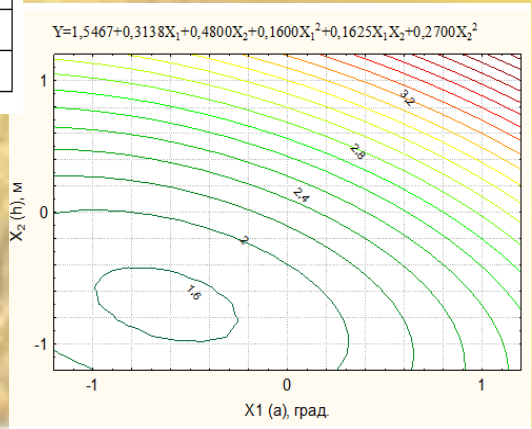
Experimental conditions				Results of experiment				Results of calculations		
	$j=0$	$j=1$	$j=2$							
i	X_0	X_1	X_2	y'_{ei}	y''_{ei}	y'''_{ei}	y_{ei}	y'_{pi}	$y_{ei}-y'_{pi}$	$\Delta\%$
1	+1	-1	-1	1,29	1,32	1,28	1,30	1,29	0,01	0,77
2	+1	0	-1	1,36	1,38	1,40	1,38	1,39	0,01	0,72
3	+1	+1	-1	1,66	1,62	1,67	1,65	1,63	0,02	1,21
4	+1	-1	0	1,42	1,44	1,40	1,42	1,42	0	0
5	+1	0	0	1,60	1,60	1,57	1,59	1,62	0,03	1,85
6	+1	+1	0	1,97	1,94	1,94	1,95	1,94	0,01	0,51
7	+1	-1	+1	2,10	1,89	2,01	2,00	1,99	0,01	0,50
8	+1	0	+1	2,20	2,21	2,22	2,21	2,18	0,03	1,36
9	+1	+1	+1	3,01	3,00	2,99	3,00	3,02	0,02	0,67

Graphical interpretation of the dependence of the power consumption of the branch chopper on the cutting angle and the size of the knife protrusion .

$Y=1,5467+0,3138X_1+0,4800X_2+0,1600X_1^2+0,1625X_1X_2+0,2700X_2^2$



Regression levels of power consumption of the branch chopper



To determine the power consumption of small-sized branch chopper, the equation form will be:

$$W = 0{,}3138\alpha - 0{,}6167 \cdot h + 0{,}0244\alpha \cdot h + 0{,}1600\,\alpha^2 + 0{,}2700\,h^2 - 28{,}335,$$

- where *a* is the cutting angle (the angle of feeding the branches to the loading tray), *a=15X1+45* ;

- h - are the knife protrusion values, *h=0,01X2+0,015*

- we found out the optimal cutting angle settings should be considered at *a=30 degrees 00 minutes....41 degrees 45 minutes*

- we found out the optimal settings for the size of the protrusion of the knives should be considered at *h=0,005....0,011m*

- we found out with optimal settings the power consumption of the electric motor of a small-sized tree branch chopper will be optimal and it will be equal *to W=1,29…1,83kw/h*

The results of conducted research will help the population in utilization of tree branches, shrubs and other plant residues

1 - Cod biomass as fuel material;

2 - Miscanthus biomass as fuel;

3 - Coniferous biomass as a feed additive to animal feeding rations;

4- Cod biomass as mulch basal part of the tree;

5- Cod biomass as insulation material for grape vines;

6 - Biomass of cod prevents the penetration of pests, in particular the roach, in raspberry plantations;

7 - The grass biomass in the vineyards promotes the natural development of the beneficial bacteria of the hay bacillus;

8 - Biomass of tree bark is used in landscape design;

9 - Cod biomass for the production of heat-insulating arbolite;

10 - Cod biomass for construction.

Prospects for further research.

The Considering that the improvement of choppers does not stop in any case, theoretical studies of their energy-saving operating modes will continue. Mechanical means for chopping are becoming more and more complex, they combine more and more operations (cutting, chopping, sieving, etc.) in their work, so the studying of their possibilities for use in various areas of management and in households in particular is a complex practical task that requires non-standard approaches and original solutions.

Conclusions

1. A comparative multi-criteria analysis of existing technologies for chopping of branches of fruit trees cut during the care for their crown indicates the feasibility of using the technological process of chopping the branches with their subsequent use as fuel material.

2. The introduction of technology for utilization of cut branches using the developed chopper of tree branches will allow to reduce labor costs by 1.4 times, to get more fuel material by 2.6 times and to reduce the mentioned operating costs by 1.9 times compared to the existing technology, which involves burning wood branches.g the branches with their subsequent use as fuel material.

3. The proposed technology for utilization of cut branches will allow to eliminate environmental pollution and additionally use the chopped wood as organic fertilizer or mulch.

4. It is established that the average length of the particle of chopped tree branches, which meets the technical requirements of boiler operation, in the total weight of the chopped material is about 87% with the length of 3.15 mm to 67.5 mm. So, the chopped material can be can be classified as class P100CEN/TS 14961:2005 according to the classification standard.

5. The use of optimal values of the parameters for setting of the chopping machine will lead to the sorting of branches by their diameter. Such studies will be promising because there is a growing demand for universal machines with the ability to customize them for certain types of branch raw materials for chopping and their operation requires a theoretical basis.

THANK YOU FOR YOUR ATTENTION!

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