RESEARCH REGARDING DETERMINATION OF WORKING INDEXES FOR TRC 150 CHOPPING MACHINE

CERCETĂRI PRIVIND DETERMINAREA INDICILOR DE LUCRU AI MAŞINII DE TOCAT TRC 150

GROSU I.[1]
e-mail: grosuionel@yahoo.com

Abstract. *The experiments were conducted in 2009-2010 at the University Agricultural Experimental Didactic Station in a vineyard inhabited with a Chasselas Dore variety. The experiments had targeted the determination of the main indices of an aggregate consisting in a Goldoni Aster tractor and in a 45 TRC 150 chopper for vegetable scraps. For this purpose, various tests were conducted, aiming the establishment of an optimum operating speed for the string chopping work on the intervals between the vine rows. Based on the interpretation of the experimental facts, it was establish that the optimum experimental version of the strings' chopping work, is the one which has the higher quality indices, with a low fuel consumption.*

Key words: viticulture, strings' chopping work mechanization, fuel consumption.

Rezumat. *Experienţele au fost efectuate în perioada 2009-2010, într-o plantaţie de viţă de vie cu soiul Chasselas doré, din cadrul Staţiunii Didactice Experimentale a Universităţii Agronomice din Iaşi, şi au vizat determinarea principalilor indici pentru agregatul format din tractorul Aster 45 Goldoni şi tocătoarea pentru resturi vegetale TRC 150. Pentru aceasta s-au efectuat diferite încercări, care au urmărit stabilirea vitezei optime de lucru pentru efectuarea lucrării de tocat coarde pe intervalele dintre rândurile de viţă de vie. În urma interpretării rezultatelor obţinute s-a stabilit varianta experimentală optimă a lucrării de tocat la care se obţin valori superioare ale indicilor de calitate, cu un consum redus de combustibil.*

Cuvinte cheie: viticultură, mecanizarea lucrării de tocat coarde, consum de combustibil.

INTRODUCTION

It is estimated that each year about 0.7 to 1.4 of t dry substance per hectare is lost out of our vineyards from all over the country after the dry cuttings (Bernaz and Dejeu, 1999).

An appreciable micro and macro elements contribution of a 6-20 kg / ha N, 0.7 to 3.6 kg / ha P and 6-20 kg / ha K is made possible by due to the vegetable strings scraps which are chopped and incorporated into the vineyards soils, over the year (Bernaz and Dejeu, 1999).

Researches made all over the world state that chopped strings' incorporation into the soil fertilizes and has a positive effect over the physical and

[1] University of Agricultural Sciences and Veterinary Medicine, Iaşi, Romania

chemical properties of the soil and it is a useful method because the land is immediately released, being ready for the following working stages.

Several researches had been carried out, in order to determine the efficiency of both strings' chopping and the resulting material incorporation's into the soil technologies.

Therefore, in 2009-2010, the TRC 150 chords chopper for vegetable scraps has been tested. The chords were left on the top of the soil between vine rows during the spring dry cuttings.

Based on the experimental results analysis, it is intended to introduce the TRC-150 machine into the vineyards maintenance technology with the main goal in reducing the fuel consumption, technological traffic, the workload used to remove cut strings, erosion and soil compaction.

MATERIAL AND METHOD

Measurements were taken in a vineyard founded in 1985, inhabited with the Chasselas Doré variety, with planting distances of 2.2 x 1.2 m and a density of 3787 vines / ha. The vineyard is located on a land with a slope of approximately 8%, exhibition west - south west and the vines rows are oriented towards the north – south direction along the contour. The predominant soil in this plantation is the cambic chernozem, with a clay-loam texture.

In spring, the chord chopping work has been done right after the dry using the TRC 150 machine manufactured by the italian company Rinieri.

The TRC 150 universal chopper (fig. 1) is composed of a frame fitted with a tractor coupling, a protective case, the rotor blades, the lifting cords teeth, the transmission mechanism and two skids for support and adjustament.

The protective case fixed on the top of the frame is made out of steel sheet. This part covers the machines' rotor blades.

The tractor coupling ensures the three points attachment to the towing machine. The machine can be fastened to the tractor side rods in two positions.

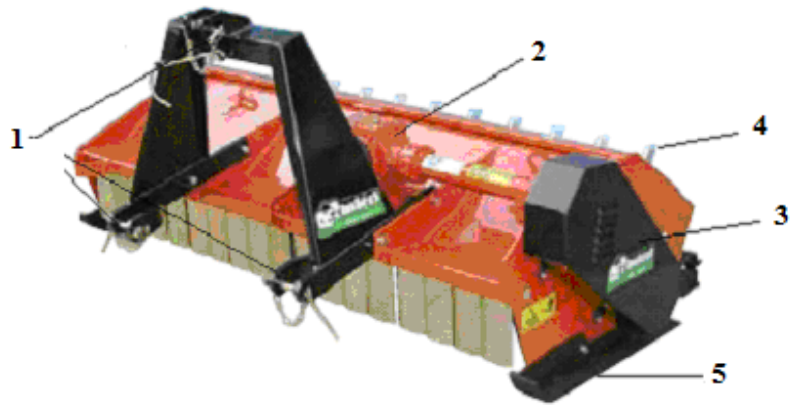

Fig. 1 - The TRC 150 universal chopper:
1 - triangular grip, 2 - the multiplier cone group, 3 - belt drive, 4 - toothed lifting, 5 - support skid.

The rotor with knives receives motion from the tractor PTO shaft. It consists of a steel shaft supported on two casings with oscillatory bearings, positioned perpendicular to the machine movement direction. The knives are fixed on a propeller shaft with two beginnings. The rotor shaft supports' number, respectively the number of blades pairs is 36.

Lifting tusks are made out of steel, have a rectangular section; their role is to pick up the strings sitting on the soil surface and to bring them in range of the knives. Therefore, the tusks are leaned forward and penetrate the soil while working at a depth of 1-2 cm (Neagu Tr. et al. 1980; Suditu P. et al 2002)

The two support strips are made of metal and can be adjusted vertically in order to obtain different rotor working heights from the surface of the soil.

The motion is transmited from the tractor PTO shaft by the means of a telescopic shaft, a conical gear, toothead wheels and drive belts. At 540 rpm speed of the tractor PTO, the rotor speed is 1600 rpm. Due to the rotor motion and the submission of the machine, the knives (the active organs) pick up the strings from the surface of the soil and chopp them by cutting and tearing. The rear tusks take the undriven strings and bring them into the rotor's action range, ultimately resulting in a continuous strip of chopped chords.

This machine was monted on an Aster 45 hp tractor, manufactured by Goldoni italian company, using the first, the second and the third gear,respectively three different speeds: very slow, slow and fast.

The devices used to determine the working indices are: simple metric frame, electronic balance, stopwatch, paper bags for taking samples and a device for measuring the fuel consumption.

In order to calculate these indices, the following formulas (Toma Dr. and Sin Gh., 1987) were used:

- **global chopping degree (G_{TG})**

$$G_{TG} = \frac{\sum_{i=1}^{i=n} \frac{G_i - G_f}{G_i}}{n} \cdot 100 \ (\%)$$

where: Gi is the amount of existing vines strings per unit area between of the rows before the machine passing, Gf - the amount of strings with a length of 20 cm on the same surface, after the machine passing.

- **the actual aggregate driving speed** (V_l)

$$V_l = 3{,}6\frac{S}{T} \ (\text{km/h})$$

where: S is the distance (in meters) that was needed to performe the timing, respectively 50 m, T – is the time (in seconds) that aggregate runs the distance.

hourly fuel consumption of the engine (Ch) is measured during the working process, with a special device mounted on the tractor.

In order to determine the fuel consumption, the volumetric method was used. The device (fig. 2) consists of two volumetric counters from CONTOIL family, type VZO 4, manufactured by AQUAMETRO AG in Switzerland, and a counter with six

simultaneously channels, model 9201, manufactured by TRUMETER company in England.

Fuel consumption is calculated as the difference between the recorded value of the C1 counter mounted on the engine's feed line and C2 counter mounted on the return line.

The value recorded by the electronic counter is displayed on the LCD screen's type, and by using the front panel button, any of the six counts can be selected for display on the screen.

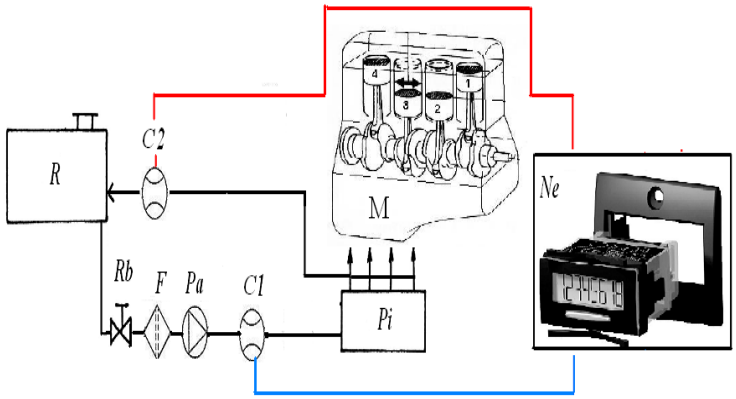

Fig. 2 - Mounting diagram of the fuel consumption measuring device
R - tank; Rb - tap F-filter, C1, C2 - volumetric meters, Pa. – fuel pump;
Pi - injection pump; Ne - electronic counter, M - Motor

The electornic counter has a RS 232 interface that allows connection to the PC in order to configurethe counters..

The hourly fuel consumption was calculated with the formula:

$$C_h = 3{,}6\frac{V_c}{t}\cdot\gamma \ \text{(kg/h)}$$

where: V_c - volume of fuel consumed (cm^3), t - the time recorded over the 50 m running distance, while the V_c volume of fuel is consumed (s); γ - the fuel density (0.845 g/cm^3 at a temperature of 15° C).

RESULTS AND DISCUSSIONS

Based on the measurements made in the vineyard, during the vine strings' chopping work with the TRC 150 macine,at working speeds between 0.65 and 7.51 km / h, the experimental results were presented in table 1.

The agrotechnicals requirements for this work impose that the percentage of chopped strings into fragments smaller then 10 cm should be at least 60%.

By summing the percentage values obtained for the 0-5 cm and 5-10 cm string fragments, is clear that the agrotechnicals requirementswerw obtained for working speeds contained between 0.65 and 5.92 km / h. It also clear that for speeds over 6 km / h, the chopping degree obtained is inadequate.

The TRC 150 vegetable scraps chopping machine has fragmented strings with a diameter between 0.45 cm and 1.7 cm, into segments shorter then 20 cm.

Table 1

The effect of the working speed over the fuel consumption and over t he chopping degree

Agricultural year	Working speed			C_h *kg/h*	The chopping degree (%)			
	Gear range	Gear	Effective speed *km/h*		*0-5 cm*	*5-10 cm*	*10-15 cm*	*15-20 cm*
2009	Very slow	I	0,66	3,5	52	16	12	20
		II	1,20	3,8	56	12	15	17
		III	1,91	4,3	59	10	6	15
	Slow	I	2,07	4,7	48	21	18	13
		II	3,73	5,2	53	17	11	19
		III	5,92	5,5	62	15	12	11
	Fast	I	7,50	6,1	24	27	26	23
2010	Very slow	I	0,65	3,3	64	5	7	24
		II	1,18	3,6	67	6	5	22
		III	1,89	4,1	68	7	5	19
	Slow	I	2,05	4,5	52	20	13	15
		II	3,66	5,0	55	18	15	12
		III	5,87	5,3	59	12	18	11
	Fast	I	7,51	6,2	19	21	27	33

The fuel consumption was comprised between 3.3 and 6.2 kg h, increasing when speed increased. It was established that the aggregate's optimum working speed for the vine strings chopping should be comprised between 5.92 to 6.0 km/h. For speeds above 6 km / h, the hourly fuel consumption and the chopping degree were much lower than the agrotechnical requirements.

CONCLUSIONS

1. Reducing the fuel consumption is an important goal for achieving an economic efficiency of a farm, because 10-15% of the price of agricultural products is due to fuel consumption and also because ofits effect over the environment protection.

2. Data obtained during the testing of the TRC 150 machine for the strings chopping in vineyards, show that this machine fulfils the requirements imposed by the agrotechnical specifications, except for speeds over 6 km / h, for which the vine chords' chopping degree is inadequate.

3. Using the TRC 150 vegetable scraps chopping machine to chop the vine chords, facilitates the acces of agricultural units during the rainy spring periods and reduces the costs related to the removal of the cut chords.

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