

THE USE OF A ROTAVATOR EQUIPEMENT AS A NEW SOIL MANAGEMENT PRACTICE IN CHESTNUT ORCHARDS: EFFECT ON VEGETATION CONTROL, ORGANIC RESIDUES PROCESSING AND SOIL PHYSICAL PROPERTIES

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Introduction

Chestnut orchards have a high economic and ecology importance in the rural environment of Northern Portugal. Previous studies have shown the need of new management practices in those agro-ecosystems in order to improve its productivity and sustainability and one of the envisaged techniques is the use of new equipment which destroys the vegetation under canopy and crushes the organic residues without disturbing the soil.

Material and methods

The equipments used in the present study, as alternative to the traditional tillage, have 1.3 m work width and allows a partial incorporation of leaves and burs in the soil and the weeds control. Supported by a new project the equipment (NTR) have been used and compared with the traditional tillage (TTC), the use of irrigated seeded pasture (ISP), unirrigated seeded pasture (USP) and the maintenance of natural vegetation cover (NTV), undercanopy. The obtained results related to the equipment operation, and the effects on the vegetation, on the residues processing and on the physical properties of the soil, are reported.

The methodology used in the trials consists of different tractors velocity, and standard equipment regime, which enables breaking in different sizes the vegetal ground surface material, especially the leaves and burs and, simultaneously the shallow mobilization of the soil, allowing the partial incorporation of that material. Smaller is the size of this material faster is its transformation into organic matter and less intense is its removing by wind of the soil surface.

Based on the trial results we selected the best compromise between the high work rate, which comes closer to the work rate of the tine cultivator, and the small size of the crushed material (leaves, burs and weeds), which improves its transformation into organic matter.

Destroying the leaves, burs, twigs and vegetation keeping them at the soil surface (NTR treatment)



The first used equipment



The new used equipment



Whole leaves

Crushed leaves

Results - leaves fragmentation

Dimensional characterization of the whole (Int) and crush leaves (Tri), according different tractor speed .

Leaves Whole vs Crushed	Speed (km/h)	Area (mm ²)	Perimeter (mm)	Major lenght (mm)	Minor lenght (mm)
Whole	0,00	4845,50	402,65	139,97	52,34
Crushed	1,12	1916,01	333,05	95,80	38,66
Crushed	2,08	2292,99	339,96	92,73	45,28
Crushed	3,68	2417,02	330,49	92,27	44,43

Results - soil compaction

Lowest resitance at surface on TTC plots but after 10 cm it increases to similar values than the other treatments.

Higher values on NTR plots, which may be ascribed to the compaction caused by the equipment.

No tillage plots shows the lower values on deep layers.

Conclusions

Considering that increasing the tractor's velocity, keeping the regime equipment, from 1.12 to 3.58 km/h, the leaf's area increases from 1916.01 to 2417.02 mm², why the highest recommended equipment's velocity is 2.0 km/h, which corresponds to 3.79 h/ha work rate, near half of the work rate of the tine cultivator (1.92 h/ha)

The average area of the whole leaves is 4845.50 mm². New tests are being carried out with this equipment and with similar ones trying to find the best solution for this kind of agricultural operation.

Conclusions (cont)

Related to the effects on soil physical properties, soil compaction was measured with Eijkelkamp Penetrologger device, making 30 measures in the soil under the canopy of each tree, on 3 trees by treatment. The obtained results showed a higher compacity on soil surface of NTR plots, which rise the need of new studies and the choice of a new equipment in order to avoid this risk which can be unfavourable to maintenance of adequate physical conditions..

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