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COPPICE AFTER 3 DIFFERENT CUTTING SYSTEMS: GROWTH CAPACITY AND MORTALITY

LOMBARDINI C., SPINELLI R. - CNR - ITALY

Coppice felling can be mechanized only if the right technology is identified and applied with sufficient skill in order to prevent stump damage and guarantee prompt regeneration. The goals of this study were to determine if mechanized cutting may affect the mortality and re-sprouting of coppiced stumps and to gauge the magnitude of such effects, if present.

The study was conducted on March 2015 in Italy in a typical mixed coppice stand located. Oaks, maples and ash constituted the main species, with a DBH of 15 cm of average. The forest was quite dense, and the characteristics were considered representative of Mediterranean coppice stands.

The 3 treatments on test were:

1) motor-manual felling with a chainsaw (control);
2) mechanized felling with a high-speed circular saw (i.e. hot saw);
3) mechanized felling with a hydraulic shear.

The experimental design was a typical split-plot, where the 3 felling treatments were distributed randomly among subplots. The observational unit was the individual stump. The number of stumps amounted to 100 units per treatment.

Each stump was attributed a sequential identification number, and for each stump we recorded: characteristics, cut quality, presence and quality of regeneration, biochemical indicators of stress (C/N ratio and sugar type). Each stump was characterized for species, circumference at cut level, minimum and maximum cut height, presence of cavities and cutting damage (attributed to 4 different classes).

On January 2016 marked stumps were inspected in order to check for re-sprouting, and we recorded: total n° of shoots, height, diameter at 30 cm above ground and kind of insertion of the 5 tallest shoots, presence of browsing. Stumps without any shoots were classed as dead to estimate mortality rates.

Field measurement showed that cutting height was significantly larger for shear, compared with chainsaw and disc saw, and analysis found no relationship between cutting height and stump circumference, that changed with species only.

Cut quality was strongly and significantly affected by cutting technology: the chainsaw produced a significantly larger proportion of clean cuts, the disc saw produced pullouts and the shear produced crack and stump pull, resulting in a much more severe damage level than recorded for the other technologies.

Resprouting vigor was significantly associated with the species and the size of the stumps. Maple stumps produced more shoots than either oak or ash stumps, but shorter and smaller. Oak stumps produced the largest shoots, for both diameter and height. Stump size had no effect on the number of shoots produced, instead larger stumps produced taller dominant shoots, with a larger diameter.

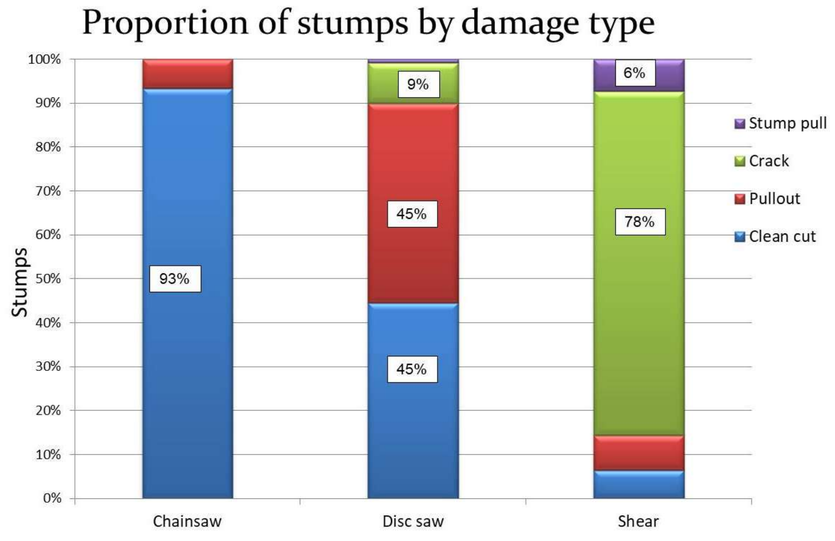
Felling technology had no effect on shoot sizes, but it had a weak effect on the number of shoots and on the insertion of dominant shoots. Cutting with shears resulted in a significant increase in the number of shoots growing on oak stumps. Maple and ash stumps cut with the disc saw presented fewer shoots that cutting with chainsaw or shear. Cutting with the shear reduced dominant adventitious shoots on ash and oak stumps, instead cutting with a chainsaw seemed to promote the development of adventitious shoots on all species.

Measurements of the content of C, N, starch, soluble sugar and C/N ratio, showed that mechanized cutting had no effect on nutrient balance. Total N and carbon accumulation in the stump followed a classic seasonal pattern and the state for N content in the stumps varied only with species: oak stumps had higher N content than did ash and maple stumps.

Characteristics of the stamps

	Mean	SD	Min	Max
Maximum height (cm)				
Chainsaw	9.4[a]	3.9	2	27
Disc saw	10.4[a]	6.2	0	33
Shear	15.2[b]	7.1	3	40
Minimum height (cm)				
Chainsaw	4.2[a]	2.0	0	10
Disc saw	4.9[a]	4.3	0	29
Shear	7.8[b]	4.6	1	24
Circumference at cut level (cm)				
Chainsaw	210[a]	75	70	410
Disc saw	213[a]	88	65	415
Shear	207[a]	86	40	460

Proportion of stumps by damage type



Re-sprouting vigor

	Oak		Maple		Ash	
	Mean	SD	Mean	SD	Mean	SD
Number of shoots						
Chainsaw	13.7[a]	7.7	37.5[a]	19.6	18.0[ab]	12.6
Disc saw	15.8[ab]	9.4	23.4[b]	19.3	13.1[a]	8.2
Shear	18.7[b]	10.3	28.6[ab]	15.8	25.6[b]	21.3
Mean shoot diameter at 30 cm from the ground (mm)						
Chainsaw	17.6	6.7	6.3	1.9	12.4	5.7
Disc saw	17.3	6.2	5.3	1.9	13.9	4.8
Shear	18.0	6.1	6.1	2.1	14.0	5.5
Mean shoot height (cm)						
Chainsaw	184	63	101	27	114	44
Disc saw	180	59	83	34	136	48
Shear	197	63	100	36	136	46

Different shoot types

	Adventitious shoots	Basal shoots	Root suckers
All treatments together – by species			
Species - χ^2 = 10.491; p-Value = 0.033			
Oak	11.0	80.9	8.0
Maple	12.3	82.9	4.8
Ash	**16.0**	78.7	5.2
Oak only – by treatment			
Treatments - χ^2 = 17.008; p-Value = 0.002			
Chainsaw	**16.8**	73.5	9.7
Disc	9.5	82.1	8.4
Shear	**6.5**	88.1	5.5
Maple only – by treatment			
Treatments - χ^2 = 9.571; p-Value = 0.048			
Chainsaw	**17.8**	74.8	7.4
Disc	9.4	87.7	2.8
Shear	9.7	86.3	4.0
Ash only – by treatment			
Treatments - χ^2 = 31.671; p-Value = 0.000			
Chainsaw	23.7	69.1	7.2
Disc	23.3	69.8	7.0
Shear	**3.6**	94.2	**2.2**

The conclusion is that while it may result in cut quality and higher stump damage levels, mechanized cutting does not seem to have any effects on coppice regeneration and growth (mortality, re-sprouting vigor and nutrient balance). The experiment will be continued in thr following years to know more information and to have more confirmation.

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