A role of the mechanical preparation of soil in the natural regeneration of pedunculate oak (*Quercus robur* L.) in floodplain forests

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ABSTRACT: The subject of our research was to verify effects of the mechanical preparation of soil in the natural regeneration of pedunculate oak in a floodplain forest. On the site of a hard-wooded floodplain forest at the confluence of the Morava and Dyje rivers (Czech Republic), several sample plots were established differing in the preparation of soil during regeneration, in weeding the plots and in the period of the implementation of soil surface scarification before and after the fall (or distribution) of acorns. On the basis of results obtained, mechanical preparation of soil on non-weed-infested plots in the heavy seed year is not necessary, however, it supports seedling emergence from acorns and eliminates weed tree emergence and weed. However, it is better to realize it only after the fall of acorns and to incorporate them into soil and thus their emergence will be increased. Soil scarification can be carried out also in the course of harvesting the parent stand through the extraction of wood and slash from the regenerating area. In weed-infested stands, however, the thorough preparation of soil before the fall of acorns appears to be a necessity.

Keywords: mechanical preparation of soil; weed; natural regeneration; pedunculate oak; floodplain forest

In the forest practice of the Czech Republic, natural regeneration of pedunculate oak is not used in floodplain forests particularly due to the long-term poor crops of acorns. Nevertheless, it has been verified that if the oaks intensely produce acorns it is advantageous to carry out natural regeneration (Vaňková 2004). However, extremely intense crop of acorns is a condition for the natural regeneration of pedunculate oak because the proportion of healthy germinative acorns is usually very low even in the heavy seed year. Matić (1996, 2000) mentions that in Croatia, the yield of seedlings from acorns ranges between 20 and 30%, Lust and Speleers (1990) in Belgium found 6.4%. At the beginning of the research in 1999, the emergence rate was 20% in the region of Židlochovice (Czech Republic). To create the inevitable compact "fur coat" of natural seeding free of gaps it is necessary at least 3 seedlings per 1 m^2 to emerge (Vaňková 2004). It means that at the 20% emergence rate of acorns, minimally 15 acorns/m^2 (ie 150,000 acorns/ha = 600 kg/ha) have to fall. According to Dengler (1972 in Korpeľ et al. 1991) and Nilsson et al. (1996) it is possible to increase the emergence rate of seedlings just by the mechanical preparation of the soil surface. Opinions when to realize the operation, however, differ. Oosterbaan et al. (1996) state that the preparation of soil before the fall of acorns is not inevitable but the area cultivation after the fall of acorns can be beneficial. However, the majority of authors recommends to implement it before the fall of acorns. For example Bermann (2001) refers to studies of Bier (1933 in Bermann 2001) who has proved that leaf-fall in autumn suffices to cover acorns and these conclusions are corroborated again in his experimental plots. According to Vyskot (1958), the most suitable period

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for soil preparation is also the beginning of autumn before the fall of acorns, however, their treatment into soil is not considered. Moreover, many foresters mention the possibility of damage to acorns during their mechanical treatment into soil.

Floodplain forests belong to the most fertile sites which become heavily weed-infested even after moderate opening up. Dense weed can hamper to the origin of natural seeding or later to cause the stagnation of its development or even its death. It refers particularly to the heavy competition of weed vegetation during the uptake of water from soil and negative impacts on oak seedlings due to excretion of root exudates. Tall weed also shades the self-seeding. And again, mechanical preparation of soil (Löf et al. 1998) is proposed as a possibility to control weed. Although some specialists recommend the preparation particularly in those cases when the soil surface is weed infested before the fall of acorns (Vyskot 1958).

The objective of the paper is to find the necessity of using the mechanical preparation of soil and to specify conditions when it is necessary to implement the measure. This operation is actually related to increased costs for regeneration, however, also in artificial regeneration it is considered to be inevitable being always applied in forest practice.

MATERIAL AND METHODS

The study was carried out in the largest complex of floodplain forests in the Czech Republic, ie along the confluence of the Morava and Dyje rivers, Forest Enterprise Židlochovice, Forest District Lanžhot where an about 20-hectare research bloc was established and fenced for the purpose. According to the Forest Management Institute (ÚHÚL) typological system, the research bloc site belongs to the set of forest types 1L (elm floodplain forest) specifically to the forest type 1L2 (elm floodplain with bishop's weed on Fluvisol). The locality occupies relatively the driest parts of the flat alluvial plain situated out of the reach of regular floods.

The main species of the initial stand for the natural regeneration was pedunculate oak of above-average quality in exploitable age. Substantial proportion was also represented by narrow-leaved ash (*Fraxinus angustifolia* Vahl.). An admixture was created by small-leaved linden (*Tilia cordata* Mill.) growing often abundantly as a subordinate species. Other subordinate species included field maple (*Acer campestre* L.) and hornbeam (*Carpinus betulus* L.). Sporadically, also other oak species occurred such as Turkey oak (*Quercus cerris* L.) and red oak (*Quercus rubra* L.).

In the shrub layer, whitethorn (*Crataegus laevigata* [Poiret] DC.) is rather frequent. In these dense closed stands, the occurrence of herb and grass weed was only sporadic.

The initial seed year for natural regeneration was in 1999. In the research bloc, 2 sample plots were established in this year to compare pure natural regeneration without the mechanical preparation of soil (*plot A*) and natural regeneration completed by acorn undersowing and the mechanical preparation of soil (*plot B*):

Plot A
– area – 1 ha,
– in winter 1999/2000, parent stand stocking was decreased to 0.9 (particularly other species than pedunculate oak were removed, namely ash and subordinate linden; even after the measure, several ash trees remained sporadically as co-dominant/dominant trees in addition to oak and many subdominant lime trees);

Plot B
– area – 0.5 ha,
– at the end of summer 1999 (before the fall of acorns), the soil surface was treated by a machine Mars (soil surface scarification to a depth of 10–12 cm),
– in autumn 1999, natural seeding was completed by the pinch sowing of acorns "under hoe" at a quantity of 400 kg/ha (ie 10 acorns/m^2),
– in winter 1999/2000, parent stand stocking was reduced to 0.9 (similarly as in plot A).

As early as the 1st year of regeneration, both sample plots were treated by means of spraying the seedlings from oak (powdery) mildew (Sulikol, Anvil, Rubigan), spraying the undesirable coppice shoots of linden (Roundup). In autumn, remaining ash trees were felled. In winter between the 1st and the 2nd year of regeneration, the parent stand was felled. Immediately after the measure, slash was gathered by means of a slash rake and chipped. Stumps were coated with Roundup or shoots were destroyed by spraying. In June of the second year, a fungicide (Rubigan) was applied to control oak (powdery) mildew, in September spraying was carried out to control undesirable tree species, in thicker individuals "stumps" of felled trees were treated by Roundup or Garlon. In the 3rd year, Casaron was used to control weed and in May Rubigan to control oak (powdery) mildew. In July, weed was mown by a scythe and in September, cutting the undesirable species was repeated and stumps were treated using Roundup.

In both plots, the "shelter" of the parent stand was thus removed after the 1st year of the natural regeneration growth (in winter 2000/2001). Because on skidding tracks, substantially larger amounts of seedlings occurred from the further crop of acorns in a year following the principal felling (2001) as against places out of the tracks, an idea originated to verify if only the disturbance of soil surface by means of skidding in the course of logging operations does not suffice to support natural regeneration.

In autumn 2001, another series of sample plots was, therefore, established and at the same time suitability was verified to incorporate the acorns together with the soil preparation. However, because a rich seed year did nor occur in the year natural regeneration had to be imitated by the distribution of acorns.

Mature stands of the 2nd series of sample plots were prepared for regeneration as early as 1999 when felling the subordinate trees was carried out (particularly field maple and linden) together with slash removal. In 2000, seed trees of ash were felled (ie just bearing seed). Thus, resulting stocking of the stand was about 0.8 and only co-dominant/dominant trees remained consisting particularly of pedunculate oak with the admixture of ash. In May 2001, however, full-grown dense weed, other trees and shoots under the stand had to be crushed by means of a machine Milata. In winter 2001/2002, actual research measures were carried out in the parent stand. The series was divided into two parts:
– in the first part, the mature stand was preserved (plots were marked by Roman numbers I, II, III, ie plots "under the stand");
– in the second part, the mature stand was completely cut out (plots were marked by Roman numbers I´, II´, III´, ie plots "on the open area").

Slash in both parts was gathered and burned. In November, level preparation of soil was carried out on the arisen clear-felled area (slash crushing, stump milling) by a machine Milata. Each part of the series of plots was further divided to 3 subplots (in total 6 subplots):
– on one plot from the open area and on one plot under the stand (*I*, *I'*) acorns were distributed manually, otherwise the clear-felled area was left without any measure;
– on the other couple of plots (one on the open area, the second under the stand, ie *II*, *II'*) soil was prepared for sowing by a machine Mars and even then acorns were distributed;
– on last two plots (on the open area and under the stand, ie *III*, *III'*), first sowing was carried out and then acorns were incorporated into soil by the machine Mars.

It is necessary to notice that soil preparation and incorporation of acorns under the parent rock were carried out only sporadically and on the soil surface. The sowing of acorns was uniform (500 kg/ha) and by about 10% less acorns were distributed on plots under the stand.

The actual monitoring was carried out in 2000 to 2002 on transects laid out on sample plots. Transects were 1 m wide, 10–35 m long and on each of the plots at least one transect was placed of a total area of minimally 20 m^2. In each metre of the transect, the frequency of seedlings of all species was determined, height of oak seedlings (cm) and weed cover (separately grass and herbs). The measurement was mostly implemented at the end of the growing season, in the event of the second series of plots and their only annual monitoring two measurements were carried out: "spring" – roughly at the end of the termination of spring increment of oak and "summer" – at the end of the growing season.

All results were statistically tested using the Statistica 6.0 program. Comparison of the sets of data was carried out (in case of fulfilling all basic conditions) by a parametric single-factor ANOVA or by a relevant *T*-test. In case of unfulfilled basic conditions, the Kruskal-Wallis test was used and 95% significance level was chosen.

RESULTS AND DISCUSSION

The overview of results obtained in the first series of plots is given in Table 1. The table shows that the successfulness of sowing "under hoe" on *plot B* (*transect No. 1*) was nearly 100%. Moderate differences from 10 emerged seedlings per 1 m^2 are given by sporadic including the seedlings from natural regeneration to sowing. In other two transects, observability of rows from sowing was very low and, thus, it was not possible to differentiate natural regeneration from sowing.

Under conditions of 100% successfulness of sowing it is possible to state that the frequency of seedlings from natural regeneration on *plot B* was considerably unhomogeneous comparing particular transects (in *transects No. 2* and *3*, it was necessary to subtract 10 seedlings per m^2, ie seedlings from sowing from the total number of emerged seedlings).

Therefore, it is not possible to say that the greater number of oak seedlings emerged on *plot B* after soil preparation than on *plot A* where the mechanical preparation of soil was not carried out. Nevertheless, it is evident that acorn sowing associated with presowing treatment "under hoe" when acorns are mechanically incorporated into soil is the ideal method of regeneration from the viewpoint of seedling emergence. On the other hand, it is pos-

Table 1. Mean values of studied characteristics (frequency of self-seeding, height of oak seedlings, weed cover) in the 1st series of sample plots (or transects) during the first three years of regeneration

Plot name	Transect name	Oak seedling frequency		Oak height	Frequency of other tree species						Weed cover	
		natural regeneration	sowing		field maple	ash	linden	hornbeam	other	total	grassy	herbaceous
		(seedlings/m^2)		(cm)	(seedlings/m^2)						(%)	
1st year of regeneration												
Plot A		11.2		11.9	1.49	3.18	0.28	0.10	0.02	5.07	14	25
Plot B	*Transect No. 1*	5.9	11.7	14.6	0.62	0.29	0.28	0.02	0.06	1.27	10	42
	Transect No. 2	19.5										
	Transect No. 3	33.1										
2nd year of regeneration:												
Plot A		14.0		20.1	1.53	2.50	0.18	0.03	0.12	4.36	23	33
Plot B	*Transect No. 1*	3.9	12.7	19.5	0.66	0.37	0.05	0.02	0.06	1.16	27	36
	Transect No. 2	15.5										
	Transect No. 3	26.4										
3rd year of regeneration												
Plot A		9.6		50.6	1.26	1.64	0.09	0.01	0.13	3.13	27	33
Plot B	*Transect No. 1*	4.1	8.4	51.1	0.57	1.04	0.05	0.04	0.10	1.80	29	33
	Transect No. 2	13.4										
	Transect No. 3	24.1										

In *transects No. 2* and *3* in *plot B*, natural seeding was dense to such a degree that it was not possible to distinguish seedlings coming from undersowing and, therefore, they are calculated together sible to note that the frequency of seedlings in the actual natural regeneration free of soil preparation (10 seedlings/m^2 as compared with a minimum of 3 seedlings/m^2) was more than sufficient.

An increase in the frequency of self-sowing in the second year of regeneration is obvious because other seedlings emerged from the next crop of acorns as well as a decrease in the frequency of self-sowing in the third year of regeneration when the parent stand shelter above the natural regeneration was not already present and thus natural regeneration from another crop could not be replenished. However, part of oak seedlings died in consequence of the competition of plants and weed.

Table 1 also gives mean values of the height of oak seedlings on both plots in particular years of regeneration. In the first year, the height lead is evident of seedlings in *plot B* with the mechanical preparation of soil. However, the advantage is lost in the next year after felling the parent stand shelter and exposure of seedlings to the full solar radiation. The higher growth of seedlings in *plot B* in the first year of regeneration could be supported by the implemented preparation of soil.

Statistically significant differences between the plots were also found in the frequency of other species in self-sowing. In this stage of regeneration, these species are considered to be "weed" species because due to their overgrowth they oppress surrounding natural regeneration of oak (mainly field maple, ash and coppice shoots of linden).

Only the natural regeneration of rare fruit trees or elms is considered to be beneficial, however, such natural seeding was not noticed in the plots. Thus, more weed trees occurred significantly in *plot A*. The preparation of soil in *plot B* showed, therefore, positive effects as for the reduction of weed species, particularly those which are dangerous for the regeneration of oak in a floodplain forest, ie field maple and ash. However, it is necessary to mention that these results can be found mainly from data coming from the first year of regeneration because in next years, cuts of weed trees were implemented as well as painting wounds by Roundup after cutting. However, it is evident from Table 1 that measures against the species do not reach significant decrease in their frequency. They only maintain the original numerical condition but hamper their growth. In *plot B,* effects of the mechanical preparation of soil in preventing the growth of weed species begin to trail off from the second but particularly from the third year of regeneration.

Table 1 also indicates certain differences in the cover of weed in the first year of regeneration. Mechanical preparation of soil in *plot B* somewhat reduced the growth of grassy weed in the first year of regeneration, however, herbaceous weed in the plot shows double cover as against *plot A*. Thus, there are positive effects of soil preparation on the growth of herbs and negative effects on the growth of grasses. In the next year of regeneration, differences between the plots disappear. Of course, it can be caused by felling the parent stand and subsequent mechanical raking the slash. Thus, the soil surface was treated on both plots before the second year of regeneration.

Results from the first series of established plots are accordingly rather distorted by the way of the whole regeneration particularly by the method of removing the parent stand after the first year of regeneration. It is possible to say that the mechanical preparation of soil reduced the emergence of weed trees. However, to corroborate further conclusions it was necessary to verify results in the second series of plots.

Result of the second series of plots are given in Table 2. According to the table, a sufficient amount of seedlings from sowing did not emerge on any plot under the stand shelter. The fact is ascribed to the heavy weed-infestation of the plot before the distribution of acorns and impossibility to realize the proper preparation of soil and reduction of the weed between trees in a stand. The fact corroborates again the uncertainty in results from the first series of sample plots where the preparation of soil for regeneration was carried out in the parent stand. Naturally, in case of the first series of plots the soil surface before regeneration was not weed-infested. It follows that weed hampers the emergence of oak seedlings. It was also proved by the heavy cover of weed already at the spring measurement on plots under the stand (*I*, *II*, *III*) and related low frequency of emerged oak seedlings.

In open plots free of the stand shelter (*I´*, *II´*, *III´*), the high successfulness of sowing occurs only in mechanically prepared plots (*II´*, *III´*). On the other hand, in a plot where the preparation of soil was not carried out and the previous weed infestation was not sufficiently suppress (*I´*) even during felling the stand only the minimum of seedlings from acorn distribution emerged.

These results agree particularly with conclusions of Vyskot (1958) who recommends soil preparation on weed-infested soils before the fall of acorns. It follows that partial realization of the preparation between trees in a stand is quite ineffective. On the other hand, the most suitable method of regeneration according to Vaňková (2004) is felling the parent stand shelter immediately after the fall of acorns which can increase effects of the soil preparation

Table 2. Mean values of studied characteristics (frequency of natural seeding, height of oak seedlings, weed cover) in the second series of sample plots in spring and summer of the first year of regeneration

Plot name	Oak frequency (seedlings/m^2)	Oak height (cm)		Frequency of other species (seedlings/m^2)					Weed cover (%)			
				field maple	ash	horn-beam	other	total	grassy		herbaceous	
	summer	spring	summer	summer					spring	summer	spring	summer
Plot I	0.5	14.4	18.6	6.1	0.1	0.1	0.8	7.1	44	45	37	60
Plot I´	0.4	19.9	25.8	9.0	0.2	0.2	0.1	9.4	50	39	15	41
Plot II	0.8	13.7	15.6	1.7	0.2	0.0	0.2	2.0	49	58	22	24
Plot II´	5.5	10.3	24.1	3.9	0.1	0.2	0.0	4.2	2	11	8	66
Plot III	1.4	14.2	16.5	1.7	0.0	0.0	0.1	1.8	52	43	48	55
Plot III´	12.8	14.3	30.4	1.1	0.4	0.0	0.2	1.7	7	23	16	56

or eliminate weed disturbing soil surface during extraction of wood and slash from the regenerated plot. Acorns are also partially incorporated into soil.

The position of *Plot III´* from the viewpoint of oak seedling frequency is substantially better as against *Plot III.* A reason consists evidently in a fact that acorns were actually incorporated into soil. As against a plot where soil preparation was carried out before the distribution of acorns more than double amount of seedlings emerged there. It agrees with the opinion of Oosterbaan et al. (1996) who also prefers to realize soil preparation as lately as after the fall of acorns and thus to incorporate them into soils.

As for the height of a newly originating stand in all plots of the 2nd series seedlings of oak were height-balanced. Markedly lower growth was reached in oak seedlings on *Plot II´* only during the spring measurement. In the course of year, the difference was balanced. On the contrary, seedlings on *Plot I´* reached higher growth in spring which was ascribed to a fact that rather dense but not too tall weed occurred on the plot from the beginning of the growing season. The weed shaded oaks only laterally but supported them in their height growth while the seedlings were fully insolated from above. On the other hand, in plots below the stand canopy (*I*, *II*, *III*), weed was excessively tall and moreover, seedlings were also shaded by the actual stand. On the contrary, in plots free of the stand shade and with soil preparation (*II´*, *III´*) almost no weed occurred which would create lateral shade for oak and supported them in height growth. These results positively corroborate an old forestry rule that from the very beginning, it is necessary to grow oak in a “fur coat” its crown to be in the sun and its stem in the shadow. In the second half of the growing season, the height growth on *Plot I´* with a marked spring advance was substantially reduced because weed began to outperform oaks in their height growth. On the other hand, in *Plots II´* and *III´*, weed began to emerge in the course of the growing season. The weed created with oaks a required “fur coat” and supported them in their height growth. On plots under the stand in tall weed (*Plots I*, *II*, *III*) only small insignificant increment was noted during the growing season. These results indicate the suitability of weed mowing (creating a “tall stubble-field”) recommended by Courraud (1990) in order oaks to develop in the vegetation cover providing lateral shadow the trees being, however, fully exposed to solar radiation from above.

Table 2 corroborates conclusions from the 1st series of sample plots concerning weed tree species. On plots of the 2nd series free of the mechanical preparation of soil (*Plots I* and *I´*), substantially higher amount of other species emerged as compared with oak (particularly of field maple) than on plots with soil preparation (*II*, *III*, *II´*, *III´*). Ash as the second most problematic species is regenerated only minimally on all plots because the previous year was not the seed year of ash and individuals of the species nearly did not produce seed.

As already mentioned above, soil preparation on plots below the stand shelter (*II*, *III*) as compared with the plot free of soil preparation (I) did not show any effect on weed infestation of the soil surface (Table 2). Throughout the growing season, tall grassy and herbaceous weed of nearly 100% cover occurred on these plots. On the other hand, soil preparation on open plots (*II´*, *III´*) markedly reduced the emergence of weed – particularly of grassy weed (as against *Plot I´* free of soil preparation). Thus, results of Löf et al. (1998) have been corroborated. The authors recommend soil preparation as a suitable method to eliminate emergence of weed. The restriction of herbaceous weed on the plots was, however, only of short-term character being balanced with other plots during the growing season. Thus, effects of soil preparation are of less than one-year duration. In case of grassy weed, however, restrictive effects of the preparation on its growth remain minimally one growing season.

CONCLUSION

Results verifying effects of the mechanical preparation of soil in the natural regeneration of pedunculate oak in flood plain forest show after three years of observation that:

- under conditions of the sufficiently intense crop of acorns, ie if more than 20 acorns per m^2 fall on the soil surface (Vaňková 2004), the scarification of soil surface in the natural regeneration of pedunculate oak is inevitable only if the regenerated stand is weed-infested before the fall of acorns;
- scarification of soil in a non-weed-infested stand is not inevitable, however, it supports the emergence rate of oak seedlings and can be replaced rather effectively by the soil surface disturbance during felling the parent stand, skidding operations and extraction of slash;
- incorporation of acorns into soil is the more suitable method of soil preparation than the mere scarification of the soil surface before the fall of acorns because the emergence of seedling is increased;
- soil scarification reduces the emergence of weed trees (ash, field maple), its effects remain minimally for three years, however, measures to control weed trees are always necessary even after their implementation;
- soil scarification reduces the growth of weed in the open area, however, in case of herbs its effect lasts only less than one growing season and in case of grasses one year.

Therefore, in case of the natural regeneration of pedunculate oak in floodplain forests, we recommend to carry out the mechanical preparation of soil only in mature stands which are weed-infested, viz before the fall of acorns the acorns to be in contact with soil. In case of non-weed-infested mature stands and sufficiently intense seed year the soil surface scarification is not necessary. Felling the parent stand immediately after the fall of acorns is a suitable technology. During the operation, soil surface is disturbed and acorns are incorporated into soil. However, if we want to support the emergence rate of acorns (eg in case of the uncertain crop of acorns) it is suitable to carry out the mechanical preparation of soil only after the fall of acorns.

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Úloha mechanické přípravy půdy v přirozené obnově dubu letního (*Quercus robur* L.) v lužních lesích

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ABSTRAKT: Předmětem výzkumu bylo ověření účinku mechanické přípravy půdy v přirozené obnově dubu letního v lužním lese. Na stanovišti tvrdého luhu při soutoku řek Moravy a Dyje (Česká republika) bylo vytvořeno několik zkusných ploch lišících se přípravou půdy při obnově, zabuřeněním ploch a dobou realizace skarifikace půdního povrchu před opadem žaludů či po něm (popř. po rozhozu žaludů). Z dosažených výsledků vyplývá, že mechanická příprava půdy na nezabuřeněných plochách v silném semenném roce není nutná, ale podporuje vzcházení semenáčků ze žaludů a eliminuje vzcházení plevelných dřevin a buřeně. Lépe je ji však uskutečnit až po opadu žaludů a zapravit je tak zároveň do půdy; zvýší se tak jejich vzcházivost. Skarifikaci půdy lze realizovat také při těžbě mateřského porostu vyklizováním dříví a klestu z obnovované plochy. V zabuřeněných porostech je však pečlivá příprava půdy před opadem žaludů nutností.

Klíčová slova: mechanická příprava půdy; buřeň; přirozená obnova; dub letní; lužní les

Přirozená obnova dubu letního se v České republice pro svou značnou problematičnost nepoužívá, ovšem poslední výzkumy ukazují, že v případě bohatého semenného roku této dřeviny lze k tomuto způsobu obnovy s výhodou přistoupit. Pro podporu vzcházivosti semenáčků dubů z žaludů a pro eliminaci růstu dřevinné, travnaté i bylinné buřeně se před umělou obnovou vždy na těchto stanovištích realizuje mechanická příprava půdy. Proto bylo cílem výzkumu ověřit vliv mechanické přípravy půdy v přirozené obnově dubu letního. Výzkum byl uskutečněn v největším komplexu lužních lesů v České republice při soutoku řek Moravy a Dyje na Lesním závodě Židlochovice, Polesí Lanžhot.

Ve výzkumném bloku bylo vytvořeno několik zkusných ploch lišících se přípravou půdy při obnově, výchozím stavem ploch (stupeň zabuřenění), dobou realizace skarifikace půdního povrchu (před opadem žaludů či po něm či po rozhozu žaludů) a vždy byla ponechána jedna plocha jako kontrolní bez přípravy půdy. Vlastní měření probíhalo na transektech vytyčených na těchto plochách, kde byla jednou až dvakrát ročně sledována četnost dřevin v náletu (popř. ze síje), výška dubových semenáčků a pokryvnost buřeně. Celkem bylo hodnoceno přes 3 500 dubových semenáčků na 300 m^2 transektů.

Z dosažených výsledků vyplývá:

- při dostatečně silné úrodě žaludů, tj. opadne-li více než 20 žaludů/m^2 (Vaňková 2004), je skarifikace půdního povrchu v přirozené obnově dubu letního nezbytná pouze tehdy, je-li obnovovaný porost před opadem zabuřeněn;
- skarifikace půdy v nezabuřeněném porostu není nezbytná, podpoří však vzcházivost dubových semenáčků a může být poměrně účinně nahrazena narušením půdního povrchu při těžbě mateřského porostu, přibližování dříví a vyklizování klestu;
- zapravení žaludů do půdy je vhodnější způsob přípravy půdy než pouhá skarifikace půdního povrchu před opadem žaludů; zvýší se tím vzcházivost semenáčků;
- skarifikace půdy omezuje vzcházení plevelných dřevin (jasan, babyka), její vliv je minimálně tříletý, ovšem zásahy proti plevelným dřevinám jsou vždy nutné i při jejím provedení;
- skarifikace půdy omezuje růst buřeně na volné ploše, její vliv však trvá v případě bylin jen necelé jedno vegetační období, v případě trav jeden rok.

Proto doporučujeme v přirozené obnově dubu letního v lužních lesích realizovat mechanickou přípravu půdy pouze v mýtních porostech, které jsou zabuřeněny, a to před opadem žaludů, aby se opadlé žaludy dostaly do kontaktu s půdou. V případě nezabuřeněných mýtních porostů není skarifikace půdního povrchu při dostatečně silném semenném roce nutná. Vhodnou technologií je navíc smýcení mateřského porostu ihned po opadu žaludů, a proto stejně dochází k narušení povrchu půdy při těžbě mateřského porostu, kdy se žaludy zároveň zapraví do půdy. Pokud však chceme podpořit vzcházivost žaludů (např. při nejistotě v bohatosti úrody žaludů), je vhodné mechanickou přípravu půdy realizovat až po opadu žaludů.

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