

EFFECT OF PRUNING DURING PLANTING ON TREE PHYSIOLOGY AND GROWTH

Brejník Martin, Matoušková Marie, Urban Josef, Vitásek Roman, Zvyniatskovskyi Yan

Mendel University in Brno / Faculty of Forestry and Wood Technology

1 INTRODUCTION

Tree transplanting is associated with many stress factors that negatively affect its subsequent establishment and growth. With harvesting of the bare-rooted or balled and burlapped trees is necessarily associated with the loss of part of the root system. Currently, there is no unified opinion on the application of tree pruning when planting them in a permanent habitat. Proponents of the application of pruning support its usefulness with the argument of maintaining a balance between the root system and the above-ground parts of the tree. Opponents of the application of the pruning argue the loss of auxin located in the top parts of the tree crown, which are partially removed by the pruning. This loss is another stressor because auxin promotes the growth of lateral roots. Another factor is the increasing stress load caused by high temperatures and radiation in the current climate change. With current domestic values, there is practically no experience with current conditions, and recommended technological procedures for tree planting can quickly lose their validity.

2 MATERIALS AND METHODS

The aim was to compare the response of the bare-rooted trees to the pruning made when planting on a permanent site. It is a comparison of the reaction of individuals who were pruned with individuals who were left without a pruning. Two broadleaved tree species were examined: three years old hornbeam plants and two years old pedunculate oak plants.

Experiment was conducted from early spring to late September. The experiment was conducted in parallel at two locations: Libouchec (North Bohemia, altitude 320 m, part of the orchard) and Řečkovice (South Moravia, altitude 300 m, training forest tree nursery) (Fig. 1.) On each location were used from each tree species 15 plants as treatment group and 10 plants as control group (i.e. Libouchec 2 x (15 + 10) trees and Řečkovice 2 x (15 + 10) trees).

An equal portion of the roots was removed from all plants to simulate root loss during transplanting. All plants were planted in plastic containers of the same size and form. Ten control trees were planted without pruning. Treatment groups were pruned with different intensity (with an estimate of tens of percent). All plants were watered with the same amount of water throughout the experiment.

Collected physiological data: water potential using a Scholander pressure chamber, photosynthesis and stomatal conductance using a LI-6800 instrument, non-photochemical quenching, linear electron flow using a MultispeQ 2.0. instrument.

Collected biometric data: intensity of pruning, trunk diameter (at the beginning of the experiment); leaf area (during the experiment); trunk diameter, average length increment (at the end of the experiment); dry mass was determined divided trees at five groups: leaves, current year shoots, older shoots and trunk, thick roots, thin roots at the end of the experiment.

3 CONCLUSIONS

Surprisingly, the measured water potential values did not depend on the pruning intensity (Fig. 6 – 9). Only for hornbeams in Řečkovice in late summer did they show more favorable values (Fig. 6). However, these values were measured on individuals with a new generation of leaves or on individuals with only residual leaves (Fig. 12).

In a comparison of the two species studied, oak is more resistant to drought and high temperatures than hornbeam after transplanting. Significant leaf damage was recorded only in hornbeam in Řečkovice (Fig. 4, 5, 12).

Preliminary results also indicate that trees respond to pruning more by changing morphological parameters than physiological parameters when transplanted (Fig. 7, 8, 10, 11).

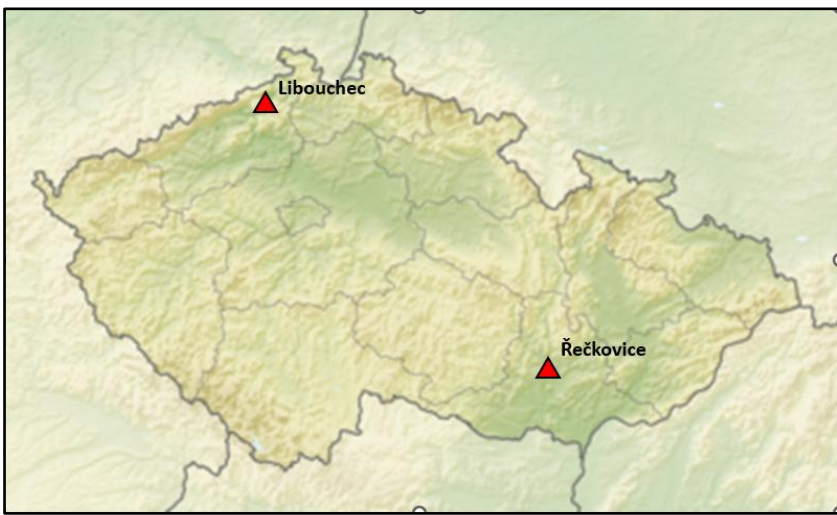


Fig. 1: Experiment locations.



Fig. 2: Řečkovice site. Part of training forest tree nursery with concrete cover.



Fig. 3: Libouchec site. Part of orchard with grassy surface.

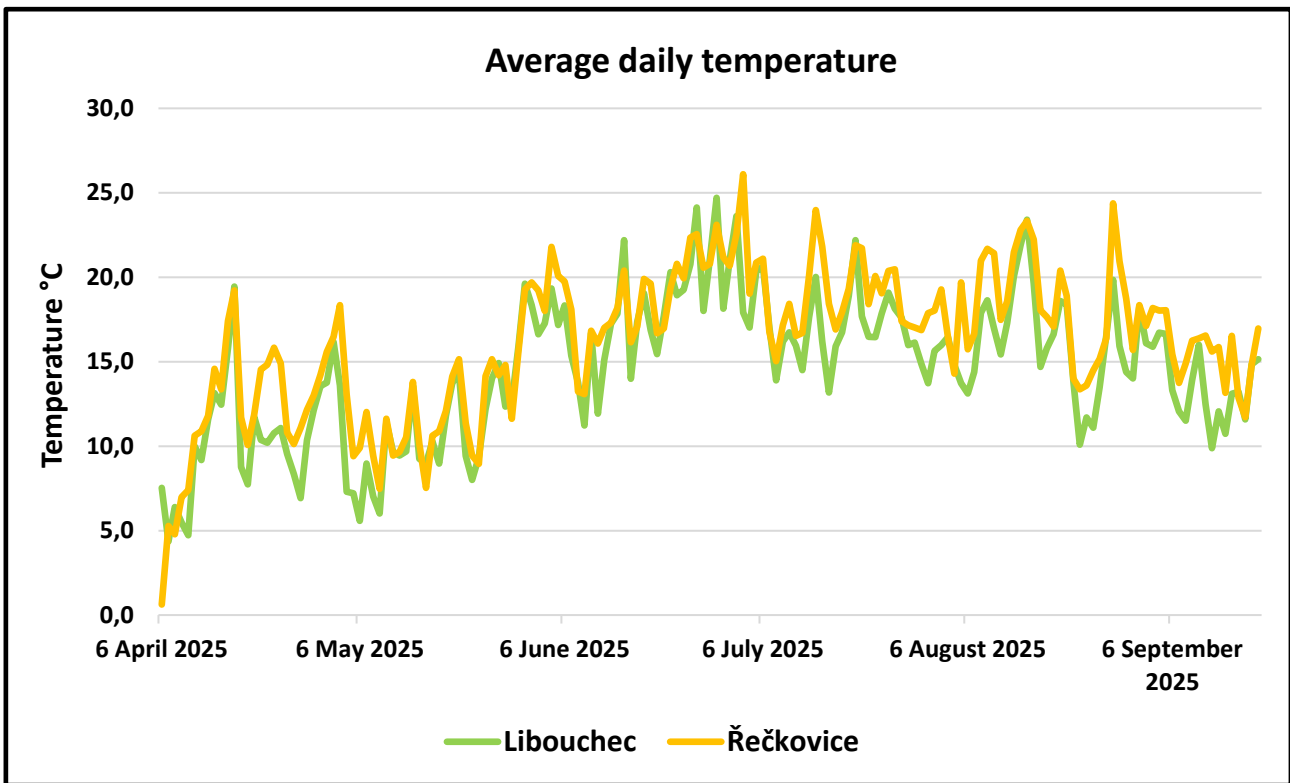


Fig. 4: The average daily temperature in Libouchec was generally lower than in Řečkovice and in May, due to the frost basin, morning temperatures fell below freezing.

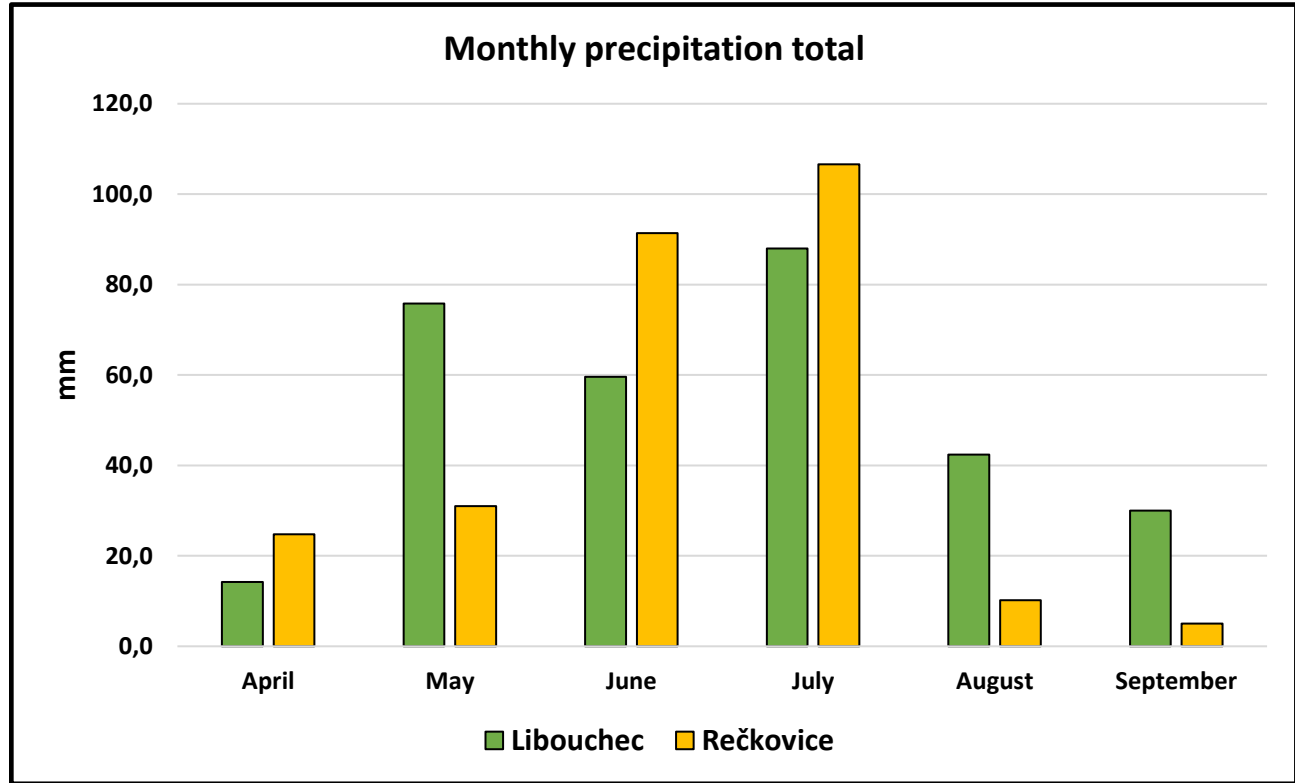


Fig. 5: Precipitation was generally higher and more uniform in Libouchec.

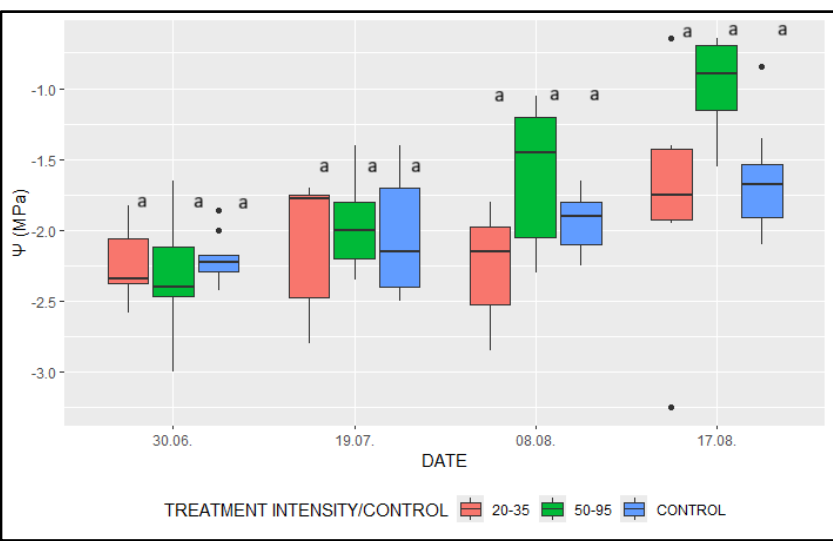


Fig. 6: Midday water potential of hornbeams in Řečkovice.

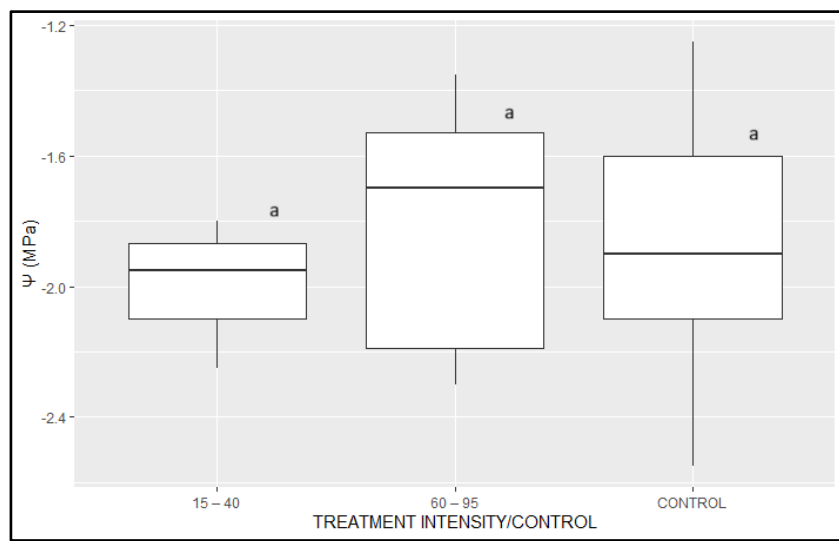


Fig. 7: Midday water potential of hornbeams in Libouchec on 13th August 2025.

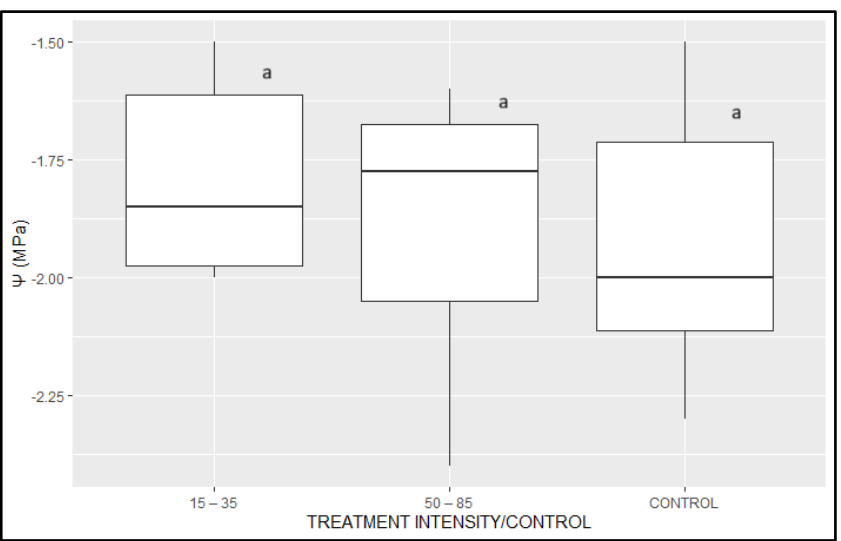


Fig. 8: Midday water potential of pedunculate oaks in Libouchec on 13th August 2025.

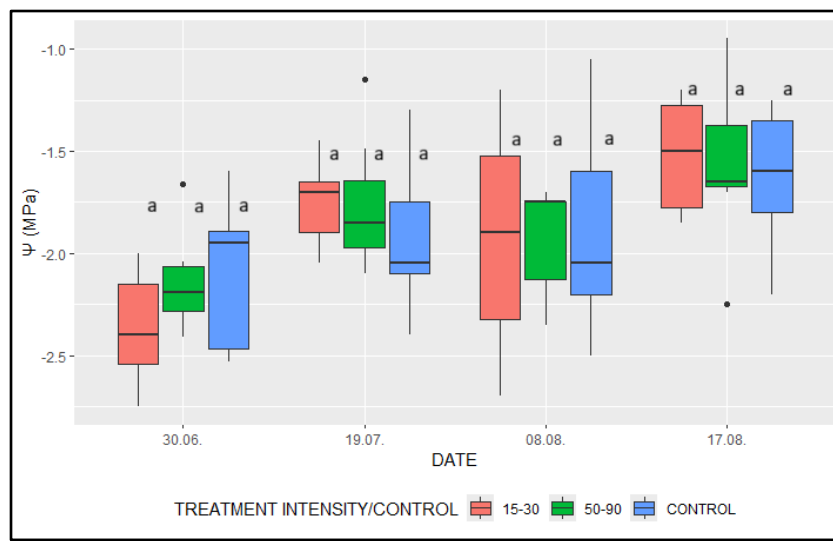


Fig. 9: Midday water potential of pedunculate oaks in Řečkovice.

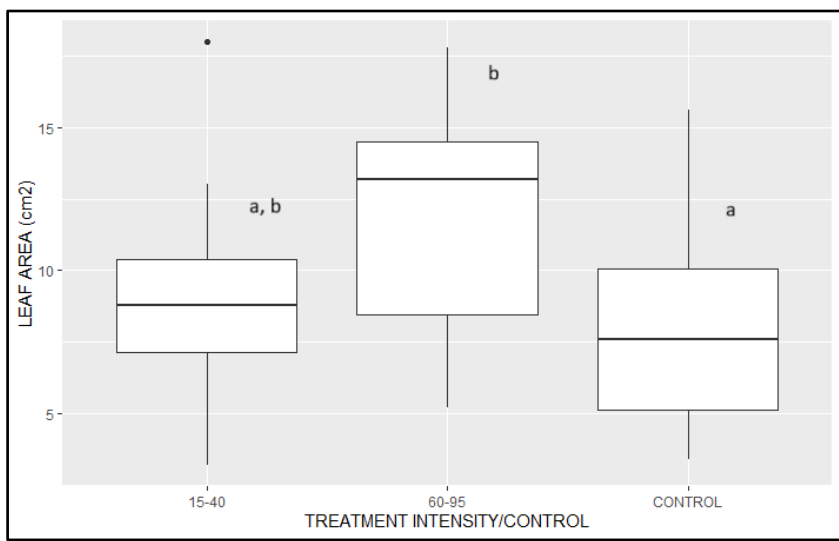


Fig. 10: Leaf area of hornbeams in Libouchec on 16th July 2025.

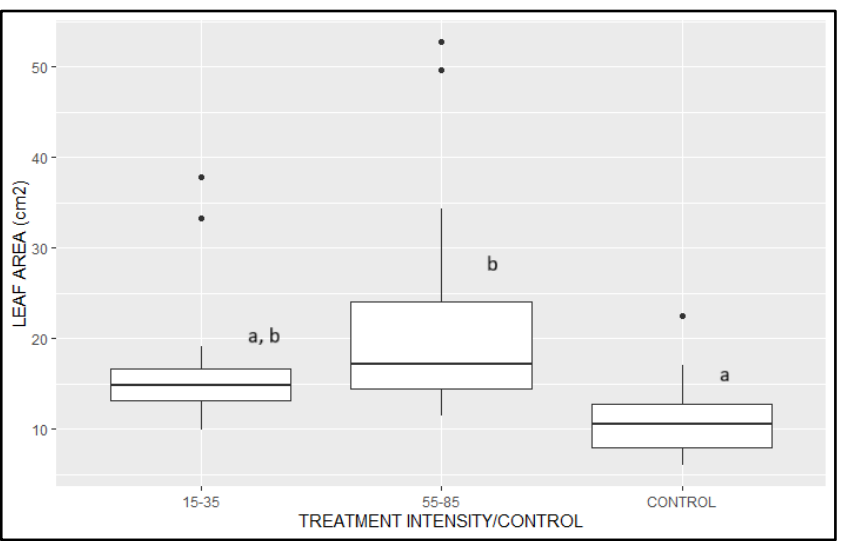


Fig. 11: Leaf area of pedunculate oaks in Libouchec on 16th July 2025.

Pruning intensity (%)	Lost or heavily damaged leaves (%)										New leaves (%)	Pruning intensity (%)
	19.7.	31.7.	8.8.	13.8.	17.8.	24.8.	6.9.	19.9.	8.8.	17.8.		
0	0	0	0	0	0	0	0	0	0	0	0	0
5	5	20	20	50	50	60	70	80	0	0	0	0
10	25	70	70	90	90	95	100	100	0	0	0	0
15	0	0	0	0	0	0	10	70	0	0	0	0
20	40	60	70	70	70	70	90	100	0	0	0	0
25	0	0	10	10	10	20	40	60	0	0	0	0
30	0	0	0	0	0	0	5	20	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0
40	30	70	95	100	100	100	100	100	0	0	0	0
45	0	0	0	0	0	0	5	5	0	0	0	20
50	20	30	40	60	60	80	100	100	0	0	0	20
55	0	0	0	0	0	0	0	0	0	0	0	25
60	20	20	40	50	50	70	90	90	0	0	0	30
65	0	0	0	0	0	100	100	100	0	0	0	30
70	0	0	0	0	0	0	10	10	0	0	0	35
75	20	50	80	90	90	95	100	100	0	0	0	35
80	50	90	100	100	100	100	100	100	0	0	0	50
85	70	90	90	90	90	90	90	90	0	20	55	55
90	90	100	100	100	100	100	100	100	20	40	70	70
95	10	20	40	60	80	90	100	100	0	0	75	75
100	10	40	40	40	50	60	80	90	0	0	80	80
105	10	70	90	100	100	100	100	100	0	0	80	80
110	90	100	100	100	100	100	100	100	0	40	95	95

Fig. 12: Loss of leaves and severe damage was noted only in hornbeams in Řečkovice. Damage and loss increase with pruning intensity. At the same time, these individuals showed the highest values of growth and leaf size.