

MENDEL UNIVERSITY IN BRNO

- MENDELU
- Faculty of Forestry
- and Wood
- Technology

SilvaNet – WoodNet 2024

Proceedings Abstracts of Student Scientific Conference



Ing. Petr Čech
Ing. Kateřina Sedláčková
(eds.)

29 November 2024
BRNO

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Proceedings Abstracts of Student Scientific Conference
held in Brno on November 29, 2024

Student Conference is organised by the Council of the Internal Grant Agency of the Faculty of Forestry and Wood Technology MENDELU under the patronage of the Dean of Faculty (Faculty of Forestry and Wood Technology MENDELU) Prof. Dr. Ing. Libor Jankovský and in cooperation with listed projects.

Specific University Research Activities of the Faculty of Forestry and Wood Technology MENDELU supported the conference.

Mendel University in Brno, Zemědělská 1, 61300 Brno

ISBN 978-80-7701-006-1 (online ; pdf)

<https://doi.org/10.11118/978-80-7701-006-1>



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SilvaNet – WoodNet 2024

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EVROPSKÁ UNIE
Evropské strukturální a investiční fondy
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TENTO PROJEKT JE SPOLUFINANCOVÁN EVROPSKÝM FONDEM PRO REGIONÁLNÍ ROZVOJ

Výzkumné centrum pro studium patogenů z rodu *Phytophthora* CZ.02.1.01/0.0./0.0./15_003/0000453

Dotační titul: OP Výzkum, vývoj a vzdělávání

Výzva č. 02_15_003 pro Podporu excelentních výzkumných týmů v prioritní ose 1 OP

Doba řešení: 1. 12. 2016 – 30. 04. 2023

Příjemce projektu: Mendelova univerzita v Brně

Koordinátor projektu: prof. Dr. Ing. Libor Jankovský

Cílem projektu je vybudování komplexní infrastruktury a vytvoření mezinárodního, interdisciplinárního a multioborového výzkumného týmu se zaměřením na výzkum chorob dřevin rodu *Phytophthora*.

Aplikací a implementací inovativních technologií na bázi mikrobiologie, bioinformatiky, biologie, ekofyziologie, anatomie dřevin, genomiky a bioklimatologie, přispět k hlubšímu poznání faktorů ovlivňujících diverzitu, adaptaci a hybridizační procesy, které probíhají u rodu *Phytophthora*. Dále se pak zabývat evoluční historií tohoto rodu a molekulárními mechanizmy řídící náchylnost a odolnost dubů proti půdním patogenům tohoto rodu. Očekávané výsledky budou rozvíjet disciplínu fytopatologie dřevin, jako jednu z klíčových oblastí excelentního výzkumu na MENDELU, s pozitivními důsledky pro management a ochranu evropských ekosystémů. Bude prohlubována stávající mezinárodní spolupráce s předními světovými institucemi, s cílem a ambicí založit a udržet vzniklý mezinárodní tým VaV centra MENDELU, jako lídra v oboru a získat navazující projekty mezinárodní spolupráce ve výzkumu chorob dřevin rodu *Phytophthora*. V rámci projektu byla doplněna stávající infrastruktura laboratoří VaV MENDELU o špičkové přístroje a vybavení bezprostředně související s výzkumem chorob dřevin zapříčiněných parazity rodu *Phytophthora*.

Partneři projektu:

- Austrian Research and Training Centre for Forests, Natural Hazards and Landscape
- Svaz školkařů České republiky, z. s.
- Arboeko s.r.o.

PhytOphthora
Research Centre



<http://www.phytophthora.org>

ERA-Chair: Striving for Excellence in the Forest Ecosystem

The project “ERA-Chair: Striving for Excellence in the Forest Ecosystem” (EXCELLENTIA) brings new insights into the issue of climate-threatened forest ecosystems in Central Europe concerning the needs of society but also sheds light on how much man has contributed to past instability by moving away from the cultivation of natural forests towards monocultures. EXCELLENTIA builds on the availability of data and the research programme already underway at the Faculty of Forestry and Wood Technology MENDELU. The necessary data collection and practical analysis are also conducted at the University Forest Enterprise Masaryk Forest Křtiny.

A cutting-edge interdisciplinary research group is established under the Faculty of Forestry and Wood Technology to research forest ecosystems under the leadership of leading scientist Professor Douglas L. Godbold. The multidisciplinary team of researchers investigate the sustainability of forest ecosystem functions in the context of the ongoing climate change and ensures forest stability for the coming decades. Drought, tree species responding differently to drought, and the susceptibility or resistance of tree root systems to pathogen attack are other issues the project addresses.

In addition to the scientific line, the EXCELLENTIA project aims to bring about structural changes in sustainable research and innovation, intellectual property rights and research data management, codification of scientific ethics and career guidance. Training activities aimed at young researchers and supervision of BSc, MSc and PhD theses are also part of the projects. Through Professor Godbold’s exceptional contacts within the European scientific community, the team is envisaged to be involved in major international projects.

The results of the project are continuously communicated not only to the professional but also to the general public. The project also envisages cooperation at the level of secondary schools.

Contact:

Douglas L. Godbold, Boris Rewald,
Department of Forest Protection and Wildlife Management (FFWT),
douglas.godbold@mendelu.cz, boris.rewald@mendelu.cz

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Funded by
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EXCELLENTIA

Forest Ecosystem Research

This project has received funding from the European Union’s Horizon Europe research and innovation programme under grant agreement N°101087262.

LECA - CE0100170 – Supporting the coexistence and conservation of Carpathian Large Carnivores

Duration: 1. 4. 2023 – 31. 3. 2026



Lead partner: Mendel University in Brno

LECA

Project coordinator: Mgr. Martin Duľa, Ph.D.

Project partners: WWF Poland, WWF Slovakia, WWF Hungary, Technical University in Zvolen, Bükk National Park Directorate, Tatra National Park, State Nature Conservancy of the Slovak Republic, Friends of the Earth Czech Republic Carnivore Conservation Programme, Ministry of the Environment of the Czech Republic, Zarand Association, Slovenian Forest Service

Large carnivores are key components of forest ecosystems in the Carpathians, hosting one of the most abundant native populations of lynx, wolf and bear in Europe. However, whether populations are stable or growing is unclear as data are not collected harmoniously across borders. There are no shared regulations and policies on large carnivore's conservation (e.g. poaching prevention) and no shared understanding and coordination between stakeholders. Clear is, however, that perceived and actual conflicts between humans and large carnivores are on the rise. To promote coexistence with local stakeholders, to enable viable large carnivores population structures, natural expansion and recolonisation of large carnivores, to establish evidence-based and coordinated practices in the Carpathian countries, and to contravene misconceptions, LECA wants to raise awareness, educate, engage and influence target groups such as hunters, foresters, farmers, livestock and beekeepers, police investigators (poaching), ministries, municipalities and the broad public.

The project aims are (1) a consistent and efficient monitoring approach involving local stakeholders; (2) up-to-date population information in cross-border regions; (3) effective conflict prevention measures to be rolled out at the Carpathian level; and (4) improved participative cooperation of key actors at local, regional and transnational level. A Thematic Guidance on large carnivore's conservation and coexistence in the Carpathians will be created and validated via pilot actions in cross-border pilots (Tatras (SK/PL), East Carpathians (SK/PL/UA), Slovak Karst - North HU Mountains (SK/HU), Beskydy-Kysuce (CZ/SK) and reference areas (SL/RO), driving pilot area strategies, national recommendations and an IT app for the public. The Guidance will cover novel, unified tools for harmonised Monitoring, Poaching investigation and Conflict prevention.

The three-year LECA project is funded by the EU Interreg Central Europe programme. More information: <https://www.interreg-central.eu/projects/leca/>

Plant pest prevention through technology-guided monitoring and site-specific control

PurPest aims to control serious plant pests during import and manage pests in the field by enabling pest detection in a timely and non-invasive manner. The PurPest concept will exploit the specific volatiles released by pests or pest-infested plants to develop a sensor system prototype (SSP) that detects the presence of these pests during plant import and monitors pests already present in Europe. Implementing the PurPest concept is expected to drastically decrease the risk of new pest invasions in Europe and optimise pesticide use, where and when necessary. Additionally, the PurPest concept used in nurseries to detect serious pests will significantly reduce the distribution of pest-infested plant material between exporting and importing countries and their further spread within these countries. PurPest will involve all stakeholders along the value chain in a multi-actor approach to promote this concept, including plant health officers, nursery representatives and forest organisations.

PurPest focuses on five diverse pests in forestry, horticulture and agriculture: the forestry pathogen causing Sudden Oak Death, *Phytophthora ramorum*, the causal agent of Pine Wilt Disease, *Bursaphelenchus xylophilus*, the Cotton Bollworm, *Helicoverpa armigera*, the Brown Marmorated Stinkbug, *Halyomorpha halys* and the EU A1 listed Fall Armyworm, *Spodoptera frugiperda*. Current detection technology is being optimised and implemented in the SSP. Using this detection tool to screen plants and wood-based packaging material during import will allow us to detect incoming pests, destroy any infected material and prevent the target pests from entering the EU and associated countries. These actions will be supported by developing policy recommendations in collaboration with the industry stakeholders, the plant pest scientists and legislators from the national plant protection organisations to ensure the feasibility, economic and ecological benefits and high efficiency of this screening method. The detection concept developed, validated and demonstrated in PurPest, and supported by appropriated policy recommendations will effectively respond to EU quarantine and other serious plant pests threatening European agriculture, horticulture and forestry.

Contact: Thomas Jung, Department of Forest Protection and Wildlife Management (FFWT), thomas.jung@mendelu.cz



This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N°101060634.

Views and opinions expressed are those of the author only and do not necessarily reflect those of the European Union or the European Research Executive Agency. Neither the European Union nor the granting authority can be held responsible for them.

ForDiL: Forest of the future: digital tools for learners to foster CCF

Since the launch of ForDiL, the project has gained momentum through several fruitful exchanges between partners and students. In April 2024, the Technical Horticultural Institute of Gembloux (ITHCF) in Belgium hosted French and Czech students for a week of exchanges and practical workshops focused on Continuous Cover Forestry (CCF). This event allowed participants to delve into CCF concepts and confront them with real-world field conditions while encouraging dialogue among young learners from different countries.

In May 2024, the project team gathered at Mendel University in Brno for an international meeting. This working session allowed the team to finalise the implementation protocol for the Marteloscope-Travailloscope field tool at the core of the ForDiL project. Marteloscopes and travailloscopes are silvicultural training sites, usually one hectare, in which all trees are numbered, mapped and recorded. Based on this data, a software program guides and evaluates the learner's tree felling/conservation choices. A travailloscope works on the same basic model but aims to test the results of different silvicultural operations and the impacts (economic, ecological) favourable or unfavourable to irregular stand management. Currently, partners focus on the designation and set-up in France, Belgium, and the Czech Republic.

In October 2024, the ForDiL team met again at the UFA in Bavay, France, to mark out the continuation of the project. The next major milestone, scheduled for 2025, will be developing the digital application linked to the Marteloscopes-Travailloscopes. This will make this forestry management approach even more accessible to learners and forest managers.

Contact:

Lumír Dobrovolný, University Forest Enteprice Masaryk Forest Křtiny (MENDELU), lumir.dobrovolny@mendelu.cz,

Pavλίna Pancová Šimková, Department of Forest Protection and Wildlife Management (FFWT), pavlina.simkova@mendelu.cz



**Co-funded by
the European Union**

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Landscaping and Landscape Conservation, Renewable Resources Economics and Management, Forest Management, Silviculture, Applied Geoinformatics and Geodesy

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ADVANCED TOOL MATERIALS AND THEIR INFLUENCE ON THE PARAMETERS OF CNC MACHINING OF WOOD-BASED MATERIALS (PART III)

Rokoský Petr, Hanincová Lud'ka, Procházka Jiří

Mendel University in Brno / Faculty of Forestry and Wood Technology

e-mail: ludka.hanincova@mendelu.cz

Keywords: advanced tool materials, CNC machining, cutting force, cutting speed, feed per tooth, MDF

1 INTRODUCTION

This study investigates the effects of tool coatings, cutting speed, and feed per tooth on cutting forces during CNC milling of Medium Density Fiberboard (MDF). CNC milling parameters, specifically cutting speed and feed per tooth, significantly impact tool wear, energy consumption, and surface quality. Coatings can enhance tool performance by reducing friction and heat transfer, thus potentially lowering cutting forces. However, there is limited research on how coatings affect MDF machining. This study examines five coatings, including DLC, TripleSi, Hyperlox, and a lapped surface, to identify optimal combinations for improved machining efficiency.

The objective of this research is to systematically evaluate the effects of different tool coatings, cutting speeds, and feed per tooth values on cutting forces during CNC milling of MDF.

2 METHODS

Experiments were conducted using a CNC milling machine (SCM Morbidelli m100). Medium Density Fiberboard (MDF) with a thickness of 18 mm was chosen for its homogeneity.

Five tools, each with a 10 mm diameter and single edge, were tested with different coatings, including a reference (no coating), TripleSi, Hyperlox, DLC, and a simple lapped surface. Cutting conditions involved three cutting speeds (8, 10, 12 m/s) and three feed per tooth values (0.1, 0.2, and 0.3 mm) with a 1 mm depth of cut. Cutting forces were recorded using a Kistler 9257B dynamometer. Both conventional and climb milling were applied to assess the impact of feed per tooth and coating type on cutting forces. The data were statistically analyzed using ANOVA and the Scheffé test.

3 RESULTS AND DISCUSSION

The findings revealed that feed per tooth significantly affects cutting forces, with higher feed rates leading to greater forces. Among coatings, the lapped and TripleSi coatings showed the lowest cutting forces, while DLC consistently had the highest. The relationship between cutting speed and cutting forces varied; however, the impact was minimal compared to feed per tooth. The optimal cutting speed was observed at 10 m/s, where certain coatings demonstrated a reduction in cutting forces. The DLC coating's higher friction coefficient caused increased forces, suggesting it may be less suitable for MDF milling under the conditions tested.

The Scheffé test confirmed statistically significant differences in cutting forces across feed per tooth values and coatings. Higher feed per tooth values increased cutting forces due to greater chip thickness and tool-material friction.

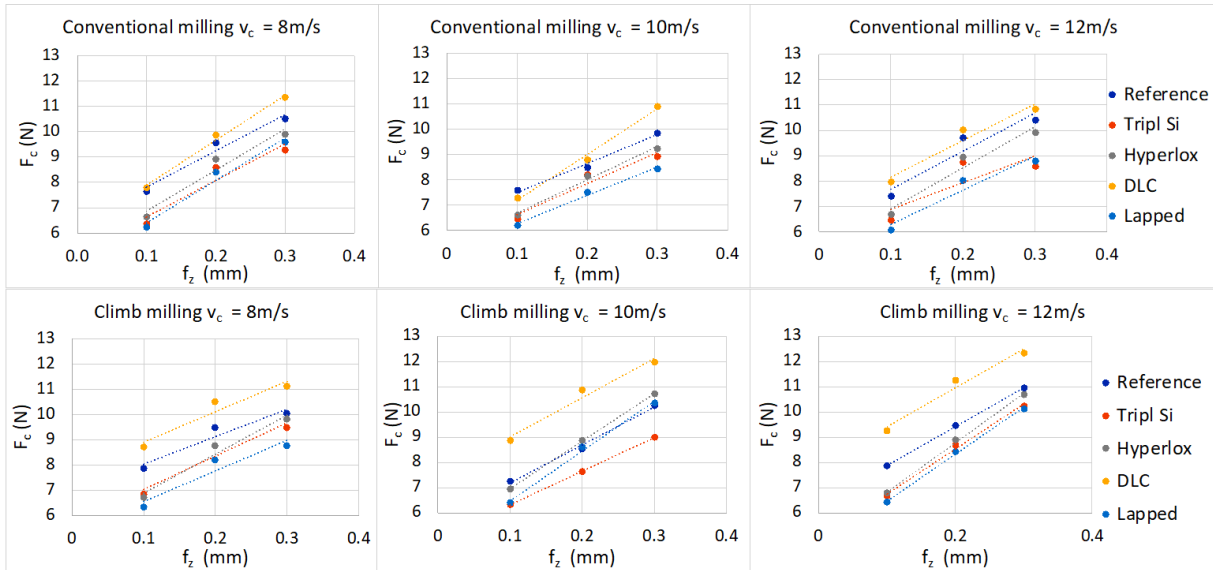


Fig. 1: Average values of cutting forces as a function of feed per tooth for different cutting speeds and tool coatings.

The study highlights the superior performance of the lapped and TripleSi coatings, which reduced cutting forces effectively. This performance could improve energy efficiency and reduce tool wear in production environments, though the lapped surface may have durability limitations.

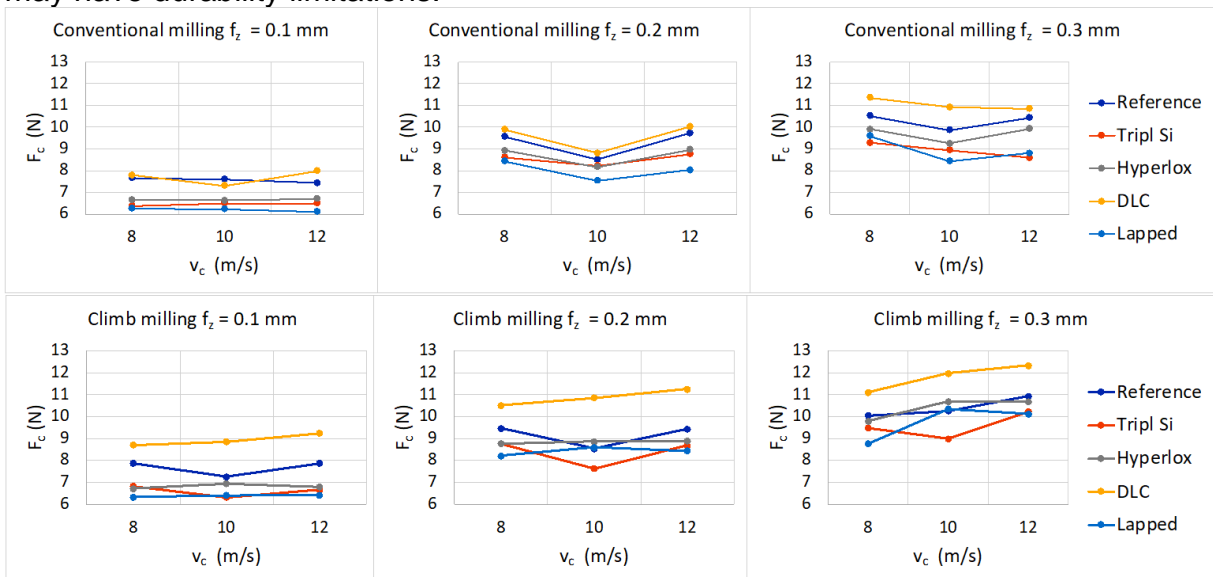


Fig. 2: Average values of cutting forces as a function of cutting speed for different feed per tooth values and tool coatings.

4 CONCLUSION

This research identifies key parameters for optimizing CNC milling of MDF. It concludes that a feed per tooth of 0.1 mm, a cutting speed of 10 m/s, and the use of TripleSi-coated tools are optimal for minimizing cutting forces. This combination reduces energy consumption and promoting a more sustainable manufacturing process.

ACKNOWLEDGEMENT

The research was supported by the Specific University Research Fund MENDELU IGA-LDF-22-TP-004: „Advanced tool materials and their influence on the parameters of CNC machining of wood-based materials.“

Conference Title: *SilvaNet* – *WoodNet* 2024

Time and place: 29th November 2024, B32, B21, B106

Conference organising committee: Pavlína Pancová Šimková, Dagmar Harazimová,
Petr Čech, Kateřina Sedláčková

Original title: *SilvaNet* – *WoodNet* 2024; Proceedings abstracts of student scientific conference

Editors and prepress: Petr Čech, Kateřina Sedláčková

Published by: Mendel University in Brno, Zemědělská 1, 613 00 Brno

Edition: 1st, 2024

Illustration: Petr Čermák

ISBN 978-80-7701-006-1 (online ; pdf)

<https://doi.org/10.11118/978-80-7701-006-1>

Proceedings did not pass language revision and authors of abstracts are responsible for the content and form of their contributions.

Circulation: e-version –<https://ldf.mendelu.cz/veda-a-vyzkum/interni-grantova-agentura/konference-silvanet-woodnnet/?psn=400>