

Technical University in Zvolen

Faculty of Technology

Department of Environmental and Forestry Machinery

13th International Scientific Conference

***MOBILE ENERGETIC DEVICES – HYDRAULICS –
ENVIRONMENT – ERGONOMICS OF MOBILE MACHINES***

PREDNÁ HORA, 8. – 10. SEPTEMBER 2025

Scientific peer-reviewed proceedings of abstracts

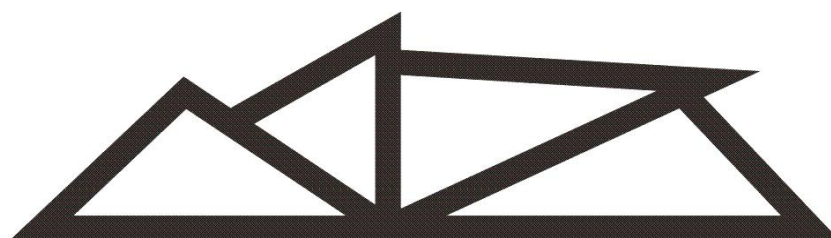


Zvolen, 2025

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Zvolen, 2025

Introduction

The scientific peer-reviewed proceedings of abstracts "Mobile Energetic Devices - Hydraulics - Environment - Ergonomics of Mobile Machines" is focused on current scientific research results and operational knowledge. The main topics of the abstracts are: development trends in hydraulic drives, systems and fluids used in agricultural, forestry and production technology, development trends in mobile technology, biodegradable oils in forestry and agriculture, current problems in the ergonomics of mobile machines, non-traditional energy sources, energy and the environment.

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Content

Monika ANISZEWSKA – Arkadiusz GENDEK – Katarzyna BALTAZIUK – Paweł TYLEK – Jozef KRILEK EFFICIENCY OF THE TECHNOLOGICAL LINE FOR SEWING LARGE SEEDS IN CONTAINER NURSERIES	7
Monika ANISZEWSKA – Arkadiusz GENDEK – Wiktoria ŁĄŻEWSKA – Jozef KRILEK – Iveta ČABALOVÁ – Paweł TYLEK LABORATORY METHOD FOR MEASURING THE PUNCTURE FORCE OF OAK SEEDS USING A STRENGTH TESTING MACHINE ATTACHMENT	8
Zuzana BRODNIANSKÁ – Marek LIPNICKÝ TEMPERATURE COMPARISON OF THE ENGINE COOLER COOLING PROCESS FOR THE COOLER FAN AND THE IMPINGEMENT FAN	9
Iveta ČABALOVÁ – Tatiana BUBENÍKOVÁ – Eva VÝBOHOVÁ – Helena HYBSKÁ – Anna DARABOŠOVÁ VOLATILE ORGANIC COMPOUNDS EMITED FROM THE WOOD-RUBBER COMPOSITES	10
Iveta ČABALOVÁ – Jozef KRILEK – Rupali TIWARI – Ivan RUŽIAK – Anna DARABOŠOVÁ THERMOPHYSICAL CHARACTERISATION OF WOOD-RUBBER COMPOSITES	11
Iveta ČABALOVÁ – Jozef KRILEK – Martin ZACHAR EVALUATION OF PARTICLEBOARD CONTAINING RUBBER FILLER FROM THE POINT OF VIEW OF FIRE PROPERTIES	12
Iveta ČABALOVÁ – Miroslav NĚMEC – Rupali TIWARI ACOUSTIC PROPERTIES OF NEW WOOD-PLASTIC COMPOSITES	13
Arkadiusz GENDEK – Monika ANISZEWSKA – Jozef KRILEK – Tomáš KUVIK – Iveta ČABALOVÁ – Jan MALAŤÁK – Jan VELEBIL LABORATORY TESTS OF RESISTANCE DURING CHIPLESS CUTTING OF WOOD WITH A FLAT KNIFE	14
Milan HELEXA – Jozef KRILEK – Ján KOVÁČ RADIAL AND DIAGONAL TYRES ON FOREST SOIL FROM THE POINT OF VIEW OF A ACHIEVED ROLLING RESISTANCE	15

Jakub CHROSTEK – Arkadiusz STAŃCZYKIEWICZ FUEL CONSUMPTION DURING TIMBER SKIDDING WITH THE PONSSE BUFFALO FORWARDER WITH CLAMBUNK CONSTRUCTION	16
Joanna JASZCZYK – Paweł TYLEK ADMITTANCE MEASUREMENT IN THE ASSESSMENT OF THE PHYSIOLOGICAL CONDITION OF PEDUNCULATE OAK SEEDLINGS	18
Mariusz KORMANEK – Stanisław MAŁEK SATURO NEW DEVICE FOR DETERMINING THE SOIL FILTRATION COEFFICIENT IN THE FIELD	19
Ján KOVÁČ ASSESSMENT OF TECHNICAL PARAMETERS OF FORESTRY WINCHES	21
Jozef KRILEK DIAGNOSTICS OF ROLLER BEARINGS OF A CONTINUOUS PARTICLEBOARD PRESS	22
Marián KUČERA – Michaela HNILICOVÁ – Jakub DRMLA CAUSES OF HYDRAULIC OIL DEGRADATION AND VARNISH FORMATION	23
Tomáš KUVÍK – Vladimír MANČEL – Ján KOVÁČ EXPERIMENTAL EVALUATION OF SPLITTING FORCE DETERMINATION METHODS IN WOOD SPLITTING TECHNOLOGIES	24
Vladimír MANČEL – Marek BARTKO COMPARISON OF METHODS FOR MEASURING THE ANGLE OF REPOSE OF GRANULATE MATERIALS	25
Danuta OWOC – Przemysław SPYCHAJ APPLICATION OF THE BRINELL METHOD FOR ASSESSING THE HARDNESS OF SPECIFIC FOREST TREE SPECIES	26
Paweł TYLEK PATENT AND IMPLEMENTATION ACHIEVEMENTS OF THE DEPARTMENT OF FOREST UTILIZATION AND FOREST TECHNOLOGY OF THE AGRICULTURAL UNIVERSITY OF KRAKÓW	27



Abstracts in the field:

***Mobile Energetic Devices – Hydraulics – Environment –
Ergonomics of Mobile Machines***

**EFFICIENCY OF THE TECHNOLOGICAL LINE FOR SEWING
LARGE SEEDS IN CONTAINER NURSERIES**

**Monika ANISZEWSKA – Arkadiusz GENDEK – Katarzyna BALTAZIUK –
Paweł TYLEK – Józef KRILEK**

ABSTRACT: The production of seedlings with a covered root system is one of the essential elements of modern forestry. The method, in which seeds are sown pointwise and seedlings grow in controlled conditions, has gained popularity due to its numerous benefits, compared to the traditional model of seedling cultivation. These include greater survival of seedlings in the ground, better adaptation to soil conditions, and increased resistance to challenging conditions, which are particularly important in mountainous or former agricultural areas. The organization of work in a container nursery consists of several key elements that ensure the efficient course of seedling production. Analysis of the functioning of the technological line for thick seeds in the container nursery in the Daleszyce Forest District showed areas requiring improvement, such as optimization of transport modules and the sowing module, which can additionally increase the efficiency of the entire process. Analysis of the process of sowing cassettes with coarse seeds indicated that the average cycle time was 4.00 (from 3.78 to 4.35) minutes for beech and 3.83 (from 3.58 to 4.27) minutes for oak. These data indicate greater stability of times in the beech sowing process, which may result from differences in the functioning of the technological line. Transport activities, including, among others, input transport of cassettes and their transfer between stages, took up a total of 59-60% of the total cycle time. The average transport time for beech was 2.4 minutes and for oak, 2.33 minutes. Approximately five cassettes leave the line per minute. According to information obtained from the nursery manager, approximately 1800-2000 cassettes are sown during a work shift. The research yielded 1825 cassettes with beech seeds and 1906 cassettes with oak seeds. A reduction of 2.7 meters in transport distances, which corresponds to a decrease of 14%, could reduce the transport time for beech to 2.06 minutes on average and for oak to 1.98 minutes, which would reduce the total cycle time to an average of 3.66 minutes and 3.50 minutes, respectively. This type of optimization would increase the efficiency of the process, as approximately 170 more cassettes would be sown with beech seeds and approximately 180 cassettes with oak seeds. The sowing efficiency of beech in cassettes was on average 55% (from 45% to 64%), while for oak it was 56% (from 47% to 66%). One of the main problems was the presence of excess preservative on the seeds, which clogged the holes of the sowing drum, which limited the precision of the seed suction and led to unsown cells. Using a sieving mechanism could remove excess dressing, improve the quality of the process, and reduce the number of manual corrections necessary. In addition, the vibration mechanism, which is currently effective in the beech seeding process, could be adapted to the oak seeding process, considering the larger size and weight of this species' seeds. The vibrations generated by the hammers would support the even distribution of seeds in the drum holes, reducing the number of unsown cells. Another improvement could be using buffer modules at strategic points in the process. The mechanism of action would be that the cassettes filled with substrate are placed on a platform, which stores them in readiness until the seeding module can accept them.

Key words: container nursery, technological line, seeds, seedling with a lump, beech, oak

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Abstracts in the field:

*Mobile Energetic Devices – Hydraulics – Environment –
Ergonomics of Mobile Machines*

**LABORATORY METHOD FOR MEASURING THE PUNCTURE
FORCE OF OAK SEEDS USING A STRENGTH TESTING MACHINE
ATTACHMENT**

**Monika ANISZEWSKA – Arkadiusz GENDEK – Wiktoria ŁAŻEWSKA –
Jozef KRILEK – Iveta ČABALOVÁ – Paweł TYLEK**

ABSTRACT: The collection and sowing of oak seeds consists of many activities. One of them is the manual and labour-intensive scarification procedure. Therefore, design solutions for devices to mechanize this procedure are sought. In connection with the scarification devices available on the market that only cut off the distal end of the acorn, a new method of scarification by puncturing the seeds was proposed. As preliminary studies have shown, the puncturing method promotes faster, uniform emergence and prevents the loss of seed material, which positively affects the uniform growth and height of seedlings. The research aimed to use the new device's design for scarification and determine the force needed to pierce the seed coat of acorns. The designed element with a sensor, attached to the measuring device, allowed for measuring the force required to pierce the seed coat in the distal and lateral parts of the seeds of three oak species. The study shows that the force needed to puncture the distal part of the pedunculate oak seed is 58.32 ± 13.94 N, sessile oak 57.47 ± 14.49 N, and red oak 94.92 ± 21.09 N. The measurements were taken for all seeds, regardless of their health status. The difference in forces between the pedunculate and sessile oak species is insignificant because the seeds of these species are very similar. However, red oak is an alien species, and the seeds of this oak differ significantly in shape and thickness of the seed coat from native species. The study also took into account the health of the seeds. For healthy seeds of pedunculate oak, the value of the force required to pierce the seed coat is 60.97 ± 14.26 N, and for spoiled seeds, 50.58 ± 9.79 N. Similar force values can be observed in the case of sessile oak for healthy (61.91 ± 12.57 N) and spoiled (43.39 ± 10.89 N) acorns. Red oak seeds require higher force values, healthy 95.84 ± 20.23 N, and spoiled 48.52 N, respectively. The force required to pierce the lateral seed coat for pedunculate oak is 80.40 ± 20.83 N, and the force for red oak is 33% higher (106.86 ± 26.30 N). Considering the health of seeds, for healthy acorns of English oak, the force needed to pierce the seed coat is 78.92 ± 19.30 N, while for rotten acorns it is 82.69 ± 23.34 N. For red oak, it is 107.80 ± 26.42 N and 84.03 ± 0.01 N, respectively. Rejecting rotten acorns from each batch during the preparatory stage is very important. The designed attachment to the strength machine, manual and table device for puncturing oak seeds, and the method of scarification by puncturing have been filed for patent protection.

Key words: scarification, oak seeds, needle, seed piercing

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Abstracts in the field:

*Mobile Energetic Devices – Hydraulics – Environment –
Ergonomics of Mobile Machines*

**TEMPERATURE COMPARISON OF THE ENGINE COOLER
COOLING PROCESS FOR THE COOLER FAN AND THE
IMPINGEMENT FAN**

Zuzana BRODNIANSKÁ – Marek LIPNICKÝ

ABSTRACT: The cooling process in the car engine cooler is significantly influenced by the air flow from the fan located on the cooler and by the forced air generated while the car is in motion. The forced air generated while the car is in motion is simulated in laboratory conditions by the external axial impingement fan. The aim of the experimental research is to compare the influence of the air flow velocity from the fan on the cooler and the external impingement fan on the cooling process of the coolant. In both cases, the cooling process starts when the operating temperature of the coolant reaches 80 °C at the inlet to the cooler. The simulation of the forced air by the external fan is performed at average velocities of 6, 8, and 10 m/s. The inlet and outlet temperatures of the cooler during the cooling process by both means are compared with each other and evaluated. The heat transfer from the coolant through the cooler tubes and fins to the surrounding environment increased with increasing velocity of the forced air from the external fan. The shortest cooling time of the hot coolant was achieved at a forced air velocity of 10 m/s, in which the thermostatic valve passed the hot coolant into the long circuit for 20 seconds. After 30 seconds of cooling, the coolant reached the outlet temperature of 57.05 °C in the external impingement fan case with an average velocity of 10 m/s, which is an improvement of 9.13 °C compared to the fan on the cooler. The faster and more intense heat dissipation from the cooler to the surrounding environment, especially in high-performance cars, helps maintain the optimum operating temperature of the car engine.

Key words: coolant, temperature, engine, impingement fan, cooler fan

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Abstracts in the field:

*Mobile Energetic Devices – Hydraulics – Environment –
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VOLATILE ORGANIC COMPOUNDS EMITED FROM THE WOOD-RUBBER COMPOSITES

**Iveta ČABALOVÁ – Tatiana BUBENÍKOVÁ – Eva VÝBOHOVÁ –
Helena HYBSKÁ – Anna DARABOŠOVÁ**

ABSTRACT: The aim of this paper was to evaluate the properties of three-layer particleboards (PBs) containing 10 wt% of rubber filler (tires, and a mixture of carpets and gaskets), waste from the automotive industry. In addition to physical and mechanical properties, it is important to analyse wood-rubber composites from a chemical perspective. For example, the volatile organic compounds (VOC) emission profile is a key parameter for describing building materials in terms of their impact on indoor air quality. For a comprehensive view of the properties of prepared particleboard containing 10% of rubber filler in the middle layer, VOCs emitted from the wood-rubber composites, as well as the rubber itself, were analysed using the HS-GC-MS (headspace extraction - gas chromatography - mass spectrometry) method. Results were compared to the reference PBs without rubber filler. Two tests were performed at different temperatures. The first test analysed VOCs emitted at 35°C (a temperature that has been common in summer in recent years). The second test analysed VOCs emitted from samples at 50°C (a temperature that can be reached on building facades in summer, or that materials can reach when they are near a radiant heat source). At 35 °C, only monoterpenes such as α -pinene, β -pinene and 3-carene were identified among the VOC emitted from the reference PBs itself. No VOC were identified from the tire granulate itself and from the rubber mixture of carpets and gaskets at 35 °C. However, a similar result was also obtained for the PBs samples containing 10% tires and a mixture of carpets and gaskets. The same results were obtained at the temperature of 50°C. Based on the achieved results, it can be concluded that recycled rubber as an additive to particleboard does not contribute to an increase in VOC emissions into the environment and in the interior of buildings, and after confirming these results with further analyses, it could also be used in the interior of buildings.

Key words: particleboards, rubber filler, material recycling, emission, healthy environment

Acknowledgement: *This work was supported by the Slovak Research and Development Agency under the Contract no. APVV-22-0034 and by the Ministry of Education, Research, Development and Youth of the Slovak Republic under the Contract no. VEGA 1/0027/24. The research presented in this paper is also an outcome of the project UNIVNET “University Research Association for Waste Recovery, especially from the Automotive Industry” No. 0201/0082/19 funded by the e Ministry of Education, Research, Development and Youth of the Slovak Republic.*

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Abstracts in the field:

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THERMOPHYSICAL CHARACTERISATION OF WOOD–RUBBER COMPOSITES

**Iveta ČABALOVÁ – Jozef KRILEK – Rupali TIWARI – Ivan RUŽIAK –
Anna DARABOŠOVÁ**

ABSTRACT: The aim of this paper was to evaluate the properties of three-layer particleboards (PBs) containing 10 wt% of rubber filler (tires, and a mixture of carpets and gaskets), waste from the automotive and construction cables (flammable and non-flammable), waste from the construction industry. At the same time, graphite was applied to the PBs in a proportion of 10 wt% along with the rubber filler (waste from the automobiles) in the middle layer to improve their fire-technical properties. The transient plane source (TPS) method was used for measurement of thermal conductivity and diffusivity and specific heat capacity of wood-rubber composites and compared to the reference PBs without rubber filler. Thermal conductivity of reference PBs was $0.202 \text{ W} \cdot \text{m}^{-1} \cdot \text{K}^{-1}$, thermal diffusivity of $0.173 \text{ mm}^2 \cdot \text{s}^{-1}$ and specific heat capacity of $1534 \text{ J} \cdot \text{kg}^{-1} \cdot \text{K}^{-1}$ for density of $761 \text{ kg} \cdot \text{m}^{-3}$. Particleboards containing rubber fillers, such as non-flammable cables, gasket and carpet mixture, tires + graphite showed the largest increase in thermal diffusivity values, followed by lower thermal conductivity compared to the reference PBs. This could be due to heterogeneity in wood-rubber composites structure, such as kind of filler, bonding types and molecular structure, and physical characteristics such as porosity and homogeneity, density, which are significant factors in determining this parameter. Based on the achieved results, rubber recycling by mixing it with wood particles is one way to contribute to environmental protection and create a quality product that can be used in building structures.

Key words: rubber recycling, automotive rubber waste, thermal conductivity, thermal diffusivity, particleboard

Acknowledgement: *This work was supported by the Slovak Research and Development Agency under the Contract no. APVV-22-0034 and by the Ministry of Education, Research, Development and Youth of the Slovak Republic under the Contract no. VEGA 1/0027/24. The research presented in this paper is also an outcome of the project UNIVNET “University Research Association for Waste Recovery, especially from the Automotive Industry” No. 0201/0082/19 funded by the Ministry of Education, Research, Development and Youth of the Slovak Republic.*

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Abstracts in the field:

*Mobile Energetic Devices – Hydraulics – Environment –
Ergonomics of Mobile Machines*

EVALUATION OF PARTICLEBOARD CONTAINING RUBBER FILLER FROM THE POINT OF VIEW OF FIRE PROPERTIES

Iveta ČABALOVÁ – Jozef KRILEK – Martin ZACHAR

ABSTRACT: The aim of this paper was to evaluate the properties of three-layer particle boards (PBs) containing 10 wt% rubber filler (tires, and a mixture of carpets and gaskets), waste from the automotive industry. At the same time, graphite was applied to the PBs in a proportion of 10 wt% along with the rubber filler in the middle layer. The influence of heat flux of $30 \text{ kW} \cdot \text{m}^{-2}$ was evaluated by the burning rate (BR) and mass loss (ML) according to applicable standards. From the perspective of burning rate, it could be stated that better results were obtained for tire + graphite (maximum BR - $0,1671\% \cdot \text{s}^{-1}$, reach time – 130 s) and mixture of carpets and gaskets + graphite (maximum BR - $0.1391\% \cdot \text{s}^{-1}$, reach time – 120 s) comparing to the PBs containing only tires (maximum BR - $0.1522\% \cdot \text{s}^{-1}$, reach time – 90 s) or mixture of carpets and gaskets (maximum BR - $0.1652\% \cdot \text{s}^{-1}$, reach time - 90 s). PBs containing mixture of carpets and gaskets + graphite, exhibits the lowest mass loss (37.48%) that indicates the best fire resisting property. Good results were obtained also for PBs containing tires + graphite (39.24%). The MS of PBs contained only tires and mixture of carpets and gaskets were higher, 48.54% and 47.15%. The use of graphite as a flame retardant has proven to be suitable for increasing the fire resistance of three-layer PBs.

Key words: waste rubber, waste tire, graphite, particleboard, heat flux, burning rate, mass loss

Acknowledgement: *This work was supported by the Slovak Research and Development Agency under the Contract no. APVV-22-0034 and by the Ministry of Education, Research, Development and Youth of the Slovak Republic under the Contract no. VEGA 1/0027/24. The research presented in this paper is also an outcome of the project UNIVNET “University Research Association for Waste Recovery, especially from the Automotive Industry” No. 0201/0082/19 funded by the Ministry of Education, Research, Development and Youth of the Slovak Republic.*

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Ergonomics of Mobile Machines***

ACOUSTIC PROPERTIES OF NEW WOOD-PLASTIC COMPOSITES

Iveta ČABALOVÁ – Miroslav NĚMEC – Rupali TIWARI

ABSTRACT: The aim of this paper was to evaluate the properties of three-layer particleboards (PBs) containing 10 wt% of plastic filler (unpainted, painted bumpers, fuel tanks), waste from the automotive industry. For a comprehensive view of the properties of prepared particleboard containing 10% of plastic filler in the middle layer, sound absorption coefficient was realized according to the Standard ISO 10534-2:2023. Materials behave different across frequencies (125 Hz to 6400 Hz) in terms of sound absorption. Materials behave different across frequencies (125 Hz to 6400 Hz) in terms of sound absorption. Followed materials could be divided into the categories: category A: reference particleboard - PB (without any filler) and PB containing 10% of painted bumpers (PAB10) and category B: PB containing 10% of fuel tanks (FT10) or 10% of unpainted bumpers (UPB10). A range of absorption coefficients from 5.4 kHz to 6.1 kHz was observed to exhibit the highest absorption in PAB10. Within this range, the maximum sound absorption coefficient for these materials reaches a value of 0.24 which is higher compared to the reference particleboard, where the highest value recorded is 0.21 for the same range. Category B materials comprising automotive waste-based particleboards, exhibit notably higher absorption coefficients at lower frequencies compared to Category A materials. These materials consider maximum sound absorption coefficients within the frequency range of 1.4 kHz to 2 kHz. The sound absorption coefficient for FT10 reaches a maximum value of 0.30, and for UPB10 value of 0.27. From the point of view of reached results it can be state that the new particleboards containing plastic fillers from automobiles have a perspective for their use in the construction industry.

Key words: particleboards, plastic filler, waste reusing, sound absorption coefficient

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Abstracts in the field:

*Mobile Energetic Devices – Hydraulics – Environment –
Ergonomics of Mobile Machines*

**LABORATORY TESTS OF RESISTANCE DURING CHIPLESS
CUTTING OF WOOD WITH A FLAT KNIFE**

**Arkadiusz GENDEK – Monika ANISZEWSKA – Jozef KRILEK –
Tomáš KUVIK – Iveta ČABALOVÁ – Jan MALAŤÁK – Jan VELEBIL**

ABSTRACT: When reviewing the available literature on cutting wood with flat knives, there is little current research, and the available publications are 25 years or more old. Since flat knives for cutting wood are still used in forestry machines, it was reasonable to undertake research on the resistance to cutting wood depending on the geometry of such a knife. The research results may contribute to the commencement of work related to improving existing designs of cutting heads or contribute to creating new ideas and designs of heads. Laboratory tests were performed on samples of coniferous wood (pine, spruce, larch) and deciduous wood (oak, alder, elm). Wood was cut using symmetrical flat knives with thicknesses of 5 mm, 10 mm, and 15 mm and a constant sharpening angle of 30°. The cutting speed was 4 mm·s⁻¹. The test samples had cross-section dimensions close to 50×50 mm and a length of 170 mm. The permissible deviation of dimensions on the cross-section was assumed to be ±2 mm, which resulted from the precision of workmanship in the carpentry shop. The wood was cut on a testing machine, Inspekt table 100 (Hegewald und Peschke, Germany), with a measuring range of up to 100 kN. Before cutting, the characteristics of the wood were determined using laboratory methods, determining its moisture content, density, hardness, and graininess. After entering the data necessary for measurement into the system, the LabMaster software controls the machine and continuously records the cutting height (feed) and force during cutting. Based on the data recorded in the system, the average cutting force, maximum momentary cutting force, total energy needed to cut the sample, and unit energy per 1 mm of the cutting edge length and per 1 mm² of the sample cross-section were calculated. For strength reasons, the most important parameter is the momentary maximum cutting force when designing the knife and cutting systems. In the case of coniferous species, it ranged from 12.7 kN to 21.5 kN, and for broadleaf species from 22.3 kN to 45.3 kN. After converting to a unit force per 1 mm of cutting edge length, these results ranged from 254 N·mm⁻¹ to 455 N·mm⁻¹ for coniferous species, and from 427 N·mm⁻¹ to 904 N·mm⁻¹ for broadleaf species. In the case of broadleaf species, a positive correlation was found between cutting resistance and knife thickness. In coniferous species, there was a significant increase in cutting resistance when the knife thickness changed from 5 mm to 10 mm. Another change in the knife thickness to 15 mm caused a decrease in resistance associated with longitudinal cracking of the samples and their delamination at the contact of successive annual rings. It was found that the length of the samples plays an important role in these measurements.

Key words: cutting resistance, cutting force, flat knife, wood

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**RADIAL AND DIAGONAL TYRES ON FOREST SOIL FROM THE
POINT OF VIEW OF A ACHIEVED ROLLING RESISTANCE**

Milan HELEXA – Jozef KRILEK – Ján KOVÁČ

ABSTRACT: The main component of the loss resistance of mobile work machines with wheeled running gear is the rolling resistance of the running wheels. Given that mobile work machines often move not only on paved roads but especially off-road, the rolling resistance of their wheels is a more complex quantity. The experimental measurement performed focused on monitoring the rolling resistance of two selected tires, one radial and the other diagonal, of similar proportional dimensions on selected forest soil under soil bin conditions. The soil in the soil bin consisted of loamy sand with an average moisture content of 30 % and a bulk density of $1,445.07 \text{ kg.m}^{-3}$. From the point of view of the obtained results and statistical assessment, no significant differences were found between the studied tires in terms of the achieved rolling resistance values. The obtained results also show that changes in tire inflation pressure cause more significant energy losses than changes in vertical load alone, for both tires studied. The results also indicate that even with classic radial or diagonal tires, the issue of choosing the right inflation pressure is not negligible, especially when driving off-road and on the soil.

Key words: tyre, forest soil, forestry machines, testing, soil bin

Acknowledgement: *The publication was created based on the solutions of the projects KEGA 007TU Z-4/2023 “Innovation and educational support of subjects in the field of technical diagnostics of agricultural and forestry technology with an orientation to practice” and the project KEGA 12SPU-4/2025 “Implementation of modern methods in the Smart Farm 4.0 concept when sharing common data within the framework of teaching for agricultural and forestry sciences”.*

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FUEL CONSUMPTION DURING TIMBER SKIDDING WITH THE PONSSSE BUFFALO FORWARDER WITH CLAMBUNK CONSTRUCTION

Jakub CHROSTEK – Arkadiusz STAŃCZYKIEWICZ

ABSTRACT: Longwood skidding is very popular in the Long-Length-System. It is realised by a number of different types of skidders adapted to this type of extraction. In recent years, forwarders have become increasingly important, as the re-equipping of this type of specialised tractor, by installing special equipment on the rear axle to form a clambunk, enables the skidding of large-size long timber. The use of specialised machinery for harvesting and skidding brings many benefits, including increased efficiency. Moreover, it makes it possible to limit damage to the forest environment. In addition to a number of benefits, the use of specialised machinery also entails costs during operation, such as fuel consumption during harvesting. The aim of the study was to determine the efficiency in productive work time ($\text{m}^3 \cdot \text{h}^{-1}$) and unit fuel consumption ($\text{dm}^3 \cdot \text{m}^{-3}$) during longwood skidding, performed by the operator of a specialised Ponsse Buffalo forwarder tractor with clambunk. The research was conducted in a clear-cutting area located in a 113-year-old pine stand (100% Scots Pine (*Pinus sylvestris* L.)) in the Kobiór Forest District (Regional Directorate of State Forest in Katowice). The operator skidded longwood from a clear-cutting area to an export road over a distance of 600 m. In the field work, the method of chronometry of the working day (work shift) was used, measuring the times of operations in skidding cycles, with an accuracy of 1s. After each skidding cycle, the pieces of timber skidded were marked and the volume of the skidding load was determined using the Huber's formula. Statistical analyses were performed using the EXCEL and STATISTICA 13.3 (StatSoft Inc., 2017). The calculations were made for a skidding distance of 600 m and, assuming a constant low machine speed, estimates were made for distances of 100, 200, 300, 400 and 500m. The average fuel consumption of the forwarder was $14 \text{ dm}^3 \cdot \text{m} \cdot \text{h}^{-1}$, so that the unit fuel consumption for skidding cycles was recalculated. In addition, an attempt was made to select models depicting efficiency in productive work time and unit fuel consumption as a function of the volume of the load being skidded over the skidding distances analysed, and a multiple regression model was created to describe unit fuel consumption as a function of the volume of the load being skidded and the distance of the skidding operation. The operator of the Ponsse Buffalo forwarder made 35 skidding cycles and skidded a load with a total volume of 152.12 m^3 . For the maximum distance (600 m), the average skidding efficiency in productive work time was $8.20 \text{ m}^3 \cdot \text{h}^{-1}$, while unit fuel consumption was $1.97 \text{ dm}^3 \cdot \text{m}^{-3}$. The study showed a decrease in efficiency and an increase in unit fuel consumption with an increase in skidding distance. Furthermore, an increase in efficiency and a decrease in specific fuel consumption were found as the volume of the skidding load increased. Another result of the research was the development of models for the estimation of efficiency in productive work time and unit fuel consumption as a function of the volume of the skidding load, as well as a multiple regression model for the estimation of unit fuel consumption as a function of the skidding distance and the volume of the load.

Key words: skidding distance, productivity, load volume, clear cutting, Long-Length System



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**ADMITTANCE MEASUREMENT IN THE ASSESSMENT OF THE
PHYSIOLOGICAL CONDITION OF PEDUNCULATE OAK
SEEDLINGS**

Joanna JASZCZYK – Pawel TYLEK

ABSTRACT: One of the procedures for preparing oak seeds for sowing is mechanical scarification, which involves damaging the seed coat. This accelerates and evens out germination. A significant added value of the procedure is the possibility of visually assessing the mummification changes in acorns and rejecting those that do not promise proper germination. So far, scarification has been carried out manually using pruning shears. It is a laborious and monotonous work, requiring the employment of a dozen or so people in each nursery producing seedlings. In connection with the above, a model of a carousel, autonomous scarifier was developed, which precisely cuts acorns and sorts them based on an innovative, optical separation feature. The device has been equipped with two optical systems, the first of which checks the spatial orientation resulting from the random feeding of acorns by the feeder. Seeds that are incorrectly oriented are redirected to the container. The system has another function, which is measuring the length of the acorn. This information is then used to determine the place where the acorn was cut to ensure the same scarification intensity, regardless of the size of the acorn. The second optical system is responsible for monitoring health. This process involves identifying the relative size of mummification changes using computer vision methods. In the presented studies, seeds were separated using different parameters for identifying disease changes, and seedlings grown from seeds were compared with seedlings produced using the classical method - from seeds scarified manually. Objective methods for assessing viability by measuring electrical conductivity are currently sought. Due to the presence of a capacitive element in plant cells, which are mainly cytoplasmic membranes, the value of the measured electrical conductivity is the sum of conductance and susceptance, and the result obtained is called admittance. The paper presents the results of admittance measurements of shoots of pedunculate oak (*Quercus robur* L.) seedlings grown using the container method from acorns scarified automatically and manually. Preliminary analyses indicate greater viability of seedlings from seeds that were scarified and sorted automatically.

Key words: seed scarification, automation, container nursery

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SATURO NEW DEVICE FOR DETERMINING THE SOIL FILTRATION COEFFICIENT IN THE FIELD

Mariusz KORMANEK – Stanisław MAŁEK

ABSTRACT: In the soil environment, water is the basic factor determining the possibility of plant development. Both its excess and deficiency can inhibit plant growth. The availability of water in the soil is influenced by infiltration and filtration. Infiltration (soaking) is primarily the movement of water in unsaturated soil, i.e. when some of the soil pores are filled with air, and the percolating water gradually moistens deeper and deeper layers of soil. Filtration takes place in soil spaces fully saturated with water, and is defined as the ability of the soil to conduct water when it is fully saturated with water. It is determined using the filtration coefficient K_f , which is most often expressed in $\text{cm} \cdot \text{s}^{-1}$ or $\text{m} \cdot \text{d}^{-1}$. The movement of water in the soil, including the filtration coefficient, depends mainly on the granulometric composition associated with the porosity and structure of the soil. It also depends on the content of humus in the soil, chemical composition, temperature, the activity of living organisms, and agrotechnical treatments affecting soil compaction. The permeability coefficient can be obtained based on calculations, laboratory and field tests. Calculation methods are based on faster, cheaper and methodically easier to measure parameters characterizing the soil, most often granulometric composition or total porosity. Calculation methods are considered the least precise, and their advantages include speed, low cost and low labour intensity. When determining the coefficient using laboratory methods, water flows through a well-saturated soil sample as a result of the pressure difference on both sides of it, and the water outflow is measured and combined with the pressure difference and the size of the sample. In field conditions, various measuring devices are used. A two-ring device is often used, but measurement with this device is very laborious and usually takes a long time, especially in soils with poor permeability. An alternative is the automated SATURO device operating on the basis of cyclically changed pressure (two pounding method). The device was used to determine the permeability coefficient of soils on the surfaces of forest plantations with pine, beech and oak located in the Daleszyce Forest District. The first measurements were taken after preparing the area for planting (autumn), which consisted of making strips using a forestry mill with a countersink. The next measurement was taken in spring, after autumn planting of seedlings, and at the end of the first year after planting in autumn. Measurements on each crop and at each date were taken in three places diagonally across rectangular cultivation areas in a furrow between growing seedlings. Additionally, measuring cylinders were taken from three soil layers to determine basic physical parameters of the soils (granulometric composition, bulk density, moisture). The determined K_f filtration coefficients ranged for the pine surface from 3.4 to 5.5 $\text{cm} \cdot \text{s}^{-1}$, for the beech surface from 4.6 to 8.8 $\text{cm} \cdot \text{s}^{-1}$, and for the oak surface from 2.1 to 5.8 $\text{cm} \cdot \text{s}^{-1}$. As it was shown, there is a relationship between the determined filtration coefficient and the moisture and bulk density of the soil. When assessing the modern SATURO measuring device used for measurements, it can be stated that this is a significant advance in the method of determining the filtration coefficient compared to the two-ring device. SATURO is a fully automated device, in which after mounting the immersion cylinder in the soil, connecting the central unit, water tanks and starting the measurement is performed automatically, and the result is recorded in the device's



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memory, without the need for supervision. The measurement time depends on the device settings, the minimum is 45 minutes selected for the given soil.

Key words: soil permeability coefficient, infiltrometer, measurement automation

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ASSESSMENT OF TECHNICAL PARAMETERS OF FORESTRY WINCHES

Ján KOVÁČ

ABSTRACT: Nowadays, many companies are engaged in the production of forestry winches with various technical parameters, which makes it difficult for a future operator to choose from such a large number of forestry winches. A winch is currently a widely used additional device for various types of material handling, such as lifting, pulling or approaching. A winch is the basic and most important adapter in forestry operations when concentrating wood. They are most often used in two basic versions, namely as an adapter on a mobile machine or as part of rope systems. Interest in tractor winches has increased in recent years. There are many modern and reliable winches on the market from various leading manufacturers. Manufacturers are doing their best to improve their products. The capacity of the winches is wide. This article analyses the technical parameters of forestry winches in order to make them as wide and optimal as possible in practical applications. The article deals with the technical parameters of forestry winches, which are currently widely used in material handling. The main goal of the article is to analyse and compare the technical parameters of winches so that their selection and practical use are as efficient as possible. Manufacturers strive to constantly improve their products and offer a wide range of solutions.

Key words: wood concentration, forestry winch, technical parameters, regression analysis

Acknowledgement: *The contribution was prepared within the framework of the project KEGA 007TU Z-4/2023 “ Innovation and educational support of subjects in the field of technical diagnostics of agricultural and forestry technology with an orientation to practice “.*

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DIAGNOSTICS OF ROLLER BEARINGS OF A CONTINUOUS PARTICLEBOARD PRESS

Jozef KRILEK

ABSTRACT: The aim of the paper is to analyse the bearings of a continuous press, the variables that affect these bearings in the working environment and to analyse the suitability of the type of lubricant used. The result of the analysis aims to compare the size of the prescribed dose of lubricant from the manufacturer of the continuous press with the result achieved by calculation. Optimization activities were evaluated, especially from the point of view of maintenance, such as bearing assembly, lubrication, diagnostics and fault analysis. To achieve the required bearing life in the press, a combination of all the aforementioned factors is necessary. The optimal ratio of the lubricant dose has a direct impact on the processes in the bearing, which can be observed through the spectrum of vibrations and possibly temperatures. The main contribution of this work is to optimise the lubricant dose and the lubrication interval with regard to meeting production goals for the efficient and economical production of large-area agglomerated formats.

Key words: diagnostics, bearing, grease, press, vibration, maintenance, lubrication

Acknowledgement: *This output was developed as part of the project of the Cultural and Educational Grant Agency of the Ministry of Education, Science and Technology of the Slovak Republic KEGA No. 007TU Z-4/2023 entitled "Innovation and educational support of subjects in the field of technical diagnostics of agricultural and forestry technology with an orientation to practice".*

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CAUSES OF HYDRAULIC OIL DEGRADATION AND VARNISH FORMATION

Marián KUČERA – Michaela HNILICOVÁ – Jakub DRMLA

ABSTRACT: Given the new and more powerful machines and equipment and the resulting demanding operating conditions, it should be noted that the degradation of hydraulic oil has a complex and difficult character. It is often caused by several mutually influencing factors and the causes can be found, for example, in new formulations of lubricating oil or more demanding operating conditions. Recently, the increase in resins (varnishes) and sludges has been observed in particular, which are the cause of certain operating problems, dominated by pollution, oxidation, high temperatures and incorrect oil change intervals. These subsequently have an impact on the functionality and reliability of machine parts and also the service life of the hydraulic oil itself.

Key words: hydraulic oil, degradation, varnish, sludge, MPC test

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**EXPERIMENTAL EVALUATION OF SPLITTING FORCE
DETERMINATION METHODS IN WOOD SPLITTING
TECHNOLOGIES**

Tomáš KUVIK – Vladimír MANČEL – Ján KOVÁČ

ABSTRACT: This paper analyses and compares two different approaches for measuring splitting force: using strain gauges and using a pressure sensor. The method with the strain gauge, applied directly to the piston rod, allows for real-time acquisition of the force value. In contrast, the pressure sensor method, using an HBM sensor, requires the application of empirical formulas to estimate the force. The measured data from both methods were statistically analysed using the STATISTICA 12 software and evaluated with a T-test, which yielded a value of 0.032, indicating an insignificant difference between the methods. From a precision standpoint, both techniques can be considered equivalent. The experimental findings demonstrate the suitability of both approaches for accurate and reliable splitting force determination, which is essential for the optimization of splitting operations and ensuring system efficiency.

Key words: splitting force measurement, strain gauge method, pressure sensor

Acknowledgement: *This publication is the result of the project implementation - VEGA project No. VEGA 1/0196/25 "Research and innovation of cutting mechanisms in wood processing" and APVV project No. APVV-21-0180 "Innovative approaches to increase the lifetime and reduce the energy consumption of cutting tools in wood processing in forestry".*

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COMPARISON OF METHODS FOR MEASURING THE ANGLE OF REPOSE OF GRANULATE MATERIALS

Vladimír MANČEL – Marek BARTKO

ABSTRACT: The cone and cylinder method of determining the angle of repose of rubber and plastic granulates is the main emphasis of this research. The measurement techniques were carried out using the legitimate technical standard for rubber and plastic materials from construction and automotive waste in the fraction 1-4 mm granulate form. The cone measurement method, the cone calculation method, and the cylinder measurement method were employed to determine the angles of repose. Following that, the outcomes of each approach were transformed into tables and graphs. Numerous differences in values between the individual measurements were displayed in the findings, which may have been brought on by human error. Using the cone calculation approach, the average angles of repose ranged from 33.41° to 43.32°, the cone measurement method from 37.2° to 46.2°, and the cylinder measurement method from 30.4° to 46.6°. It may be inferred from the data that the cone calculation approach produced the most accurate results. Within the scope of waste recovery, the findings of this study will offer crucial information regarding the handling and storage of the aforementioned waste rubber and plastic granulates, which can be employed in the process of producing composite materials.

Key words: angle of repose, granulate, cone method, cylinder method, rubber, plastic

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APPLICATION OF THE BRINELL METHOD FOR ASSESSING THE HARDNESS OF SPECIFIC FOREST TREE SPECIES

Danuta OWOC – Przemysław SPYCHAJ

ABSTRACT: This study examined the hardness of wood from three species: black alder (*Alnus glutinosa*), common elm (*Ulmus minor*), and aspen (*Populus tremula*). The research material came from two forest districts: Zagnańsk (black alder) and Daleszyce (common elm and aspen). Hardness measurements were performed using the Brinell method using a SHIMADZU AGX-V testing machine. For each tree species, 30 cubic samples, 6x6x6 cm, were prepared, representing different parts of the tree, from the pith to the bark. Wood hardness tests were performed in three directions depending on the grain orientation: perpendicular to the cross-section P1, perpendicular to the radial section P2, and perpendicular to the tangential section P3. The influence of grain direction, moisture content, and density was taken into account. Average hardness after conversion to 12% moisture content was: common elm – 67.34 HB (P1), 24.51 HB (P2), and 32.63 HB (P3); black alder – 54.80 HB (P1), 16.90 HB (P2) and 21.19 HB (P3), aspen – 50.46 HB (P1), 13.60 HB (P2), and 17.93 HB (P3). Average moisture content of the samples: common elm – 26%, black alder – 28%, aspen – 46%. The average density of the samples was for common elm – 578 kg/m³, black alder – 464 kg/m³, and aspen – 410 kg/m³. Wood hardness is strongly dependent on the grain direction. This confirms the anisotropic nature of wood and the need to consider the direction of measurement when assessing it. Pearson linear correlations were performed between hardness, moisture content, and density for the studied tree species, demonstrating the interdependence of the parameters studied.

Key words: hardwood, black alder, common elm, aspen poplar

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**PATENT AND IMPLEMENTATION ACHIEVEMENTS OF THE
DEPARTMENT OF FOREST UTILIZATION AND FOREST
TECHNOLOGY OF THE AGRICULTURAL UNIVERSITY OF
KRAKOW**

Paweł TYLEK

ABSTRACT: The technological and technical progress observed in the industry over the last decades is increasingly visible also in the area of forest management. Over the last dozen or so years, the phenomenon of mechanization, automation and robotization has intensified, and is included with different accents in all areas of forestry mechanization, such as: seed and nursery work, afforestation and breeding, and the processing of wood material. The presentation presents the benefits and challenges related to the aforementioned changes, using examples of mechanized and robotic agrotechnical processes proposed as part of research and development work conducted by employees of the Department of Forest Utilization and Forest Technology of the University of Agriculture in Krakow. Issues related to the commercialization of the resulting solutions were also discussed.

Key words: machine design, robotization, intellectual property, commercialization

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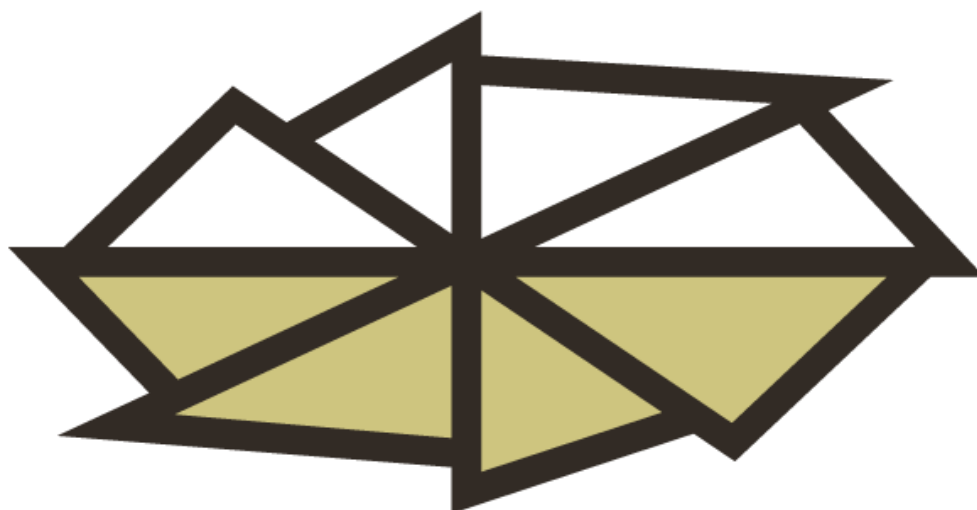


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**TRADIČNÝ DODÁVATEĽ SLUŽIEB A VÝROBCA
STROJOV PRE LESNÉ HOSPODÁRSTVO**

**Komplexné práce v ťažbovej činnosti
a sústred'ovaní dreva harvesterovými uzlami
a lanovými systémami**

**Výroba komponentov pre odvoznú
súpravu (opleny, drapáky na HR)**

**Výroba adaptérov na čelné nakladače
(drapáky, lyžice)**

**Odvoz dreva odvoznými
súpravami**



**Výroba a montáž nadstavieb na odvoz
dreva (dlhého dreva aj sortimentov)**

**Výroba a renovácie manipulačných
liniek pre expedičné sklady dreva**



**Servisné, zámočnicke
a kovoobrábacie práce**

**Údržby, investičná výstavba
lesných ciest a zväžnic**



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e-mail: zltbb@lesy.sk**



Abstracts in the field:

***Mobile Energetic Devices – Hydraulics – Environment –
Ergonomics of Mobile Machines***



**TECHNICKÁ UNIVERZITA VO ZVOLENE
VYSOKOŠKOLSKÝ LESNÍCKY PODNIK**



VŠLP sa organizačne člení na ústredie, lesnú správu Budča, lesnú správu Sekier, a stredisko služieb Lieskovec.

Obhospodaruje lesy na výmere 9 942 ha, z čoho je 9 065 ha štátnych, 27 ha vo vlastníctve TUZVO a zvyšok prenajaté od urbárskych spoločností.

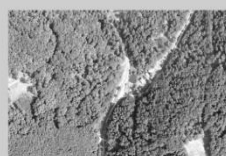
Využívanie prírodných daností lesa nad rámec bežného obhospodarovania umožnilo zaradenie lesov vo vlastníctve štátu do lesov osobitného určenia, čo predstavuje 78 % z celkovej výmery, 13 % tvoria ochranné lesy a zvyšných 9 % sú lesy hospodárske.

Variabilné prírodné podmienky v rozpätí nadmorskej výšky 250- 1026 m a technické zariadenia umožňujú na relatívne malom území sledovať rôzne spoločenstvá flóry a fauny a vykonávať širokú škálu lesníckych výskumných a prevádzkových aktivít.

VŠLP hospodári na území, ktoré sa rozprestiera prevažne v Kremnických vrchoch a Javori, okrajovo zasahuje do Zvolenskej kotliny a Štiavnických vrchov.

V drevinovom zložení jasne dominuje buk s takmer 52% zastúpením, z ihličnatých drevín má najväčšie zastúpenie s 8% smrek. Celkom je evidovaný výskyt 27 druhov, ktoré podľa zastúpenia predstavujú 83% listnatých a 16% ihličnatých drevín.

Hospodárska činnosť podniku, zriaďovanie trvalých výskumných a poloprevádzkových plôch, nadobúdanie rôznych technických zariadení, ale aj špeciálne budovanie demonštračných objektov, má ako hlavný cieľ vytvorenie optimálnych podmienok na plnenie hlavného poslania, ktorým je zabezpečenie praktickej výučby pre študentov TUZVO.



Výrez z ortofotoplánu územia VŠLP (Podjavor)



V tejto budove začala v roku 1958 svoju činnosť Fakulta lesného hospodárstva



Skalný hrb „Čertova skala“ v NPR Boky





Abstracts in the field:

***Mobile Energetic Devices – Hydraulics – Environment –
Ergonomics of Mobile Machines***

BRC Slovakia s.r.o. - <https://www.brcslovakia.sk/>

BRC Slovakia was established in 2006. We are a certified distributor of PARKER Hannifin with operations throughout Slovakia. We cover the diverse and growing demands of customers in the field of machine servicing, installations of smaller power units and development of equipment in the field of pneumatics, hydraulics and mechanics. As a PARKER DISTRIBUTOR we offer Parker brand components, including hydraulic and pneumatic hoses, pumps, motors, actuators and valves. In our stores in Bratislava and Martin we offer you a wide range of pneumatic and hydraulic components.



Company history

2006 – The establishment of BRC Slovakia

2009 – Opening of a specialized store in Vrútky

2010 – Development and assembly of equipment in the field of pneumatics, hydraulics and mechanics

2011 – Opening of ParkerStore and specialized service centre for hydraulic and pneumatic systems and equipment in Vrútky

2012 – Commissioning of the Parker Hose Doctor vehicle, opening of the ParkerStore Zvolen

2014 – Opening of ParkerStore in Bratislava and receiving the Distributor of the Year 2014 award from Parker Hannifin

2015 – Opening of ParkerStore Košice, defending the position of Distributor of the Year 2015

2016 – Opening of a specialized workplace for teaching fluid mechanisms at the Technical University in Zvolen

2017 – Receiving the Distributor of the Year 2017 award for Slovakia

2018 – Implementation and use of a certified quality management system according to the STN EN ISO 9001:2016 standard, defending the position of Distributor of the Year 2018 for Slovakia

2019 – Adding a new pneumatic stand to the Fluid Mechanisms Education and Training Centre at the Technical University in Zvolen





Abstracts in the field:

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CSM Industry s.r.o. - <https://csm.sk/>



History of production began in 1967. Throughout the history we have created a number of successful products. In 1967 began to be written the history of production of the new series of legendary multi-purpose telescopic excavator UDS. In 50 years to company produced more than 30.000 construction machines which are exported to entire world. The technological equipment of CSM Industry Ltd enables to produce various parts such as frames, booms, arms and other for its customers and can provide them with comprehensive services from operations as material preparation to final machining, painting and assembly. A part of the production process is also a separate development design engineering centre, in which the production process begins. We provide our services to renowned international companies, to which we supply various components, jigs and assembly units.

Projects

Reducing energy consumption in the CSM production hall no. 310041BXB1

Reducing energy intensity and increasing the use of renewable energy sources no. 310041BSV3

Support for innovation in the company CSM Industry s.r.o. no. NFP313012CPW9





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Way Industries a.s. - <https://way.sk/>

Way Industries a.s. is a manufacturing company with more than 50 years of experience in the field of production and assembly of civil and military vehicles and related services. In its beginnings, the company began to produce components for the engineering industry. Over time, the company wanted to upgrade its production and bring customers higher added value and invent a product that would reach the peak of innovation in the Slovak Republic. We launched the production of skid steer loaders, which achieved a high level of annual productivity. After obtaining various certificates and attestations, the company launched the production of a unique product - the BOŽENA mine clearance system, thereby gaining global leadership in its manufacturing industry. Currently, the company is primarily engaged in the production of LOCUST loaders and BOŽENA mine clearance systems, which it regularly improves and innovates, thus offering the customer the facilitation of hard work in any conditions and the protection of his safety in dangerous, life-threatening situations.



Company history

21.10.1969 – Laying the foundation stone

1981 – Final production of the first UNC60 loader

1990 – Independent state enterprise ZŤS Krupina

1993 – Development and subsequent production of the set ROBOT BOŽENA 1

1995 – Development and subsequent production of a mine clearance system BOŽENA 2

2000 – Start of production of the TALET 30 airport equipment tractor and loader LOCUST 752

2001 – New name: Way Industries

2002 – Start of loader production LOCUST 1203

2002 – Start of production of the mine clearance system BOŽENA 4

2004 – Start of serial production of loaders LOCUST 853 and LOCUST 903

2005 – Start of production of the mine clearance system BOŽENA 5

2010 – Strategic partnership with the company YANMAR Construction

2016 – Serial production of L903

2022 – Start of production of a new line of loaders L904 and L1004

2023 – Acquisition of Tatralift, start of production of cable cars, ski lifts and bobsleigh runs

