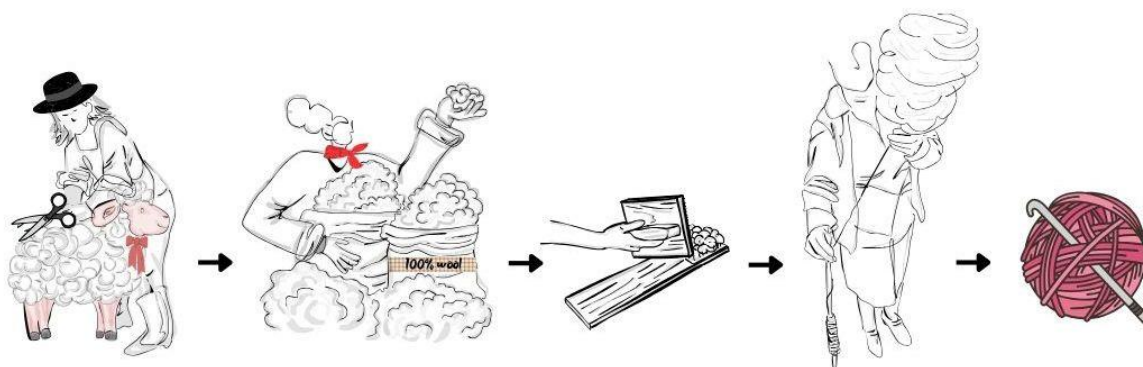


Book of abstracts

TEXTILE SCIENCE RESEARCH CENTER

OPEN DAY 2025

**THE STRENGTH OF DOMESTIC WOOL – FROM
SUSTAINABILITY TO INNOVATION**



Organizer: Textile Science Research Centre (TSRC)
University of Zagreb Faculty of Textile Technology
Technical Museum Nikola Tesla

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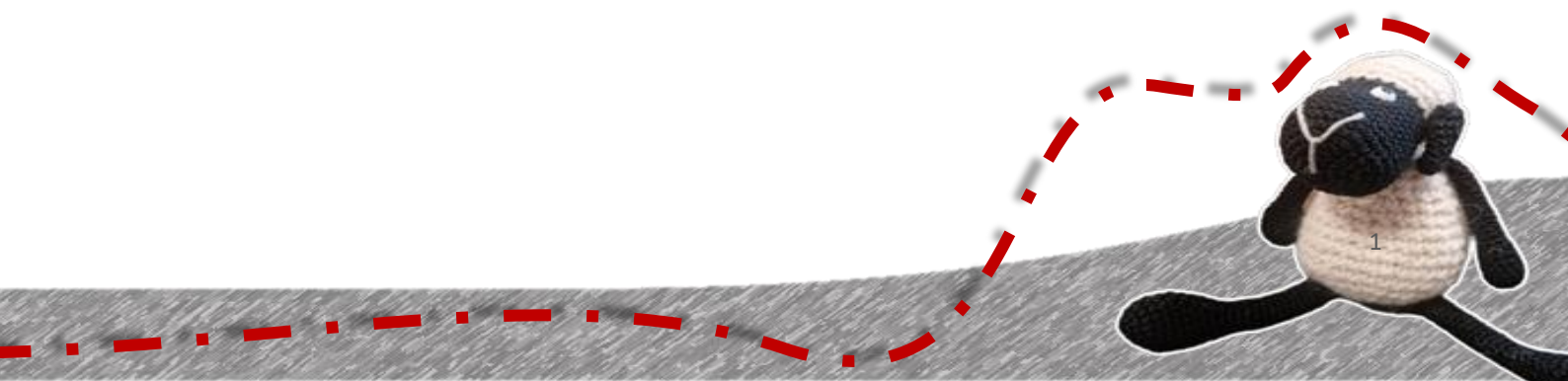
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Lectures



CEBULLA HOLGER:

University of Technology Chemnitz, Chemnitz, Germany

CHALLENGES OF WOOL SCOURING IN GERMANY

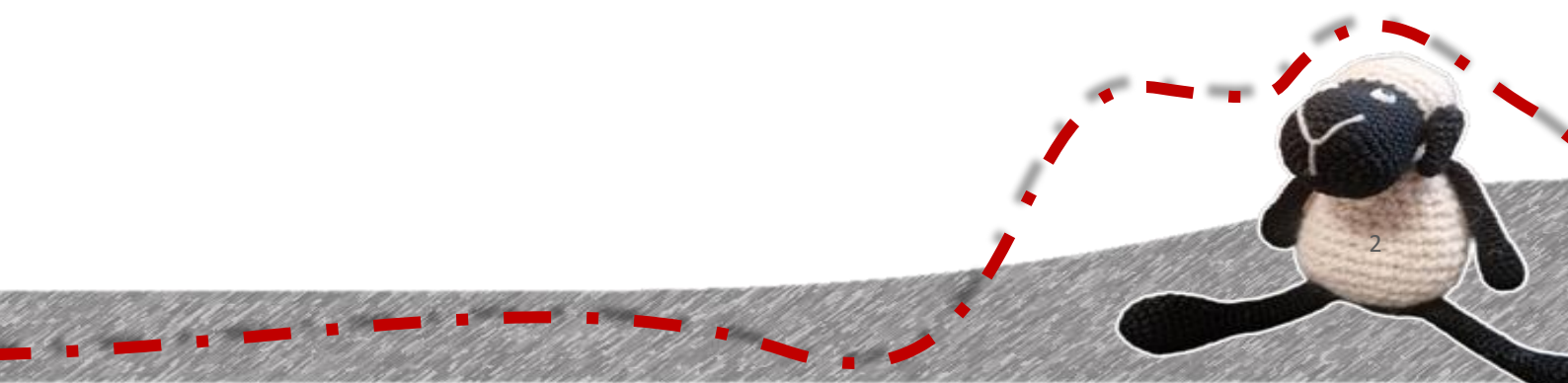
Abstract:

The situation in Europe regarding wool scouring is difficult. Due to price pressure, wool scouring facilities have been relocated to Asia, where further processing also takes place. The number of facilities is declining, and those few that remain are designed for large quantities of wool. There are fewer professional shepherds, and as a result, the size of sheep flocks is decreasing. At the same time, the number of sheep breeds remains virtually constant. This means that the batches for wool scouring are becoming smaller. Further processing of the wool often takes place by hand on site. For these small batches, the effort and cost of transporting them several hundred kilometers to the wool scouring plant is too high. To make matters worse, the quantity of wool is too small to be processed economically in the large plants.

To be able to wash these small batches of wool economically, several decentralized smaller wool scouring plants are necessary. However, these are not available on the market. Currently, there are only very small plants with a batch size of up to approx. 7 kg. That is why Chemnitz University of Technology is developing a new wool washing plant in collaboration with a regional mechanical engineering company. The aim is to be able to wash approx. 100 kg in one washing process. The project started on 1 August. Initial preliminary tests are promising in terms of wool cleanliness and water consumption. The aim is to have a prototype ready by mid-2026.

Key words:

wool, scouring, sustainable scouring



ŽELJKO KNEZIĆ:

University of Zagreb Faculty of Textile Technology, Zagreb, Croatia

FROM SHEEP TO YARN

Abstract:

The Majur Municipality is participating in the INTERREG DRP0200404 Green-Tex project, and one of the project activities is to determine the number and type of sheep in the Sisak-Moslavina County, to test the quality of domestic wool yarn and finally, to manufacture various textile products.

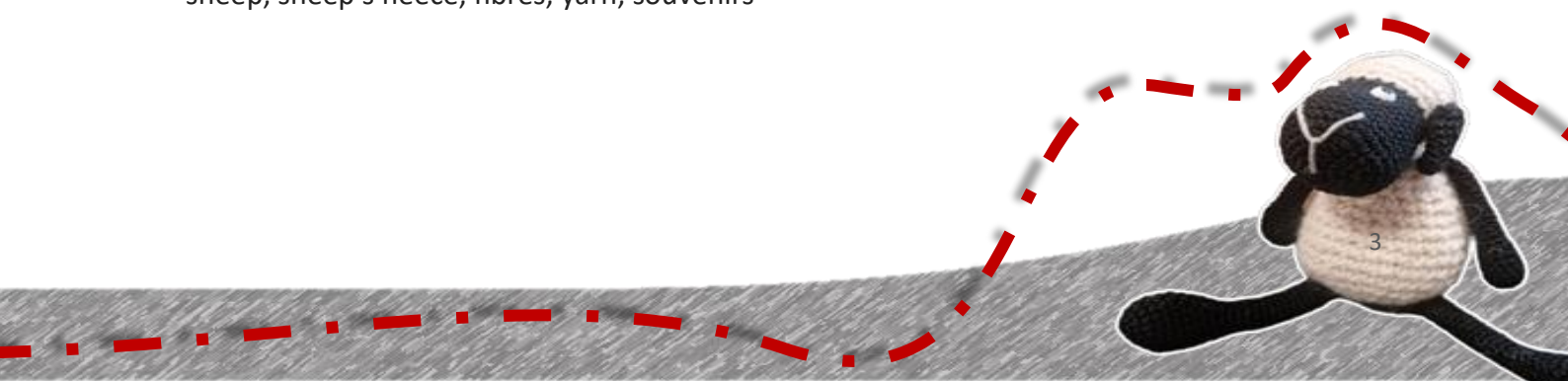
The number of sheep in the Sisak-Moslavina County, but also in the entire Croatia, has significantly decreased, and poorly managed breeding was polluting the environment because wool fleece has not been used in most cases.

Already from the sheep's appearance it is visible how it was treated and in which environment it lives. This is especially important when processing wool fleece after the shearing. Dirty wool, with remnants of biological and accidental impurities, requires more complex procedures for their removal. It often happens that parts of thistle plant remain, or that fibers damaged by urine cannot be dyed in light shades. The quality of the wool fiber determines its final application and the type of textile product. The use of the dirtiest and damaged wool fleece that is separated during shearing for agriculture and gardening is justified by saving water and detergent.

In the Municipality of Majur, the storage for woolen fleece was established, and devices for its washing and further processing were purchased (wool washing tubs with wringing rollers, wool pulling machine, wool spinning machine and a 160 cm wide manual loom). The general goal was to start solving the problem of waste wool "step by step" from education of sheep breeders, enhancement of sheep shearing quality, ecological wool washing, organization of educational workshops to learn procedures of fleece opening, wool pulling, hand spinning and weaving for manufacture of autochthonous souvenirs or functional textile products.

Key words:

sheep, sheep's fleece, fibres, yarn, souvenirs



TANJA PUŠIĆ, TIHANA DEKANIĆ:

University of Zagreb Faculty of Textile Technology, Zagreb, Croatia

HOW TO WASH WOOL IN AN ECO-FRIENDLY WAY?

Abstract:

Wool is one of the oldest natural fibres that humans have been using for thousands of years. Its outstanding properties – excellent thermal insulation and breathability, natural antibacterial protection and the ability to regulate moisture - make it an indispensable material in modern textile production. Depending on the breed of sheep and environmental conditions, raw wool can contain up to 68% biological impurities (lanolin, waxes, sweat) and foreign matter (soil, dust, plant residues), which must be removed before further processing. In conventional cleaning, the impurities are treated successively in an alkaline medium with soaps and surfactants, whereby the impurities are gradually removed – from coarser particles in the first stages to finer residues in the final baths. While these processes are effective, they consume significant amounts of water and chemicals and can affect the keratin structure of the fibres, reducing both their natural lustre and mechanical strength. In line with the principles of sustainable development, current research is focussing on environmentally friendly alternatives. Enzymatic treatments with lipases, proteases, pectinases and cellulases allow the selective removal of fats and vegetable residues, reducing the dependence on aggressive chemicals and preserving the elasticity and mechanical integrity of the wool. Plant-derived surfactants containing saponins have proven to be very efficient in emulsifying waxes and removing dirt, while reducing the environmental impact of wastewater. As a natural and readily available source of saponins, horse chestnut (*Aesculus hippocastanum* L.) represents a biodegradable product from renewable sources that fulfils sustainability requirements. The saponins in horse chestnut act as natural surfactants that enable efficient and environmentally friendly wool washing. By combining enzymes and natural surface-active agents, and carefully controlling physical parameters such as temperature, pH and process duration, wool can be cleaned effectively with a minimal risk of fibre damage. Such an integrated, environmentally conscious approach represents a significant step forward as it combines traditional expertise with modern sustainability practises to achieve high fibre purity while significantly reducing environmental footprint.

Key words:

wool, scouring, enzymes, saponins, horse chestnut, sustainability

SNJEŽANA FIRŠT ROGALE, DUBRAVKO ROGALE, ROBERT MATAŠIĆ:

University of Zagreb Faculty of Textile Technology, Zagreb, Croatia

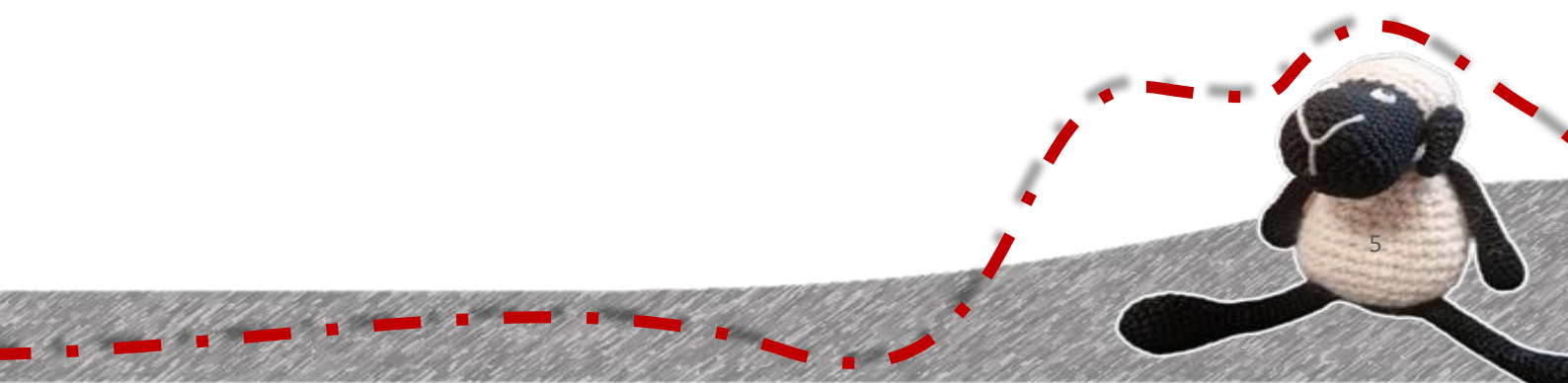
THE SECRET THERMAL CONDUCTIVITY OF WOOL

Abstract:

The lecture "The secret of wool's thermal conductivity" aims to investigate the thermal contact conductivity of composite clothing consisting of a layer of wool with and without interlinings and different types of lining. It is shown that compressibility significantly alters the thermal properties of the embedded materials that make up the composite clothing. The results obtained with the multi-purpose differential conductometer provide information on the behaviour of composite clothing under actual wearing conditions, which is crucial for the technical design of clothing with known thermal insulating properties. When buying clothing, the buyer does not even know the approximate value of the objective thermophysiological parameters of clothing comfort. In addition to other information on sewn-in or attached labels on the clothing, such as size, raw material, type of care of the clothing, the value of at least one thermophysiological parameter should be indicated. This can have a positive impact on the circular economy as it would reduce the production of clothing with unknown thermophysiological properties, i.e. clothing for which the environmental conditions for which they were developed are not known, extend the life cycle of clothing and reduce the amount of textile waste.

Key words:

wool, composite clothing, thermal contact conductivity, compressibility



**ANA SUTLOVIĆ¹, MARTINA GLOGAR¹, JELENA ĐUKANOVIĆ²,
IVA BRLEK¹, IVANA ČORAK¹:**

¹University of Zagreb Faculty of Textile Technology, Zagreb, Croatia

²Institute for Wool of Montenegro, Nikšić, Montenegro

NATURALLY DYED WOOL: FUNCTIONAL PROPERTIES AND HEALTH EFFECTS

Abstract:

Natural dyes, traditionally derived from plant, animal, and mineral sources, have recently regained attention due to their sustainability and the potential for extraction from bio-waste and renewable resources. In wool dyeing, natural dyes exhibit the highest fastness, producing intense and brilliant shades.

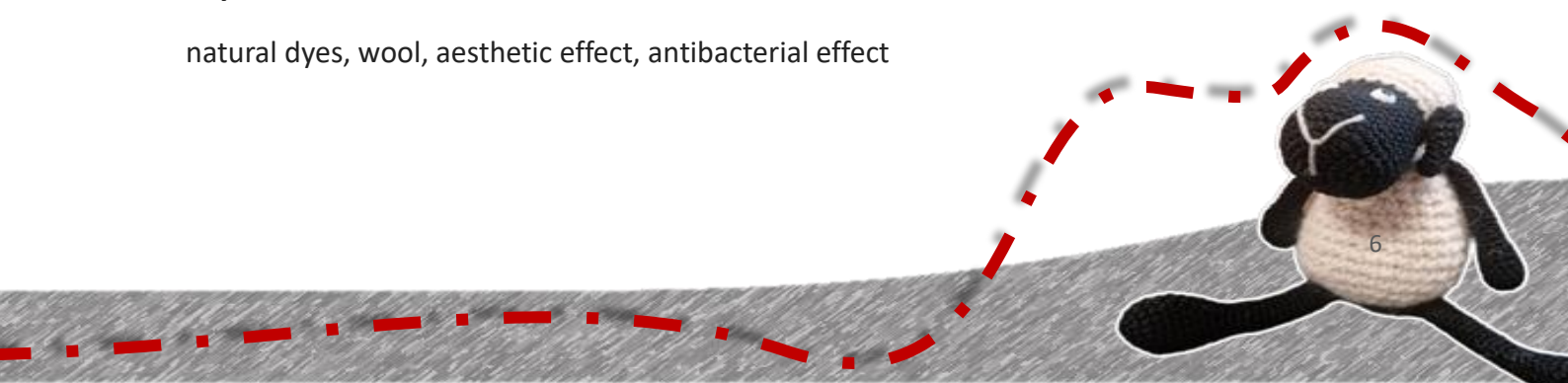
Beyond their aesthetic value, natural dyes possess a range of functional properties, including antibacterial, antifungal, antioxidant, and insect-repellent activity, as well as excellent UV protection. Research has confirmed significant antibacterial activity of wool dyed with natural dyes against various bacterial strains, including *Staphylococcus aureus*, *Escherichia coli*, and *Salmonella enterica*. Furthermore, laboratory tests have indicated the positive psychological and emotional effects of colors obtained from natural dyes, contributing to user well-being.

To improve dyeing efficiency, different pre-treatment methods have been investigated, with cold oxygen plasma treatment standing out as particularly effective in enhancing the affinity of wool for natural dyes. In addition, recent studies conducted at the Ruđer Bošković Institute have demonstrated that nano-forms of natural dyes can synergistically enhance antibiotic activity, opening possibilities for their application in medical contexts.

These findings confirm that natural dyes transcend purely aesthetic functions and represent a valuable resource in the development of functional textiles with positive impacts on both mental and physical human health.

Key words:

natural dyes, wool, aesthetic effect, antibacterial effect



JASMINKA GRŠKOVIĆ:

Family Farm Tohoraj, Krk, Croatia

INNOVATIVE USAGE OF PRAMENKA SHEEP WOOL

Abstract:

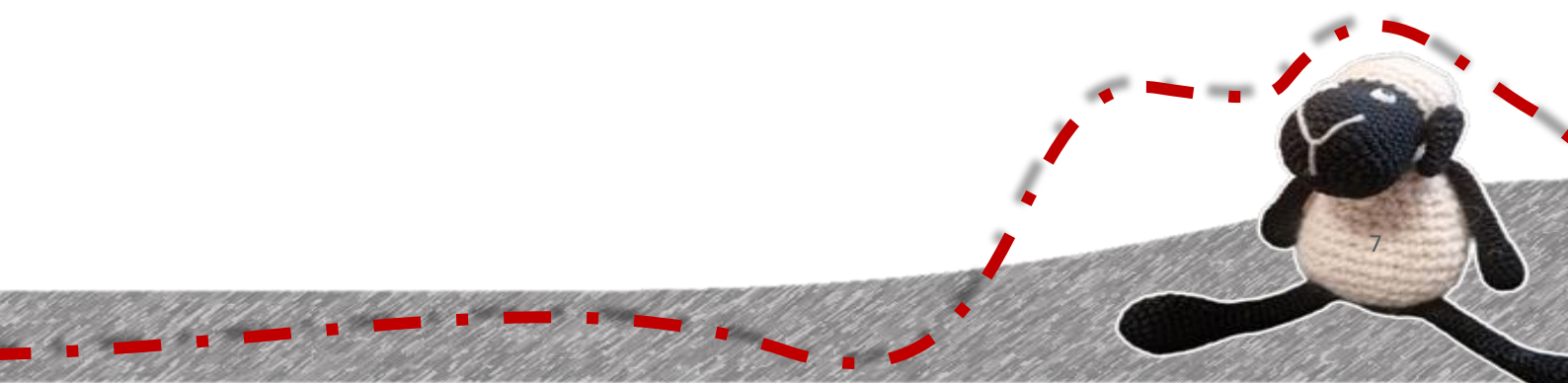
The indigenous Pramenka sheep breed has been used for centuries to make clothing and textiles in rural households. However, two main reasons have contributed to the significant decrease in the use of wool in Croatia. The first reason is the wide availability of alternative raw materials and significant changes in lifestyle and economy.

The second reason is the quality of the Pramenka sheep wool, which is known for its coarse, uneven and less elastic fibers. These characteristics make it unsuitable for the textile and clothing industry, and over the time, Pramenka wool has gone from a precious raw material to a waste category.

Piles of wool that were left in numerous households of island Krk prompted me to think about its use, which led to the creation of two innovative products - tactile balls with the scent of lavender and dryer balls. Through creative workshops where children and adults create various useful and decorative items from sheep's wool using the felting technique, we strive to preserve the identity of our islands in coexistence with sheep, and to present wool as a raw material that certainly has its future.

Key words:

Pramenka sheep, wool, lifestyle changes, raw material-waste, felting, innovations, sustainability



TATJANA FILIPI:

Fabrica d.o.o., Zagreb, Croatia

PRODUCTION OF SHEEP WOOL FERTILIZER

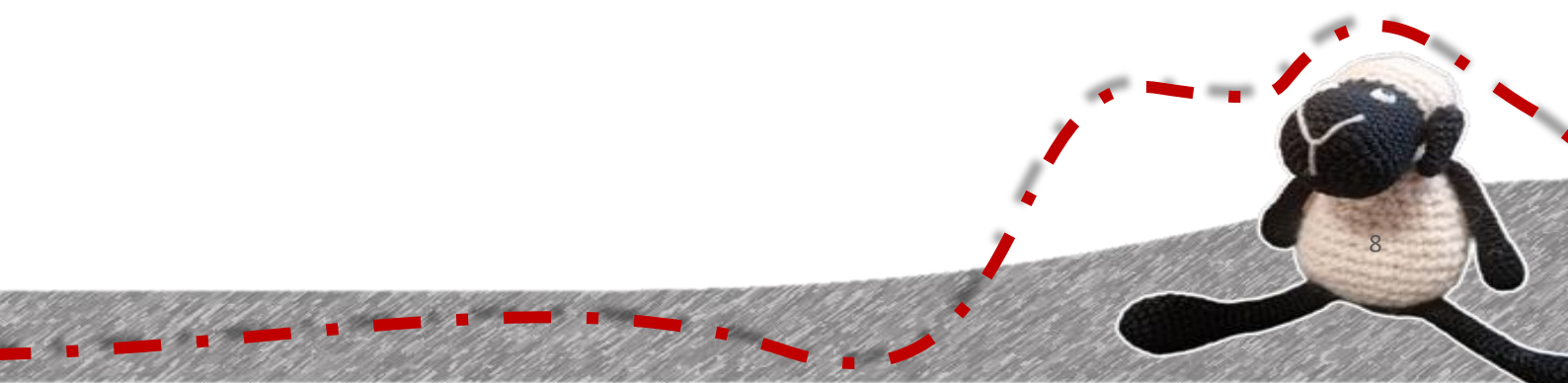
Abstract:

Whether we are going to use it or not, sheep wool is widely available. Sheeps are bred for meat and milk which is determined by the breed, while woolen fleece usually presents a burden. Therefore, we would like to present our solution which is a perfect example of waste usage and production of renewable raw material. Main idea was to skirt the fleece and use better quality parts for washing, scouring and further processing to woolen yarn and to use the rest for fertilizer. Sheep wool fertilizer is the only product that does not require scouring, so production of pellets seemed the fastest way to get a final product. Fertilizer is rich in nitrogen and potassium, and above all in carbon. It disintegrates slowly in the soil, releasing nutrients up to 6 months. It is completely organic and biodegradable with no harmful residues. Used as mulch, it provides effective protection against slugs and snails.

Production process is simple and mechanical, while the regulation is another story. Wool is strictly regulated by EU, as well as domestic regulations, and is under the jurisdiction of Veterinary Administration. Traceability is required, production line has to be registered, which means fulfilment of specified requirements in production organization, regular quality and microbiology testing have to be undertaken in registered laboratories. After that organic fertilizers come under the EU legislation for fertilizers which determines what the declaration of the product should contain before its placement on the market. Every step in this process adds up to the final price of product and influences its competitiveness.

Key words:

sheep fleece, renewable raw material, pellets production, organic fertilizer



MARKUS KRÜGER:

Indorama Ventures Schoeller Wool Austria GmbH, Dornbirn, Austria

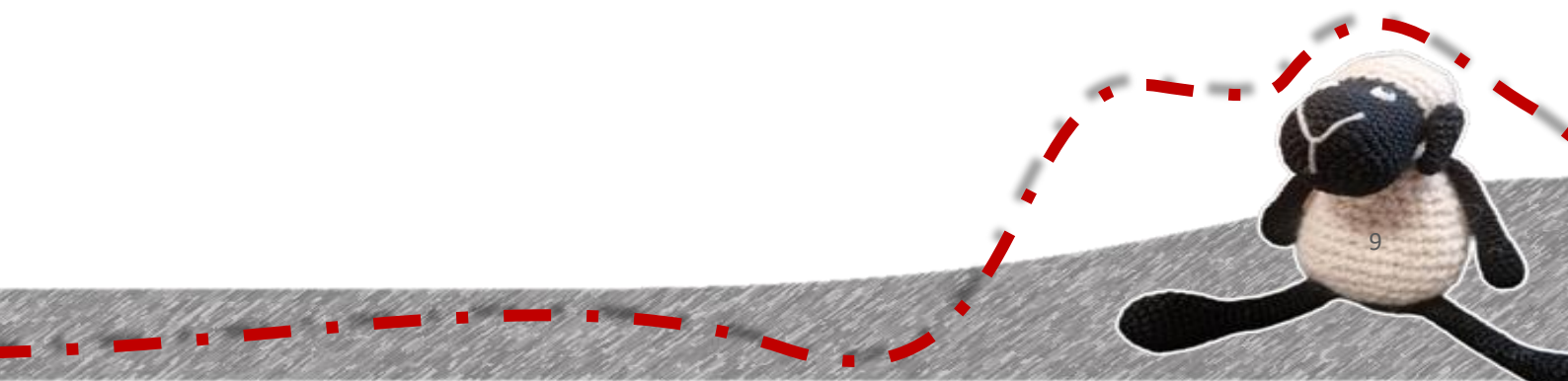
BENEFITS OF WOOL FUNCTIONALIZATION

Abstract:

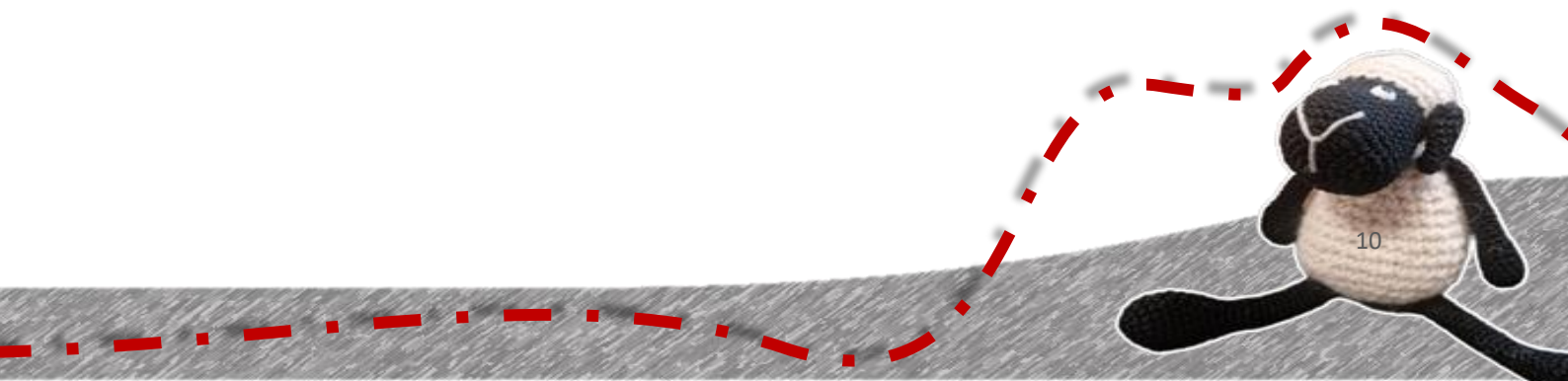
The benefits of wool functionalization are illustrated in various application examples. The term “functionalization” is used in a broad sense. The topics of chlorine-free washing treatment, antibacterial finishes, flame retardancy, dirt repellency, and fiber blends with wool are addressed and briefly presented. Their relevance in the context of product development are explained.

Key words:

wool, blends, functionalization, product development



Exhibition Sustainable Design



Koraljka Kovač, University of Zagreb Faculty of Textile Technology, Zagreb:

Exhibition: Permanence in Painting

Abstract:

The tapestries presented on this occasion are completely determined by earlier paintings and are circular and rectangular formats, segments separated from her paintings. Therefore, the paintings are transposed into another medium that painters do not often use in this way, namely hand-tufted tapestries. This indicates the painter's professional aspirations in the field of textiles, in which it is sometimes forgotten how important artistic literacy is. The exhibited tapestries by Koraljka Kovač are a special opportunity for the correlation of these media and an insight into the uniqueness of their manual execution. And so, with yet another performance, the painter Koraljka Kovač neither begins nor ends, but continues the work, to perceive the world around her and herself in it. She always reflexively looks back at what influences the form of everything. This is what leaves traces of time in the painting.

Key words:

painting, tapestry, hand tufting



The tapestries are realized in reGALERIJA in Zabok, 2025

Marijana Tkalec, University of Zagreb Faculty of Textile Technology, Zagreb:

Exhibition: Wool and Handcraft – Application in Textile Design

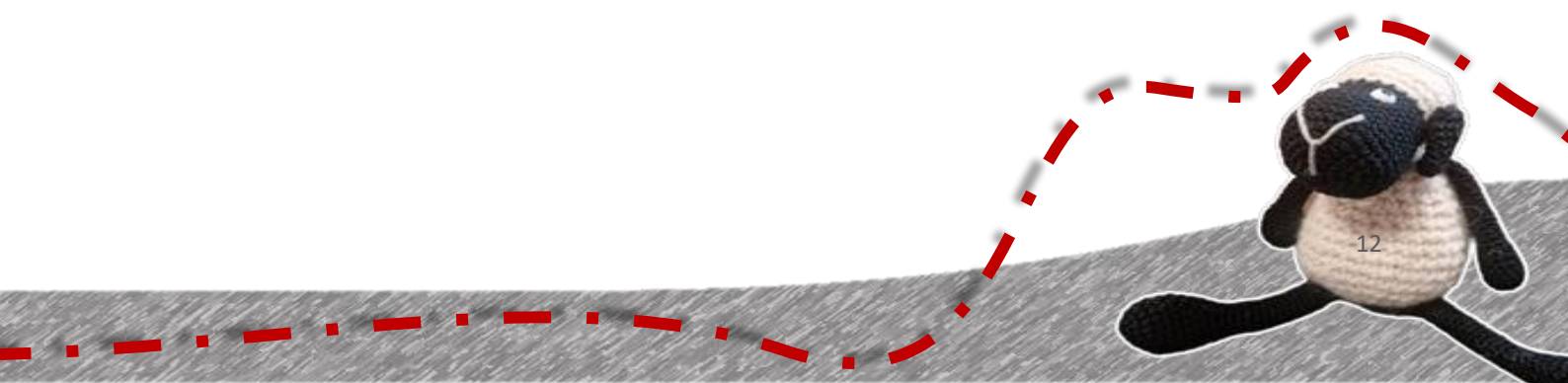
Abstract:

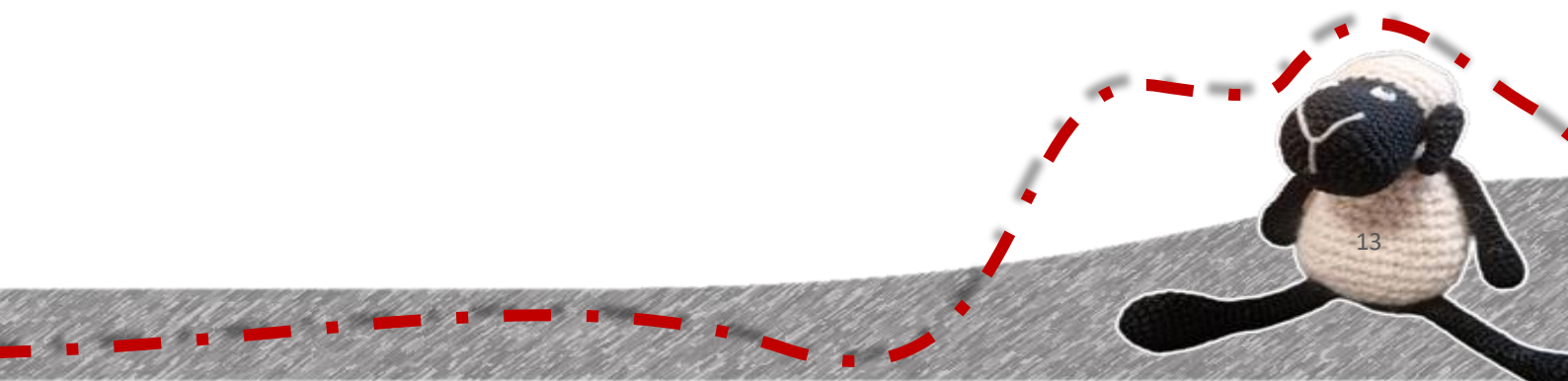
Wool, as a high-quality natural fiber and a highly valued but expensive raw material, in the digital age of rapid and mass production of often low-quality textile products, is unfortunately becoming quite neglected and is often treated as waste. Moreover, its disposal is becoming an environmental problem. Although there was a long tradition of sheep breeding in our region and wool was used as a raw material to produce clothing, due to the expensive and demanding production process and contemporary lifestyle, the use of wool has been neglected. Wool is primarily used as a raw material for the textile industry due to its thermal properties, but in addition to the production of clothing and carpets, it can also be used to make decorative items and for other purposes in different areas.

The exhibited works show products made from domestic wool—collected, recycled, and used to create new products, using techniques of hand weaving of complex wool and hemp threads, felting, knitting, and crocheting. In the work process, the emphasis is on the harmony of colors and the density of the yarn, with the aim of creating a harmonious composition. Traditional techniques, handcraft, a modern approach, and reflection on the use of natural raw materials such as wool in the design of new products contribute to the inclusion of the community in waste management, education about the values of natural raw materials, and reducing the ecological footprint. Some of the works were created as part of workshops held in the Municipality of Majur as an activity of the GreenTex project, which deals with recycling and the wider use of natural materials in textile production and works on innovative solutions for the collection, recycling, and reuse of wool waste.

Key words:

wool, hand weaving, traditional techniques, eco-conscious products





Lana Radnić & Ivona Pleše, The LoopLab:

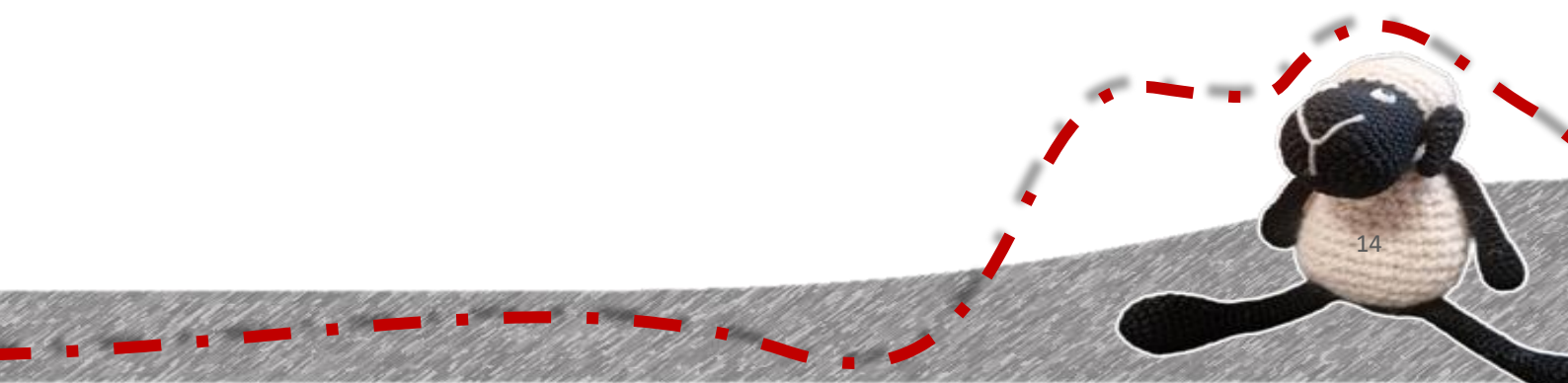
Exhibition: Natur

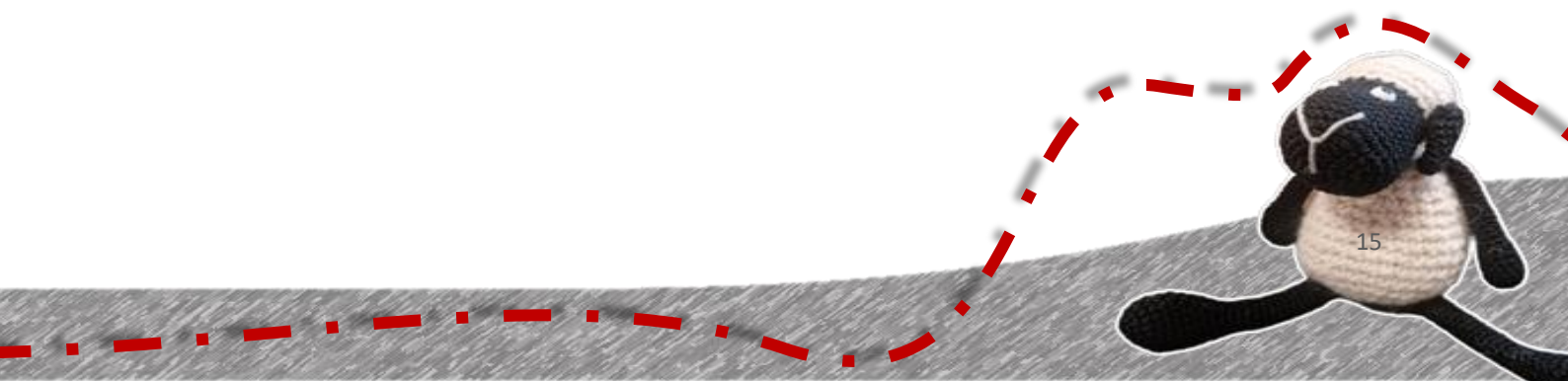
Abstract:

The studio theLoopLab is run by two authors who explore wool as a medium of contemporary expression and experiment with tufting techniques. For this exhibition we present the collection “natur”, a series of tufted rugs and tapestries inspired by nature. Starting from this traditional and sustainable material, we create works that balance between functional objects and artistic pieces, emphasizing the importance of tactile experience and presence in space. “natur” is a tribute to the landscape and its forms – textures recall the stratification of soil and rocks, lines echo the traces of wind and waves of grass, while colors evoke the changing of the seasons. Each piece is created through a process that is both intuitive and thoughtful, merging the gestural quality of drawing with the precision of handwork. In this way, the surface of a rug or tapestry becomes more than a decorative element: it transforms into a visual and tactile landscape that brings nature into interior spaces and creates a sense of immersion in its rhythm. Working as a duo, our ideas intertwine and complement each other, forming a unique shared signature. Our studio fosters a collaborative approach and constantly explores the boundaries between design, art, and traditional craft. Wool enables us to question the role of textiles in a contemporary context – as a means of artistic expression, but also as a reminder of sustainability, warmth, and our connection to nature. With the “natur” collection, we aim to open a dialogue on how artistic and design objects can shape the atmosphere of a space, and how materials and techniques can remind us of deeper bonds between humans and nature.

Key words:

wool, tufting, nature, tapestry, contemporary design





Branka Kožuh, School of Fashion and Design:

Exhibition: Dance of Infinite Threads

Abstract:

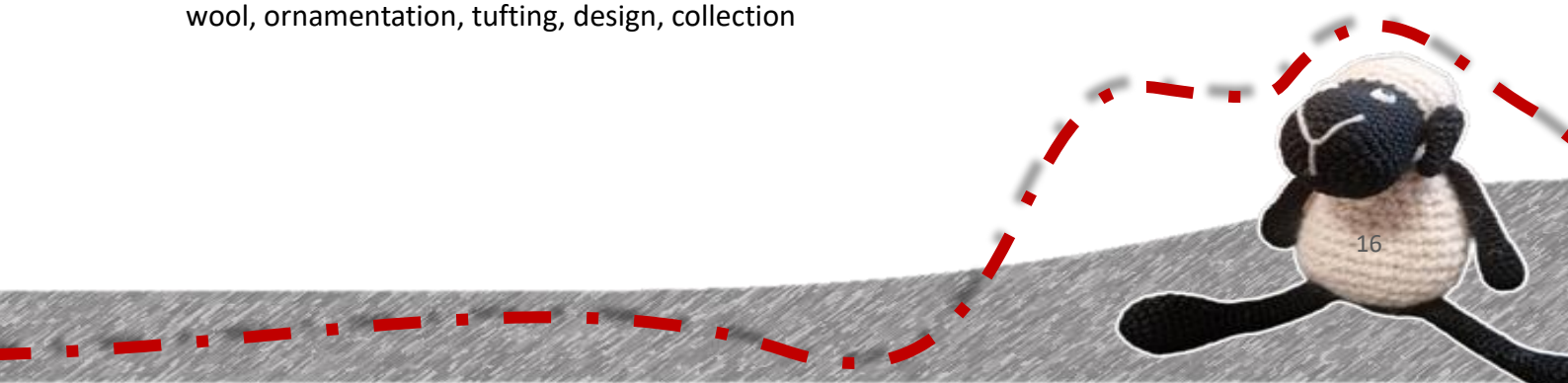
The social and cultural environment in which mass fashion has taken over a large portion of the market raises the question: Why is this so and how is it profitable? The answer to the question is simple and stems from the fact that such clothes are made from cheap synthetic materials of low quality, and the development of product design is almost non-existent, since everything is subject to uniformity. Clothes made of cheaper, usually synthetic materials are also supported by their ease of maintenance, such as washing at lower temperatures and wrinkle resistance. Therefore, it is not surprising that today's fashion consumers are increasingly following affordability and convenience in use, but unfortunately, they are not sufficiently informed of the fact that such products can have a negative impact on the skin and general health.

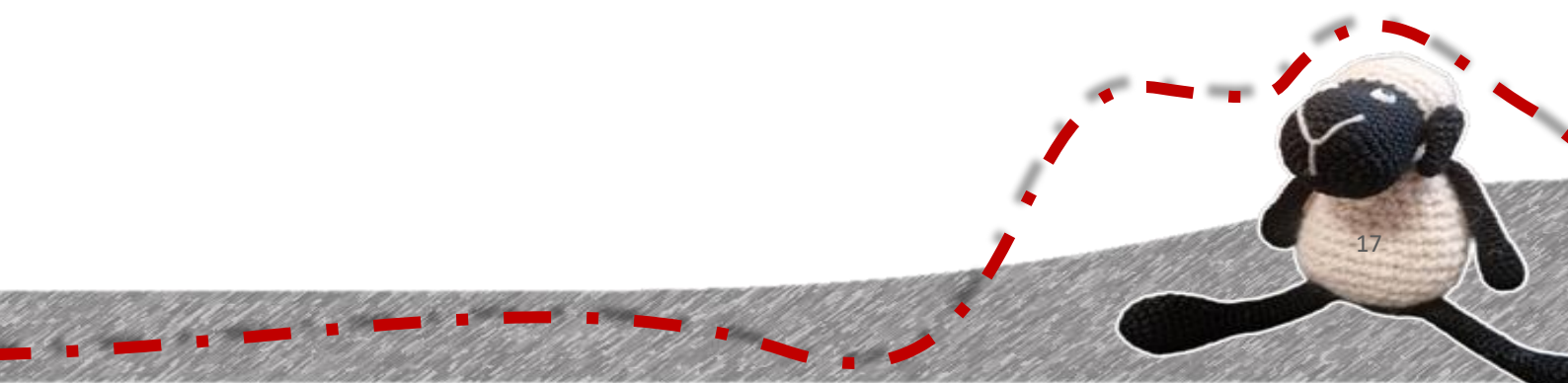
Guided by the idea of the importance of revitalizing the use of natural materials, especially wool and linen as the backbone of traditional materials of our textile cultural heritage, the Dance of the Infinite Thread collection was created. The collection is also a response to the fashion project's request to combine previously created woolen flat ornaments and high-quality earth-toned fabrics. Simple, pure, oversized cuts of trousers, skirts, dresses and blouses are enlivened by abstract wool motifs created using the manual tufting technique. The collection consists of six fashion stylings that, due to the universality and sophistication of the design of individual models, their colors and ornaments, can be combined with each other and create new, different and original fashion expressions.

The creative processes in which the new design solutions of the Dance of Infinite Threads collection were created arise from research and are not the result of a momentary whim or spontaneous fashion. As such, they carry messages of aesthetics and sustainability as an important backbone of thinking about fashion and preserving the true values of traditional beauty.

Key words:

wool, ornamentation, tufting, design, collection





Ivana Biočina, Institute for Sustainable Fashion:

Exhibition: Power of Wool, the Power of Sustainability

Abstract:

The Institute for Sustainable Fashion (IOM), under the theme "The Power of Domestic Wool – From Sustainability to Innovation," will exhibit an item made from vintage wool, that is, vintage fabric about thirty years old. At IOM, sustainability is practiced in action, and there is always a search for the best wool, whether it is European organic wool, traditional domestic wool, or vintage fabric. For the part of the year covering autumn and winter, and even a good part of spring, the power of wool is celebrated – through words, images, and objects.

The Institute for Sustainable Fashion (IOM) was opened in Podravina in 2020 with the aim of production, education, and spreading the idea of sustainable creation, work, and living. The purpose and intention of IOM, besides sustainable production practices, knowledge gathering and dissemination, is to empower individuals so that together we can be part of the change we want to see in the textile industry and demonstrate through our actions that sustainability is not just a passing thought, but the beginning and foundation of a new life that bursts forth, sprouts, and grows, which is just being born. The founder and director of IOM is Ivana Biočina, author, researcher, and textile engineer.

Key words:

Wool, vintage wool, sustainability



Jasminka Gršković, Family Farm, Tohoraj:

Workshop: Felting of Pramenka Wool from Krk

Abstract:

In a time when wool as a raw material has become waste, wool felting workshops raise awareness among a wide audience about the role of wool in the past and present. By mastering the techniques of dry and wet felting, participants are encouraged to apply wool in their practice as well as to use it in innovative ways.

Key words:

wool, Pramenka sheep, wet felting, felting with needle



wool balls for dryer

Proizvodi: OPG Jasminka Gršković
Kralja Tomislava 14, Krk
opgtohoraj.com
Sastav: 100% vuna
Product of CROATIA

**Višnja Ljubojević-Džakula & Dubravka Korasić-Odibožić,
Majur County, Majur:**

Workshop: Felting of Domestic Wool from the Banovina Area

Abstract:

Wool from domestic sheep, especially the one with finer fibers, is suitable for making various decorative objects using felting techniques. Majur County organizes numerous workshops for participants of all ages. Children are the best "masters" of creative expression and successfully convey their thoughts and feelings to everyone. The most suitable is the wet felting technique, because there is no possibility of injury, as is the case with the "needling" technique. The dirtiest wool after sheep shearing is immediately separated and will be used for other purposes. The higher-quality parts of the fleece are used and pre-cleaned from larger impurities (grass, twigs, thistles, etc.), and then "opened" with a "gargaš" (a coarse comb), so that the wool can be washed more easily with an environmentally friendly detergent. After washing, the wool needs to be carded - separated and parallelized with a carding machine, resulting with a woolen web, called „veil“. Those layers can be previously dyed and then rubbed with the palms of the hands, adding soapy water created by dissolving soap in warm water. A Styrofoam balls or a metal mold can be used to achieve different effects. Additionally, with special attention, created shapes can be further fixed by the needling technique.

Key words:

domestic wool, felting, needling, decorative products



Katica Devetak, Municipality Majur:

Workshop: Narrow Weaving of Wool Ribbons and Decorative Strips

Abstract:

Ribbons, belts and other flat products that are formed into a small width (up to ten centimeters) during their creation require additional attention due to the method of production and the choice of material.

Narrow weaving is rarely performed on a classic loom. There are traces (and remains) of devices for narrow weaving on which narrow looms with direct warping with two or four leaves were designed and manufactured, and there is also the possibility of creating warp thread gaps with "4-hole plates". Very elastic ribbons are made using the diagonal weaving technique, where there is no separate weft, but the warp threads are also the weft threads. The interweaving of the warp threads is interesting, which is easiest to carry out similarly to the production of "Lepoglava lace" by using the so-called "batić", but with an additional comb that maintains the arrangement of the threads. Recently, a special device for diagonal weaving was designed, which accelerated the process of creating ribbons and proved to be very practical, especially for beginners.

Key words:

woolen yarn, narrow weave, ribbons, belts, braids



Tamara Pecoja, Fabrica Ltd, WOONA:

Workshop: Eco Planting with WOONA

Abstract:

WOONA pellets are shredded and compressed sheep's wool without any additives. It is an organic ecological fertilizer that naturally contains all the macro and micronutrients needed for growing healthy and tasty fruits and vegetables. Additionally, it has a beneficial effect on plants and enriches the soil.

The fertilizer is rich in nitrogen and potassium and has 45% carbon in natural compounds. It reduces the need for irrigation by up to 25%, and when used as mulch, it repels and protects against snails.

The goals of the workshop are:

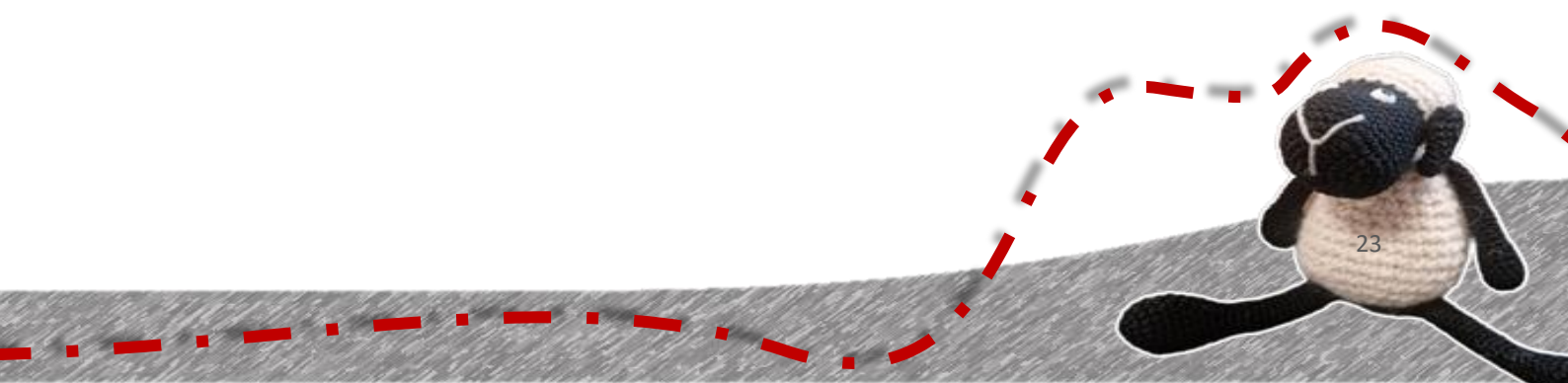
- To stimulate interest in and the need for ecological planting and the use of organic fertilizers and materials made of natural fibers in plant care.
- To acquire basic knowledge of plant care in an ecological way with fertilizer made from pelleted sheep's wool.
- To raise awareness of the importance of using materials from natural fibers as much as possible, in relation to plastic.
- To raise awareness of the importance of using products that are part of the local circular economy.
- To re-introduce wool, which is already recognized as a top-quality ecological, biodegradable, and organic material used in various industries worldwide, with an emphasis on its application in agriculture, gardening and presentation of its numerous benefits.

Workshop will present:

- How to recognize a healthy plant, how to properly care for it, how and when to transplant it, and how and when to fertilize it so that it thrives.
- How to do all this ecologically with WOONA fertilizer for eco-friendly plant cultivation and learn the role of wool in planting process.
- How to make a substrate with Woonica and fertilizer from pelleted sheep's wool.
- Transplanting and fertilizing seedlings with WOONA fertilizer from pelleted sheep's wool.

Key words:

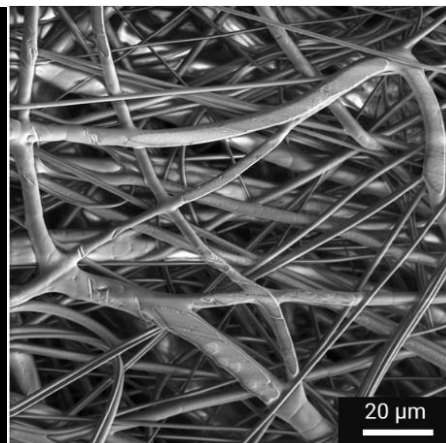
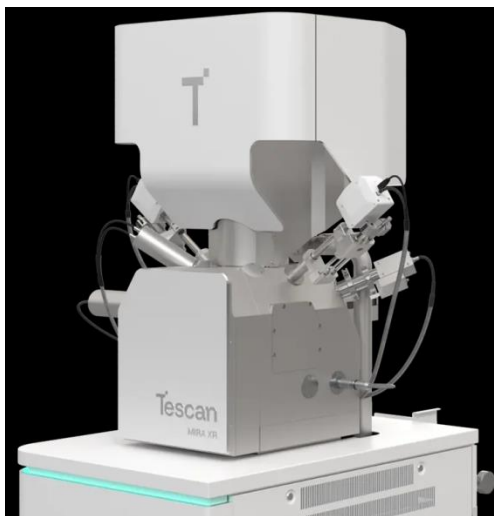
woolen fleece, organic fertilizer, eco planting, wool pellets



Mikrolux, Ltd, Croatia

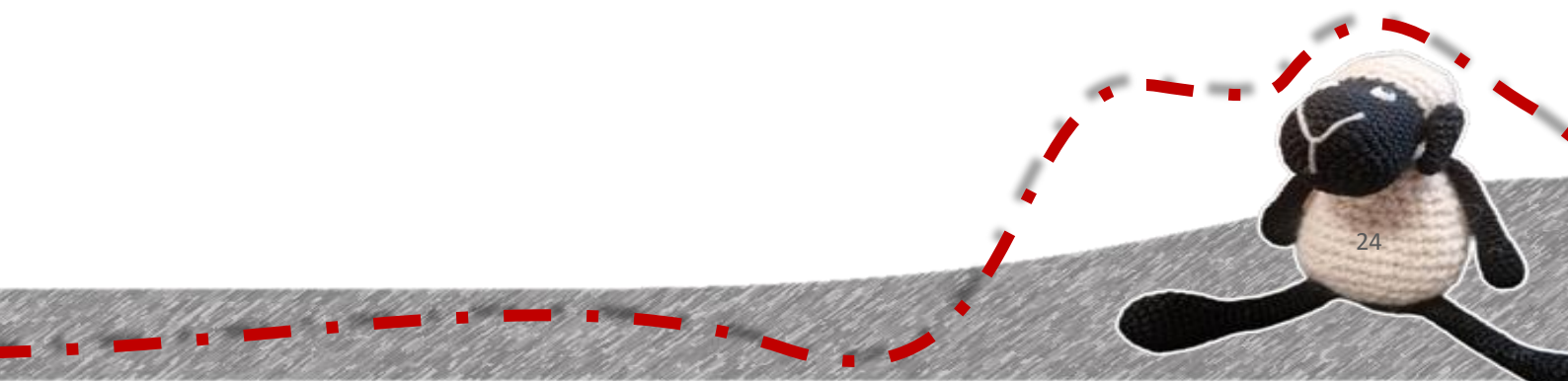


Mikrolux is the exclusive authorized distributor of Tescan, a manufacturer of scanning electron microscopes. In addition to Tescan, the company also represents other renowned manufacturers in the field of electron microscopy, such as EDS (Energy Dispersive Spectrometer) producers Oxford Instruments and Bruker. Alongside equipment sales, Mikrolux provides installation, training, support, service, and maintenance.



Surface of PP Nanofibres imaged at 3 keV in Low Vacuum (100 Pa) Mode with GSD Detector

New Tescan MIRA XR SEM – A high-performance UHR SEM platform with integrated EDS for research laboratories and quality control.



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The offer includes top-quality museum display cases, a wide selection of digital microscopes and measuring instruments, and more than a thousand items available for fast delivery in Croatia and abroad. A detailed overview of the assortment is available on the website, and selected products are exhibited in the showroom in Zagreb (Nova Ves 8).



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