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FIBER AND DYE PLANTS

POTENTIALS FOR CULTIVATION, PROCESSING, AND USE IN AUSTRIA

bmvft

POTENTIALS OF FIBER AND DYE PLANTS IN AUSTRIA

Dyer's Knotweed in Blossom

■ The increased use of renewable raw materials from environmentally sound production processes has been defined as an essential objective in the ongoing discussion on "Sustainable Economy". Using indigenous raw materials, in particular from organic farming, contributes to the conservation of fossil resources and to the mitigation of environmental impacts along the whole product life cycle. In addition, this strategy contributes to the conservation of agricultural land and to the creation and safeguarding of jobs with regional value added.

Plant-Dyed Natural Textiles, Cotton and Silk

Of all possible products based on renewable raw materials, the sector of natural textiles has become a high profile issue in international research and development. Natural textiles have been developed out of a growing awareness of the environmental, health-related, and social problems caused by the conventional production of textiles. Meanwhile, there is a large array of textiles that are advertised with terms like "natural", "eco-", or "bio". However, ***labeling*** refers to rather different quality standards. Products may be labeled as "sustainable" on the condition that raw materials come from organic farming and that manufacturing processes up to the finished garment comply with ecologically and socially acceptable production methods.

Other crucial criteria of a sustainable economy include short hauling distances and closed regional materials cycles. Therefore, raw materials that have been traditionally cultivated in Austria and that have been used in the manufacture of textiles, such as flax, hemp, stinging nettle as well as various dye plants are of particular interest in this context.

The Austrian Federal Ministry of Transport, Innovation, and Technology (BMVIT) commissioned two projects dealing with this topic. The projects aimed to provide basic information on the cultivation, processing, and marketing of native fiber and dye plants from organic farming [1] and at the development of strategies to promote utilization of these renewable raw materials in Austria. [2]

1 The project **"Faser- und Färbepflanzen aus ökologischem Landbau"** (Fiber and Dye Plants from Organic Farming), authored by A. Hartl and Chr. R. Vogl (Institute of Ecological Farming, University of Agricultural Sciences, Vienna, commissioned by the BMVIT and the Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW)) documented the present situation of these renewable raw materials and of the products manufactured thereof as well as the potentials and limiting factors for the further development and dissemination in Austria. The results are based on literary and data base research, interviews with actors from agriculture and the textile production chain, on surveys among manufacturers and traders of natural textiles as well as on planting trials with stinging nettle and dye plants conducted by the Institute.

2 The project **"Produktion von farbstofffliefernden Pflanzen in Österreich und ihre Nutzung in der Textilindustrie"** (Production of Dye Plants in Austria and their Use in Textile Industry), authored by S. Geissler and E. Ganglberger (Austrian Institute for Applied Ecology, commissioned by the BMVIT) deals with the (so far inadequate) linking of the supply side with the demand side. The project aimed to harmonize the supply of agricultural raw materials with the requirements formulated by the trades and industries that process these materials. The project worked out production-use chains that are feasible from an economic, technical, and ecological point of view. Departing from the requirements of the textile industry and agriculture, respectively, the project described the processes, technical facilities, and actors involved; it also identified problems and made recommendations for the use of dye plants in the trades and the industry. Participants in the project, for the first time, developed a color chart for vegetable dyes, which constitutes an essential prerequisite for the implementation on an industrial scale.

Labeling

The labels "better" and "best" awarded by the "International Association of Natural Textiles Manufacturers" and the "EKO" label of the Dutch certifying organization "Skal" are the most demanding labels as far as environmental, health-related, and social soundness of the whole textile chain is concerned. What is needed, in this context, is the comprehensive information of consumers on the benefits of natural textiles as well as targeted publicizing of these already existing labels.

(Source: A. Hartl und Chr. R. Vogel)

PROJECT

1 FIBER AND DYE PLANTS FROM ORGANIC FARMING

The results of the project "Faser- und Färbepflanzen aus ökologischem Landbau" have shown that the determining factors for the further development of natural textiles produced in Austria are related predominantly to processing, demand on the market, and the social framework conditions. The requisite knowledge of the cultivation of the raw materials already exists, – if only of conventional cultivation methods. Regarding organic cultivation, however, there is still need for further research and optimization. Practical experience already exists with flax and hemp crops; as far as stinging nettle and dye plants are concerned, comprehensive experience is still missing.

Of all fiber plants formerly native to Austria (flax, hemp, and stinging nettle), only flax is currently being cultivated for the use in textiles. However, all plants mentioned above could potentially be used as raw materials from organic farming for the manufacture of natural textiles.

One of the decisive criteria consists in the possibilities of an environmentally sound manufacturing method and in an enlargement of the array of available products. This is particularly true for stinging nettle textiles and for plant-dyed textiles, which are currently scarcely available on the market. Another opportunity lies in the fact that many species are suited for several different applications. As experience from organic flax growers in other EU countries has shown, organic farming could benefit from applications in the foodstuff sector, too; the same applies for the stinging nettle in the foodstuff, medicinal, and cosmetics sectors.

FLAX

At present, linen is the only fiber material on the market that is available in certified organic qualities. The total crop area in Austria, in the year 1999, was 336 ha, and of this 10 ha was cultivated organically. The eco-linen products available on the market are characterized by a good quality.

The development of a wide range of products using all parts of the plant (shives, short fibers, and linseed) would increase the potential for flax crops. International experience has shown that the marketing of organic linseed and its products provides for an additional source of income in the high-price range.

Problems in the cultivation of flax arise on account of the highly weather-dependent rust diseases and the concomitant risk of losses in quality or even crop shortfalls. Alternative, environmentally sound methods of fiber separation have been envisaged as possible solutions and are already under research. Important barriers to organic farming consist in weed control and an only limited number of available varieties. Competition by low-cost imported linen (especially linen-mixed fibers) constitutes another decisive limiting factor for a more intense production of organic flax.

HEMP

At present, the crop area for hemp amounts to some 290 ha in Austria; the crop is, however, not used for fiber production, only the seeds are used. The fibers contained in the residuals have not been used in the manufacture of textiles, so far. Fiber production is economically and ecologically feasible only if the crop needs not be hauled over long distances (< 80 km) for further processing. Austria still lacks the necessary infrastructure and the technical know how for the production of hemp textiles. There is need for further research, especially in the fields of harvesting, retting, fiber separation, and further processing (spinning, weaving); tough competition on the market comes from hemp textiles imported from Eastern Europe and Asia.

STINGING NETTLE

In Austria, stinging nettle has been cultivated only for research purposes, so far. Within the scope of the project, a field study on an organic farm has been conducted, which aimed to quantify the yield, fiber content and quality of five stinging nettle clones. The potential benefit of the cultivation and processing of stinging nettle can be found in a larger range of available fiber materials in temperate climates, the high quality of the fibers, and in environmentally sound cultivation methods.

Strategies for successful cultivation, processing, and marketing have to aim at a close corporation between farmers and processing industry as well as at a multiple use of the plant, and at the development of a diversified range of products. Organic farming could offer the opportunity to improve the market potential for stinging nettle through side products for the foodstuff, cosmetics, and medicinal plants sectors. Further research is still needed in the fields of harvesting technology, fiber separation on an industrial scale, and industrial processing for the manufacture of textiles.

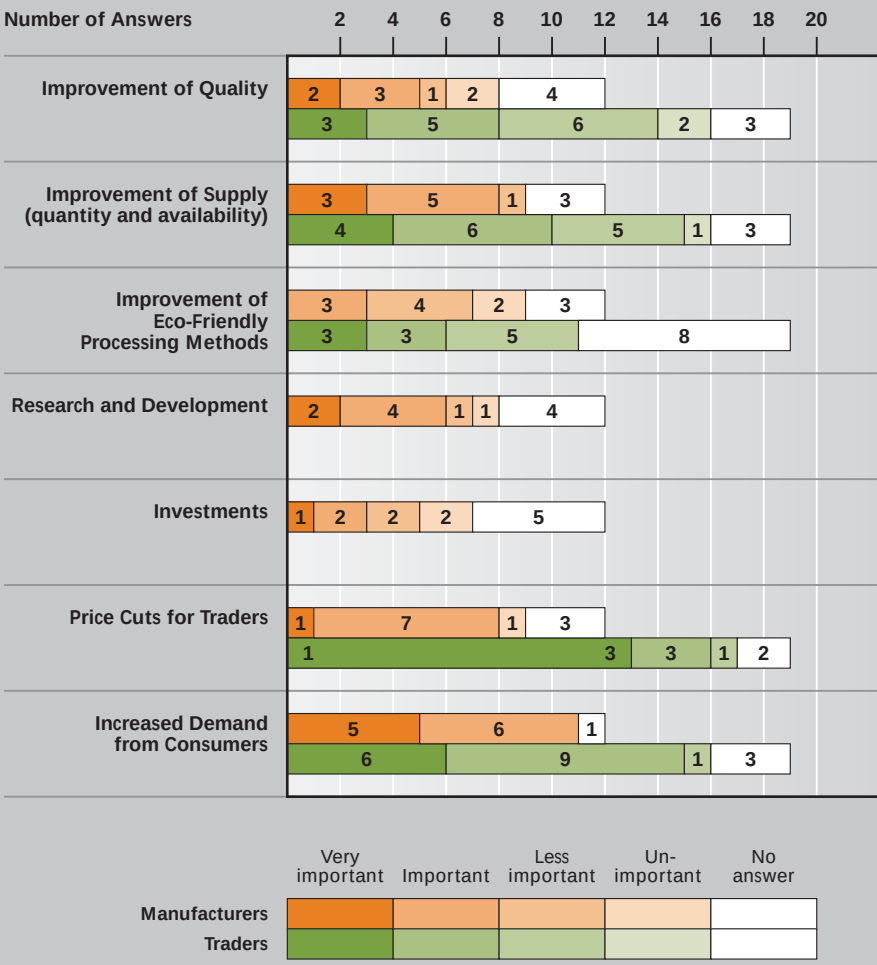
DYE PLANTS

At present, dye plants for the extraction of textile dyes are not being cultivated commercially in Austria. Research within the EU has shown that fundamental questions concerning the selection of suitable species, cultivation in conventional farming, harvesting and processing of the harvested crops have already been settled. The species madder (red), dyer's rocket, Canada golden rod, dyer's chamomile, and dyer's knotweed are known as particularly suitable. Cultivation methods developed for conventional farming can, however, not be simply transferred for practical use in organic farming. An important potential for the optimization of cultural methods in organic farming lies in the comprehensive experience and already existing infrastructure for the cultivation of biological medicinal plants and aromatic herbs in Austria.

The essential quality criterion in the cultivation of dye plants consists in the dyeing matter content. The role the various substances play in the dyeing process has not yet been entirely understood. The decisive factor in the application of vegetable dyes on an industrial scale relates to the quality of the dyeing matter and in the optimization of the dyeing process. Simple, environmentally acceptable technologies have to be developed that can be used in conventional dyeing works and that ensure a high dyeing quality as well as a wide range of colors. The development of guidelines and certification systems is one of the prerequisites for the improvement of the dissemination of information on the type and origin of raw materials, for the environmental soundness of the dyeing processes as well as for quality assurance.

Prerequisites for an Increased Supply of Linen Textiles from Organic Farming

According to Manufacturers and Traders



Source: A. Hartl and Chr. R. Vogl, 2000

Fiber and dyeing raw materials for natural textiles, - like all products made from renewable raw materials, - meet with tough competition from products manufactured and processed by non-sustainable methods. Possible strategies to increase the value added and to stabilize the market consist in multiple uses and marketing on a broad basis of the raw materials and finished products in other fields of application, too. Suppliers of natural textiles demand, above all, an improvement of supply and price cuts. In order to improve the market position, joining together of the usually small natural textiles businesses seems to be expedient.

While there are already comprehensive research results and practical experience in the field of cultivation, the problems prevailing in marketing and trade suggest that there are political and societal barriers. Shaping the political and economic framework is an important prerequisite for the positive development of products made from the above-mentioned raw materials. Targeted promotion of sustainable production methods as well as strategies to raise awareness and improve information with actors and consumers are much needed.

2 USE OF VEGETABLE DYES IN THE TEXTILE INDUSTRY

■ If dye plants are to be used on a large scale, the special requirements of the textile industry on the one hand and of agriculture as supplier, on the other, have to be met. A one-year project conducted by the Institute for Applied Ecology aimed at establishing the fundamentals of dye plant use in the textile industry. For this purpose, the study ascertained the conditions of production in agriculture and, in a survey among potential users of plant dyes, identified their requirements concerning quality, terms of delivery, etc.

The agricultural aspects of the project have been worked out by the Austrian Association for Agricultural Research (O. Schütz, R. Reiterer, A. Hartl). Findings have shown that the production of dye plants is feasible, in principle. The actors involved considered it desirable to use already existing technologies of cultivation, harvesting and processing; in addition, farmers demanded purchase commitments, in particular for perennial crops.

A survey among dyeing works conducted by the Industriewissenschaftliche Institut (Simone Sandberg) has shown that the textile industry, basically, was interested in using plant dyes. When it comes to practical application there are, however, requirements that cannot be easily reconciled with the logistics currently prevailing in agriculture: One requirement by the industry was that they wanted a single partner on the supply side who was expected to standardize the plant material as well as to guarantee for the quality and fastness of the dyes.

It is usual, in industrial dyeing plants to use color charts as a reference: the charts serve to identify the properties and quality specifications of different dyeing agents. One of the goals of the project consisted in presenting, for the first time, a color chart for dyeing plants. For this purpose, the range of the primary colors blue, red, and yellow had to be covered. Eight plants were used in concrete dyeing tests: Barberry, golden rod, madder, privet, hollyhock, walnut, black alder, and ash. By applying a uniform dyeing process, it is possible to use mixtures of various dye plants and mordant, which yields additional shades of color. At the same time, care was taken to avoid environmental burdens by selecting adequate plant species and dyeing processes. All aspects pertaining to dyeing technology were dealt with by the Institut für Textilchemie und Textilphysik at the University of Innsbruck (T. Bechtold), which also carried out the dyeing tests.

Extraction of Indigo from Dyer's Knotweed within the Project "Faser- und Färbepflanzen aus ökologischem Landbau"

The researchers also worked out possible process chains for the selected plants, from the production of raw material to the dyeing process. This systematic compilation of processes and actors enabled researchers to identify "gaps in the system". An important finding concerned the "missing Link" between suppliers of plant matter and the textile industry. Only when there is a partner for enterprises who, like conventional suppliers of dyes, undertakes to take care of processing, standardizing of the material and to provide consultancy for customers, will plant dyes be used in the Austrian textile industry.

Remaining questions are currently being dealt with in a follow-up project within the scope of the BMVIT sup-program "Fabrik der Zukunft". Apart from aspects pertaining to dyeing technology, the project focuses on the issue of networking suppliers and purchasers in the industry. The project also explored possibilities of embedding the processing, standardization, and distribution of plant dyes in already existing structures.

Further information:
www.fabrikderzukunft.at
www.ecology.at

Third Year Stinging Nettle Clones at Harvest Time

RESULTS FROM CULTIVATION TESTS: STINGING NETTLE AND DYE PLANTS

Cultivation tests with stinging nettle and a selection of dye plants were carried out within the scope of an extension of the research project "Faser- und Färbepflanzen aus ökologischem Landbau".[1]

The determining factors for the potential use of **stinging nettle** in the textile industry relate to fiber quality, indication of yarn qualities as well as yarn patterns. The cultivation test (site: Neulengbach, Lower Austria) was a first step toward the realization of these requirements. Five stinging nettle clones were tested under organic farming conditions, for yield, fiber content, and fiber quality. Second and third year crops were used for analysis, because stinging nettle yields are insufficient in the first year. Yields in the third year (743 – 1,016 kg fiber/ha) and fiber content (8 – 16% of dry stalk matter) confirmed maximum values achieved in studies in Germany (even results from conventional cultivation) and achieved the minimum values (as stated in standard literature) for an economically viable cultivation.
The results have shown that organic cultivation of stinging nettle with satisfactory yields is possible in Austria, if there are adequate processing plants and sufficient demand from manufacturers of natural textiles.

The cultivation test with **dye plants** also aimed at a preliminary quantification of yields and of content and quality of dyeing matter. Dyer's rocket, dyer's chamomile, and dyer's knotweed were cultivated under organic farming conditions at two sites in Lower Austria. Dye content and dyeing quality were evaluated of plants coming from three different origins for each species and compared with dyeing agents currently available on the market. The results of the dyeing tests have shown that, apart from the light-fastness of dyer's rocket and dyer's chamomile, good to very good results concerning fastness can be achieved. The project also highlighted approaches to the optimization of dyeing processes; researchers expect improvements of the dying results (especially of the light-fastness of dyer's rocket and dyer's chamomile). Future planting trials should focus on improved yields in these two species as well as on weed control at the juvenile stage of dyer's knotweed.

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Faser- und Färbepflanzen aus ökologischem Landbau
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