VILLIAGO INTEGRATED SERICULTURE PROJECT: A MODEL FOR SERICULTURE TECHNOLOGY ADOPTION

Eric E. van Monckhoven ericvm60(at)gmail(.)com 2014

Organic farming and multi-dimensional agriculture within the EU

With about 12 million full-time farmers, half of the European Union's land is farmed. This fact alone highlights the importance of farming for the EU's natural environment. Farming and nature exercise a profound influence over each other. Farming has contributed over the centuries to creating and maintaining a variety of valuable semi-natural habitats. Today these shape the majority of the EU's landscapes and are home to many of the EU's richest wildlife. Farming also supports a diverse rural community that is not only a fundamental asset of European culture, but also plays an essential role in maintaining the environment in a healthy state.

Through various instruments, and notably the Common Agricultural Policy (CAP), increasingly aimed at enhancing the sustainability of agro-ecosystems, while encouraging farmers to continue to play a positive role in the maintenance of the countryside and the environment, the EU favours sustainable, productive, and competitive agriculture, even in regions where conditions are difficult. It also promotes diversification, pluriactivity and multifunctionality as possible survival strategies for farmers.

Over recent years, both the numbers of organic and multidimensional farms have increased within the EU. About 180 000 farm holdings practice certified organic farming and more than one third of EU-27 family farmers carry out non-agricultural activities, ranging from tourism, accommodation and other leisure or social activities, to handicraft, processing of farm products, wood processing, aquaculture, production of renewable energy, and contractual work. For small farmers (less than 5 ha), both organic farming and multidimensionality have proved to be a fair answer to the risk of disappearance.

Sericulture: A tradition with a future

Sericulture[1], the art and science of rearing silkworms, has a long and colourful history that started in China some 2.700 years B.C. Since then, the techniques have been widely spread and improved. Practiced at economic scale in more than 25 countries all over the globe, sericulture today is a blend of ancient techniques and modern innovations.

An industry with tradition in Southern and Eastern Europe, sericulture follows a descending route from a boom period in the past centuries to a complete loss of interest in its development and expansion in the end of the 20th century and beginning of the new millennium. However, due to its potential as income and livelihood generation and the development of new technologies and applications (biomedicine, cosmetics, food industry), as well as the growing demand of the European market for high quality silk products, some research institutions in Bulgaria, Italy and Romania, are reconsidering re-establishing part of the cocoon industry in Europe with a strong emphasis on research and innovation, education, environmental sustainability (climate/energy, low-carbon economy), job creation and poverty reduction.

Public and private investments in sericulture are necessary to develop innovative research programs, experiment new technologies, create new lines of production through unexplored

[1] For the purpose of this paper, the term sericulture is to be limited to the sustainable production of silk cocoons, from the moth, Bombyx mori (L.), for both the filament they are composed of and other by-products. Since the silkworm is fed with mulberry tree leaves, the culture of the mulberry tree (moriculture) is part of sericulture.

collaborations between advanced multidisciplinary science, cutting-edge engineering, and small and medium enterprises who have a high-potential, but high-risk innovative ideas, closer to the market. Within the EU, support to sericulture till the industry takes root could lead to novel innovation clusters that could make a difference for new niche markets in the decades to come[2].

Italian silk sector

Up until the 13th century silk was only available as an oriental import and only very wealthy people could afford it. In Europe, southern Italy, while under Norman rule became an important centre for breeding silkworms and spinning silk. Italy soon became one of the most important centres for manufacturing silk, with Genoa, Venice and Florence as the main production areas. For a long time Italy remained the leading silk country in Europe until France expanded its silk weaving in the middle of the 17th century.

On the turn of the 18th century, Como became Italy's largest silk producer, with the help of mechanical methods replacing older ones. Sadly, silkworm breeding died down in Italy after World War II, but the industry is still thriving in Como. Today the silk district of Como is a major provider of silk products in Europe (80%) and the world leader in the production of high-end textiles for clothing (fashion industry) and furniture. In 2012 it registered an increase by 11.7% of its total turnover. The excellent aesthetic and functional properties of the fibre are well-known. Hence, most of the raw material, the natural grey silk yarn, is imported from the Far East or Brazil. Manufacturers in Como handle exclusively the final stages of the cycle. They no longer operate in the sectors of breeding silkworms, nor thread spinning.

In Italy, despite the lack of interest from policy makers for sericulture, two research institutions still play a crucial role for the future development of the silk industry. CRA-API of Padua, an Experimental Sericulture Station established in 1871 under the Ministry of Agriculture, Industry and Commerce, is capable of producing some hundreds of high quality silkworm boxes per year. The same institution is actively working on silkworm genetics and artificial diet in order to support biomedical and niche textile production of cocoons, and is implementing important research activities in the fields of moriculture (i.e. mulberry germplasm bank). On the other hand, the Silk Division of Innovhub[3], a textile research centre with a large specialization in the silk sector, is implementing research activities in the field of qualitative standards for silk production (textile and non-textile industry).

The two institutions are joining forces within the framework of SILKBIOTECH (2012), a research project aimed at developing and manufacturing a totally new silk fibre endowed with antimicrobial peptides "in vivo" co-extruded with the silk proteins by the worms, and at implementing the traditional techniques of silkworm rearing with advanced biotechnological solutions.

[2] In addition to traditional textile applications, silk is acquiring interesting positions in two other areas, cosmetics and biomedicine. In the cosmetic field the use of one of the silk protein (sericin) as an additive in creams, shampoos, lotions, soaps, has become very popular. The volumes are reduced, the amounts added to each product are quite low (<5%), but the claimed effects are extremely interesting (protective film forming, anti-wrinkle, moisturizing, regenerating, etc..). In the biomedical sector silk (fibroin) is gaining an increasing interest for the development of devices for tissue regeneration (skin, cartilage, bone, blood vessels, nerves, tendons, ligaments, etc…); biomedical devices made from silk are not commercially available, because many still are in the phase of pre-clinical evaluation, others have just reached the clinical phase.

[3] Stazioni Sperimentali per l'Industria

Project rationale

Silk represents a tiny percentage of the global textile fibre market but it is a premium agricultural commodity with a unit price roughly twenty times that of raw cotton. In past decades, Italian silk industry took an overall rather steep downturn. The primary set of operations in the value chain of production, including the breeding of silkworms, was dropped for reasons of cost efficiency. These operations were too labour intensive and required significant capital investments, which became simply no longer sustainable. The cost of silk "Made in Italy" was considerably higher than that mass-produced in the ultra-industrialized regions of China. This eventually led to the closing down of most factories, and the loss of thousands of craftsmen's jobs.

Until recently, sericulture had the only scope of producing silk for the textile industry. Since the 1990s, due to advance in technology and new market opportunities (biomedicine, cosmetics, high-quality silk, and food industry), sericulture has been reconsidered under its multi-functional facets. The major challenges to the sericulture is how to improve its position as multi-product provider, increase returns to stakeholders along the marketing chain, lower costs, improve productivity, and increase value added. Part of the challenge is to recognize that innovation and governance along the value chain are key elements of any strategy aimed at sustainable development of the industry. It is not just a matter of trying to reduce costs and increase productivity.

In recent years (2013), based on a market research that identified a potential market in the cosmetics & personal care sector, CRA-API of Padua has activated a working partnership with Veneto Agricoltura, the regional body responsible for forests and agro-resources in Veneto, and a group of SMEs to develop planning schemes for the cooperative production of high quality silk cocoons in the Province of Belluno, northeastern Italy. Apart from generating incomes and livelihoods to local communities, it could contribute to help families stay on farmland that has been handed down for generations by creating small side revenues. Sericulture is an environmental friendly, highly women/old people-focused, rural based, income leveller activity that can contribute to create high value products with a minimum of investments. However, while mulberry[4] can be grown without much difficulty, the art and science of silkworm rearing and marketing arrangements for cocoons have to be organized and supported in the initial stage till the industry takes root.

From mulberry leaves to the silk cocoon

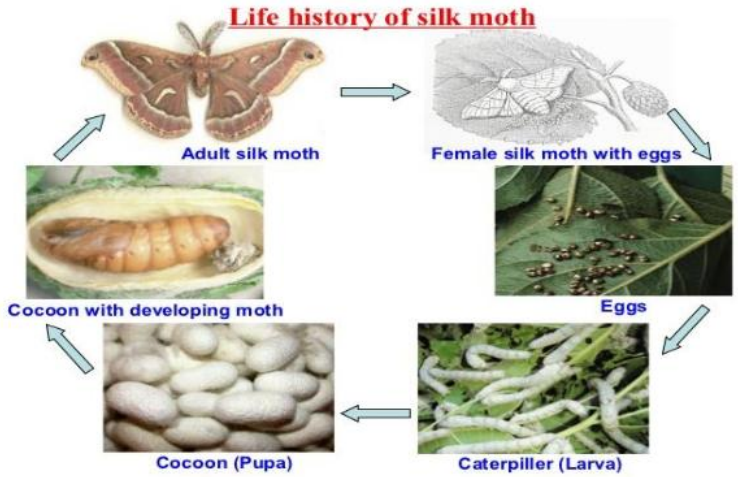
Silkworm rearing is a complex set of activities requiring not only patience and time but also ingenuity and hard work. It comprises diverse activities ranging from breeding and maintenance of silkworm races through the rearing the silkworm larvae for the production of cocoons.

The female moth lays around 350 to 400 eggs and the moth dies soon after. For about six weeks the silkworm eats almost continually. It feeds preferably on white mulberry (morus alba) leaves, but it may also eat the leaves of any other tree or shrub of the morus family, like the morus rubra

[4] Mulberry leaves are the sole food for silkworms in commercial sericulture and the quality and quantity of the mulberry leaf fed during rearing decide the success of silkworm crop. Mulberry leaves for young silkworms must be soft and reach in water, proteins and carbohydrates.

or morus nigra. After growing to its maximum size at around 6 weeks, it stops eating and is about 10,000 times heavier than when it hatched. The silkworm is now ready to spin the silk cocoon. It attaches itself to a compartmented frame, twig, tree or shrub in a rearing house to spin the silk cocoon over a 3 to 8 day period. The silkworm rotates its body in a figure-8 movement some 300,000 times, constructing a cocoon and producing about a kilometre of silk filament. The larvae

will then enter into a pupa phase enclosed in a cocoon made of raw silk produced from the silk glands.



Silkworms possess a pair of specially modified salivary glands called sericteries, which are used for the production of fibroin – a clear, viscous, proteinaceous fluid that is forced through openings called spinnerets on the mouthpart of the larva. Liquid secretions from the two large glands in the insect emerge from the spinneret, a single exit tube in the head. The diameter of the spinneret determines the thickness of the silk thread, which is produced as a long, continuous filament. The secretions harden on exposure to the air and form twin filaments composed of fibroin, a protein material. A second pair of glands secretes a gummy binding fluid called sericin which bonds the two filaments together.

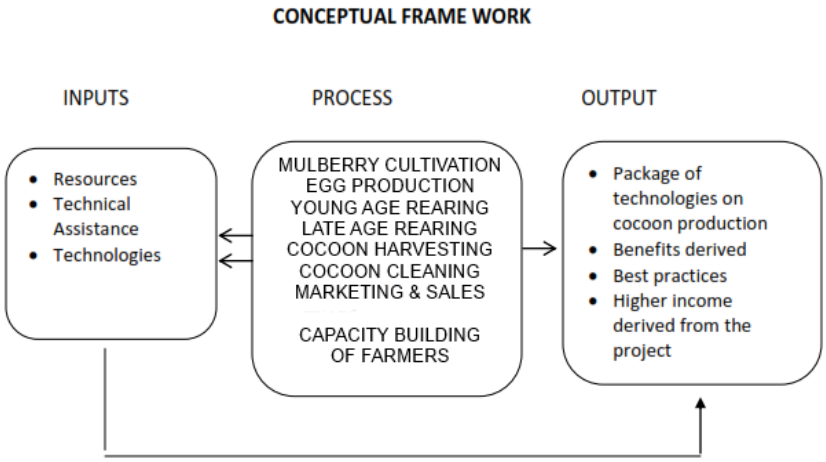
Designing a model for sericulture technology adoption

The present proposal is aimed at addressing questions about the development of a sustainable supply chain of high-quality silkworm cocoons for textile and non-textile products in the Province of Belluno, northeastern Italy, by undertaking experiments[5] about processes, products, structures, and relationships. It will produce both new knowledge and new firm capacity that can contribute to the start-up and development of small income generating activities benefitting the rural communities of Val Belluno through the setting up of a sericulture cooperative. The multi-level

[5] Experiments will be performed at the individual-, organizational- and ecosystems levels. This reflects the understanding that transformation to sustainable enterprise requires change in:

- the way individuals understand the roles, responsibilities and impacts of their company and of their own decisions and actions.
- the strategies, structures, processes and products of businesses and their stakeholders
- the markets, public policies and operating environments in which businesses operate.

modelling will leverage both data and experiments to develop, test and refine models for scientific knowledge, technological innovation, and business strategy and policy-making purposes.



Organic mulberry cultivation, sound silkworm seeds production and clean young age silkworm rearing are vital aspects for the development of healthy larvae and harvesting of successful cocoon crop besides well trained manpower at workers and managerial level.

There are several steps involved with silkworm cocoon production, including:

- Growing mulberry trees (in order to feed the silkworms with proper food)
- Producing silkworm seeds
- Rearing young age silkworms
- Rearing late age silkworms
- Monitoring silkworm cocoon production
- Marketing and selling of silkworm cocoons

Although those activities seem straightforward, the adoption of sericulture in a totally new socio-cultural environment is far from being an easy process. The production of high-quality silkworm cocoons with cost-effective methods requires much technology and an intensive level of human skills and conspicuous financial investments during the start-up phase. Moreover, the development of the supply chain requires linkages to a large variety of related businesses and institutions (research, training, education). For example, linkages between organizations and traders who will purchase cocoons and the producing sericulture farmers are necessary. A well-established relationship of supply and demand from downstream to upstream, from processed products and sales to sericulture farmers, based on both domestic and international consumption needs is therefore essential. On the other hand, sericulture needs to be strongly promoted and farmers to be trained to rear silkworms and encouraged to join their efforts in sericulture cooperatives.
Scientific cultivation of mulberry and adoption of new technologies in silkworm rearing plays an important role in the production of high quality cocoons. The larval duration in the life cycle of the silkworm, ranges from 24-28 days. The larval stage comprises of 5 instars, and 4 moults. Rearing of silkworms from 3rd or 4th instar up to spinning stage is called the late age silkworm rearing. During this period the silkworms consumes more than 94% of total mulberry leaves required, 133 times increase in body size, 125 times increase in body weight and 1000 times increase in the silk gland weight from the time of hatching. Scientific rearing methods and rearing skill method are necessary for achieving maximum growth and survival of the larvae, thereby increasing the cocoon yield and silk production.

Because of the total novelty of the mulberry cultivation and rearing of silkworms in the project area, sericulture will be introduced under a cooperative project whereby farmers will not take individual risks of adoption, but collectively run the rearing project. A young age silkworm facility

centre will be set up at provincial level and provide local farmers with sound and healthy larvae for late age rearing, spinning larvae handling and cocoon harvesting. The cocoons will then be collected for data gathering, grading and cocoon assessment. Marketing and sale of clean cocoons will be arranged by the newly established cooperative or consortium. The project will also set up decentralized support services to provide training, capacity-building, inputs and advisory services to farmers, and warrantee a fair price for the cocoons. Individual farmers will be encouraged to have their own mulberry plantations with a minimum of 0.3 ha and small rearing houses accommodating 2-3 boxes per rearing cycle.

If this model is fully implemented, one farmer will have annual income of ..... Euro by the 3rd year, from cocoon production alone.

VILLIAGO INTEGRATED SERICULTURE PROJECT:
A MODEL FOR SERICULTURE TECHNOLOGY ADOPTION

Project Summary

Project area. The project will have provincial coverage. While farmers will be selected from various areas of Val Belluna, the project headquarters will be based at the Pilot and Demonstration Centre Villiago of Veneto Agricoltura[6], located on the territory of the Municipality of Sedico (Belluno), which will host an organic mulberry plantation of 1 ha (2 000 saplings) and the project's pilot and demonstration young age silkworm rearing centre.

Target group. The project will target small farmers willing to develop a new line of products associated with organic mulberry cultivation and silkworm cocoon production, especially women and newly established young farmers.

Project objectives. The project's goal is to demonstrate the sustainability of the sericulture value-chain by improving organic mulberry cultivation and silkworm rearing technology and developing cooperative schemes of production and marketing.

Project description. In addition to project management and institutional support, the project will progressively set up a cost-effective business model for sericulture in Val Belluno, allowing cooperative members to earn sustainable income through sericulture. It will support the introduction of household-based cocoon production, where farmers maintain individual mulberry plantations and rearing houses. It will provide access to inputs and appropriate support services to farmers, building on existing cooperatives and on a sericulture support centre managed in collaboration with CRA-API of Padua and Veneto Agricoltura. Whenever possible, selected value chain stakeholders will have timely and adequate access to a range of diversified financial products (including investment and working capital loans, grants and equity shares) and risk-mitigating products (life insurance and weather index-based insurance), allowing them to develop profitable and sustainable activities in project-supported value chains. The project will also provide related capacity-building.

Project partners. CRA-API / Veneto Agricoltura / Cantiere della Provvidenza

[6] Veneto Agricoltura is the Veneto Region Agency aimed at "promoting and carrying out interventions for the modernisation of farms and agro-forestry soil conservation, as well as making the best effective use of agricultural land, the development of aquaculture and fisheries, in particular concerning research, experimental trials and support of the market" (R. L. 35/97 – art. 2). Veneto Agricoltura encourages innovation, promoting agriculture and "providing specialist services for the enhancement and commercialisation of typical regional products". It organises and promotes food quality certification, supports applied research, experimental trials and agricultural training, encouraging a better use of environmental resources. Moreover, Veneto Agricoltura is specially dedicated to the safeguarding and the preservation of biodiversity through the management of regional forest nurseries, nature reserves and state forests.









NOVITÀ
FIMO
dall'esperienza
delle migliori spa
e dei centri benessere
di tutto il mondo
presenta...
SERÍ®
seta sul tuo viso
Illumina il tuo