

From woad to safflower: Cultivation experiments by P.A Gadd in the 18th century

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In 18th century Sweden there was a vivid botanical activity and strong interest in the cultivation of various exotic plant species. Dye plants formed an economically important area since large amounts of dyestuffs were needed to dye fabrics. Domestic wool was also a focus of interest, and the plan was to dye locally produced woolen broadcloths with locally cultivated plant dyes. The aim was to decrease the cost of the products and guarantee that money and wealth remained within the country.

In other European countries, such as France, Netherlands and Germany, dyes were cultivated in such a large scale that whole towns survived on the income that dye production brought. The production of dyestuffs for the European market had begun at the Middle Ages. The most important cultivated colorants were **woad** (*Isatis tinctoria*), **dyer's madder** (*Rubia tinctoria*) and **weld** (*Reseda luteola*). Moreover, to feed the increasing needs of the European dye markets, dye plants were cultivated in tropical areas in the colonies, shipped to Europe and sold at high prices. Of these dyes the most important were tropical indigo (*Indigofera tinctoria*), dye trees (*Hematoxylon* and *Cesalpinia* species) and cochineal insects (*Dactylopius coccus*).

In Sweden, attempts to get farmers interested in cultivating dye plants were made by Carl von Linné. He also wanted to boost interest in building woad mills for processing of all the leaf material from the (expectedly vast) woad fields. On the eastern side of the Baltic Sea in Turku, Finland (part of Sweden then), at the *Kungliga Akademien i Åbo* experimental cultivation in search of suitable dye plants was also carried out. Among others by Pehr Adrian Gadd (1722–1797) and Pehr Kalm (1716–1779) who both at times have been called the “Father of gardening in Finland”.

P. A. Gadd was interested in economic issues, metallurgy and chemistry in general as well as useful plants. He had two gardens, one in Turku and one in Kaarila near Tampere. He experimented with over 600 species, including many medical plants, edible plants, fiber plants, oil plants and trees for carpentry. Of these species can be mentioned apple, plum, lemon, figs, saffron crocus, roses, aloe vera, oleander, sugarcane, cotton, hemp, tomatoes. White mulberry trees and opuntia cacti were also experimented as well as dye plants such as woad, dyer's madder, weld, Canadian goldenrod (*Solidago canadensis*) and safflower (*Carthamus tinctoria*).

Woad has been used to dye textiles different shades of blue and when mixed with other colorants it was possible to get black. In the 18th century, woad blue appeared in upper class textiles as well as in folk and army textiles. For example, the blue color of the Swedish flag was originally dyed with woad. The blue colorant is lightfast and gained from the first year's leaves of the biennial plant. In the second year the plants produce seeds. In Finland, woad grows as a wild plant in coastal archipelago areas. But at the time of Gadd there was no traditional woad cultivation in Finland, and apparently no knowhow on how to extract the blue colorants from the leaves; blue textiles were dyed but with imported dye-stuff. Nearest center for large scale woad production was Germany, where it had been cultivated since the 12th century AD. In Gadd's gardens woad thrived, probably because it was well adapted to the local climate.

Dyer's madder can be used to dye textiles red and orange. In France the cultivation of dyer's madder began already in the 9th century AD, but in the 18th century the Dutch madder had great importance in the Baltic Sea trade. Madder red can be seen as Turkish red in oriental carpets, in royal an upper-

class clothing, the embroidery of folk textiles as well as in military jackets. Its volume at European market was enormous. For example, when the ship *Vrouw Maria* sank in the Finnish archipelago in 1771 she carried about 10 000 kilograms of Dutch madder in her cargo. In Gadd's experiments madder grew well, especially in dry soil.

In 18th century Sweden the most striking use of **weld** was probably the yellow cross of the Swedish flag. Weld contains colorants that are relatively light fast, luteolin and apigenin. When mixed with woad the result was different shades of green. For example, the green clothing of Robin Hood has been said to be a result of weld and woad. Weld is difficult to cultivate in the Nordic climate. Gadd and his students tried to find a substitute for it; a plant that would survive Nordic winters. One possibility was **Canadian goldenrod**, introduced from North American colonies because of its contents of yellow colorants. It grew well in Finland, and today it's considered an invasive species, because it seems to spread faster than previously.

Safflower can be used to dye silk pink. In Finland attempts to cultivate safflower were not successful: it produced seeds only in very warm summers. The desire to have this plant in domestic cultivation can be compared to the desire to cultivate white mulberry trees. These are host trees of silk worm and there apparently was a wish to produce domestic silk. Similarly over-optimistic was the desire to cultivate opuntia cacti in Finland. These plants are host of cochineal insects that produce the most expensive carmine pink dye.

The dye plant experiments were thought to have a strong potential to bring money to the country. In reality the outcomes remained weak, because it was difficult to inspire peasants to cultivate these plant species. The benefit for Sweden's and Finland's fabric production was slight because it was impossible to guarantee a continuous flow of dyestuffs for industry. The cultivation of dye plants needed man-power and Sweden was involved in several wars in the 18th century. There was not enough workers and fields available to establish intensive dye plant production. Considering woad, it may have been easy to cultivate in Nordic climate, but the peasants would rather use available fields for edible plants like potatoes, a new arrival from the Americas at the time. Also, local people knew that it was easy enough to go to forests and meadows and pick dye plants, like bedstraws (*Galium* species) for red and for example heather (*Calluna vulgaris*) for yellow. They were probably not that interested in cultivated dye plants.

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