

Dyes and additives for fossil-free textile chains: linking fibre production, protected cultivation of high-value products and processing

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Objective(s)

The production of materials for textiles (fibres and auxiliaries like dyes) is one of the largest consumers of carbon based materials. In this project, we aim to design a value chain, in which high-value crops grown in protected cultivation can be used in a fossil-free textile chain, re-using "waste" material of the production. The design of the system will take the possibilities for local product valorisation into account, exploring the scale at which production needs to take place.

Main (Key) Results

Result 1. Inventory of the characteristics of crops to be suited for production of dyes in protected cultivation systems

Result 2. Analysis of > 10 crops in terms of cultivation conditions and characteristics, options for breeding and selection, inventory of which dyes can be extracted and their characteristics, and the biorefinery steps that can be taken for complete valorization of the crop

Readiness

In principle, the readiness level of this project is high, since people already color fabrics with dyes derived from plants for ages. However, to do this nowadays in an economically feasible system is a challenge. Where do we stand? At an inventory level, investigating the options, most suited crops, waste streams, dye characteristics, etc. With highly interesting discussions, where these knowledge domains meet, which really takes the project and the topic to a next level.



Figure 1. Blue dye can be derived from *indigofera tinctoria*

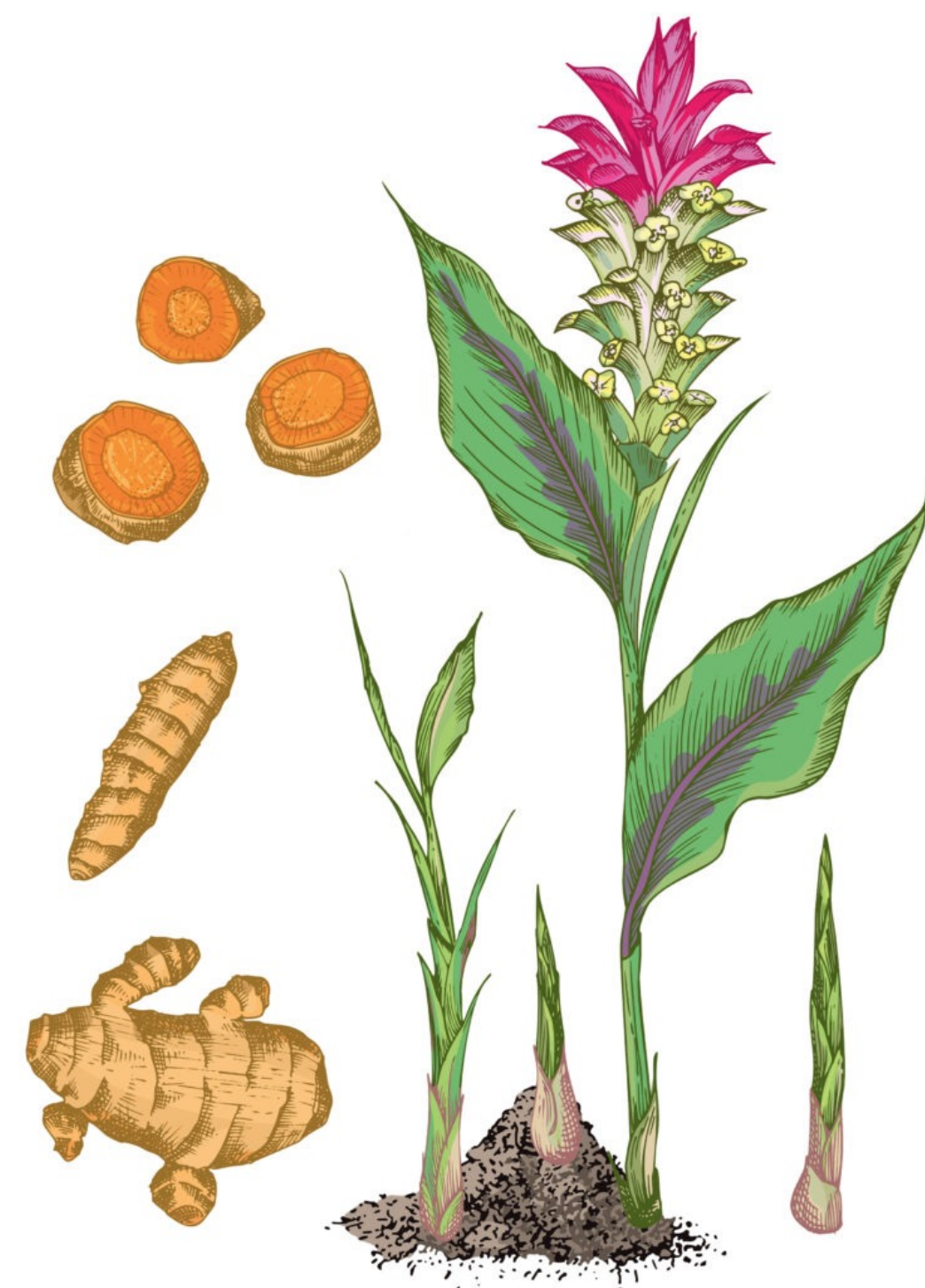


Figure 2. New business options for the ornamental *Curcuma longa*

Table 1. Inventory of crop and characteristics

colour structure	Name plant (NL)	(EN)	Species (Latin)	Plant type	Plant part
tannin-based flavonoid	Acacia		Acacia catechu	Tree	bast van de boom
	Duizendblad		Achillea millefolium		
	Stokroos		Alcea rosea		
	Vrouwenmantel		Alchemilla	Perennial herbaceous plant	blad
Naphthoquinones	Fraaie vrouwenmantel		Alchemilla mollis		
	Vrouwenmantel		Alchemilla vulgaris		blad
	Alkanna, alkanet		Alkanna tinctoria	Herb	wortel
Flavonoids	Rode ui		Allium cepa		schillen
	ui	Onion	Allium cepa	Vegetable	ui
carotenoids	Kattenstaartamarant		Amaranthus caudatus		bloem
	Ananas	Pineapple	Ananas comosus	Shrub	Leaves
	Gewone ossentong		Anchusa officinalis		wortels
	Gele kamille	Chamomile	Anthemis tinctoria	Perennial flowering plant	bloemen
	Berendruif		Arctostaphylos uva-ursi		Bladeren droog
Flavonoids	Bijvoet		Artemisia vulgaris		stengel
	Jackfruit	Jackfruit/jacktree	Artocarpus heterophyllus	Tree	debarked wood
	Mansoor		Asarum europaeum	Flowering plant	wortel
	Verbedstro		Asperula tinctoria		

Lessons learned

One of the starting points of this projects, was that we intended to select "dual function" crops, of which we could harvest a regular product (e.g. tomato fruits) and the dye. And to control the levels of the dye, the crop should have to be cultivated in indoor systems, with restrictions to its size. However, the inventory showed us that most crops that contain substantial amounts of dye are either "tree size" or "weeds". That implies that we had to change our point of view, and we had to re-evaluate our list of potential crops.

Next steps

- Finalizing crop inventory in terms of cultivation, characteristics of the dyes, options for breeding and selection, chemical characteristics to bind to fabrics and biorefinery steps for valorization of the crops.
- Enjoy the discussions and exchange of knowledge
- Organize a workshop with experts in different fields to take steps to realise textile chains based on plant-derived dyes
- Finalize the report, and communicate on our results and findings