Flexilis® - The rubber dandelion Crop

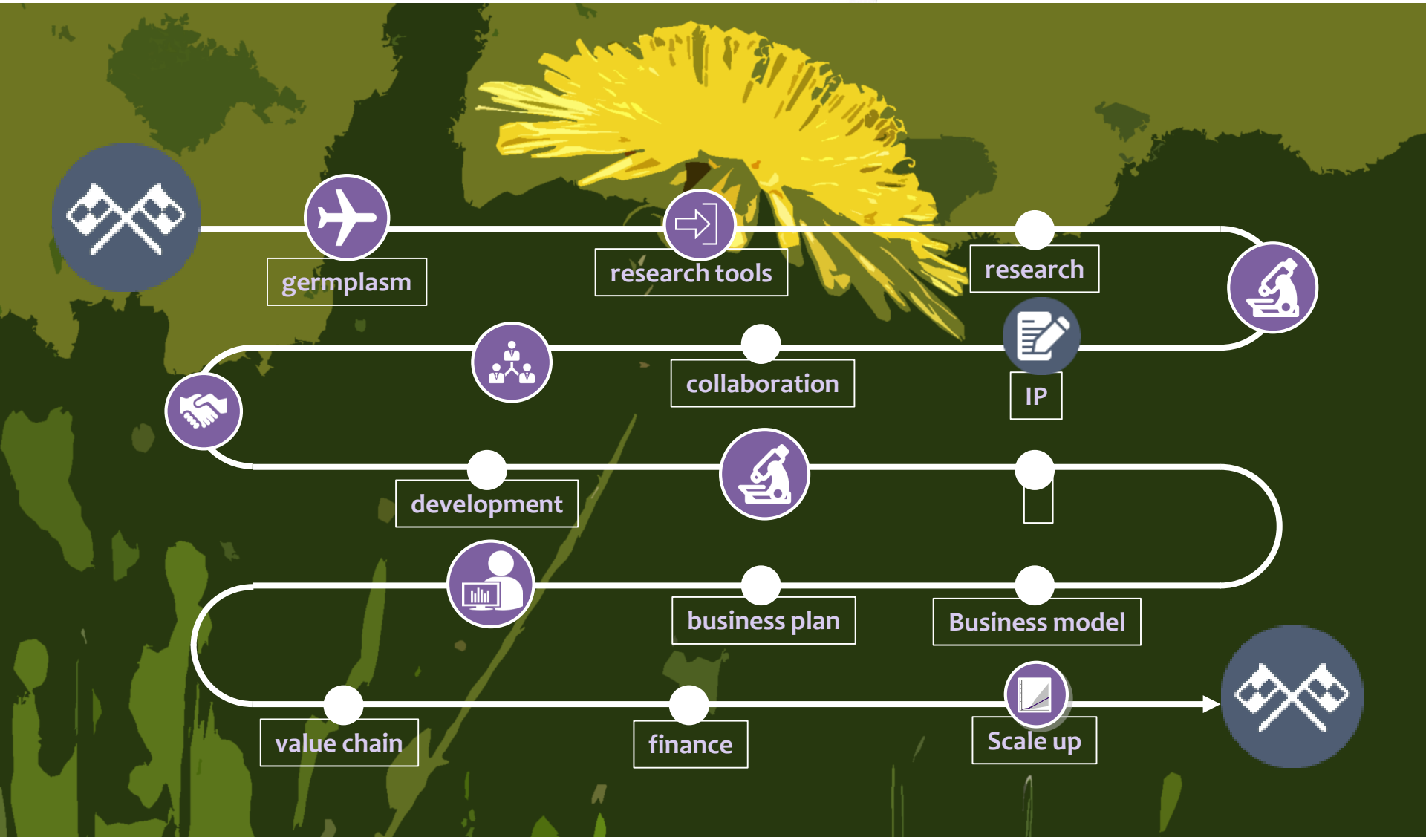
Anker P Sørensen
VP New Business KeyGene

CROP INNOVATION & BUSINESS

The Challenge

The Challenge

Where is the roadmap



Alternative Natural Rubber source

New Crop for temperate regions of the world

Where the rubber meets the garden

China's leading conservation centre is facing down an onslaught of rubber plantations. **Jane Qiu** reports from Jinghong.

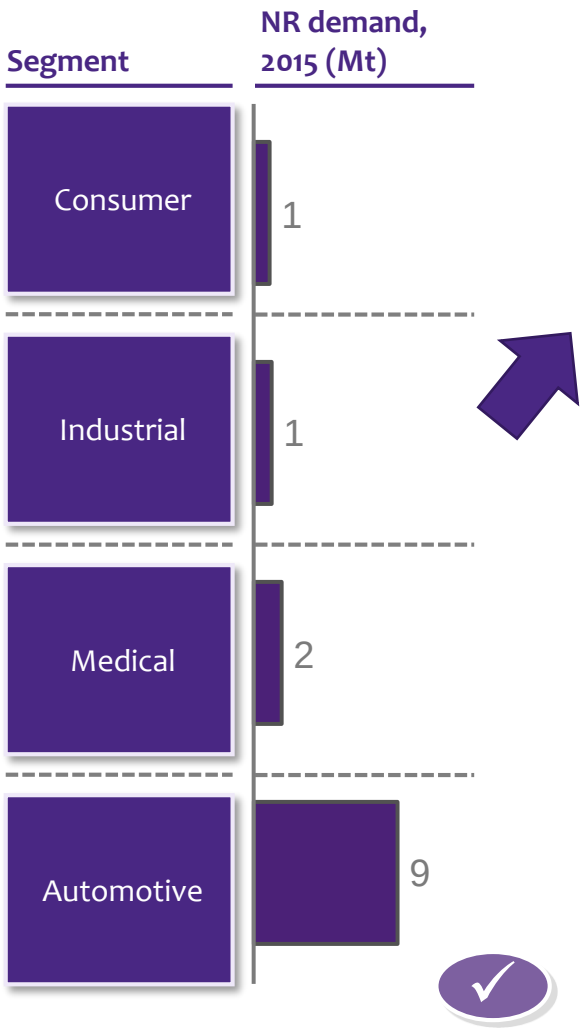
Natural Rubber Market :22.9 billion $ per year (2012)

Hevea brasiliensis is the only source

Production is threatened by:

- diseases
- oil palm replacement
- lack of cheap, skilled tappers
- unwanted deforestation

Natural rubber cannot be replaced by synthetic rubber in many applications



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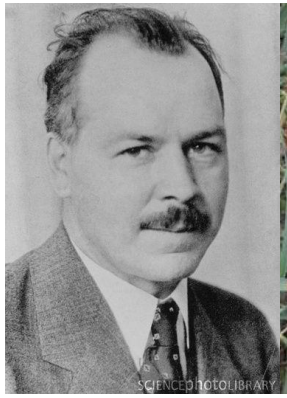


Nicolai I. Vavilov

(1887-1943)

Taraxacum Koksaghyz

discovered in 1931

Taraxacum Koksaghyz

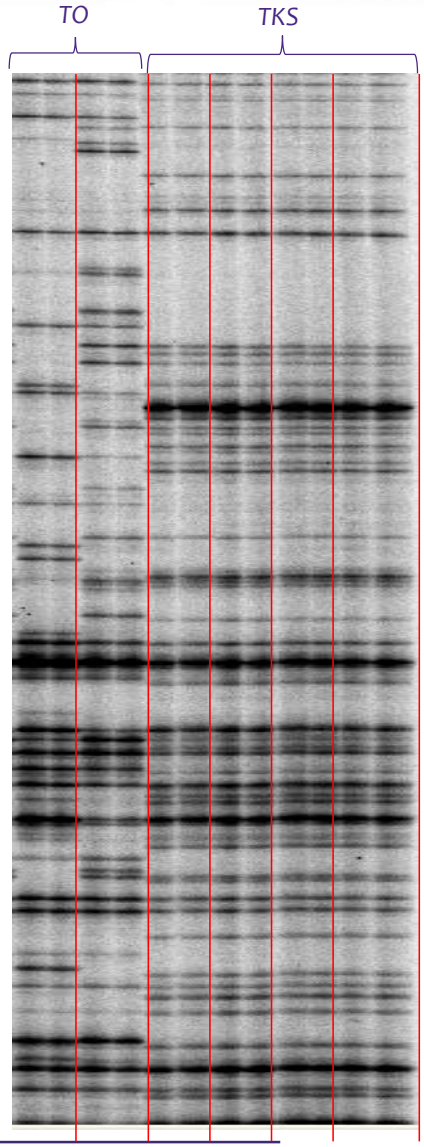
gown 1945-1955

750 Kg High Quality Natural Rubber per ha. per year.

Target Yield 2020

Alternative Natural Rubber source

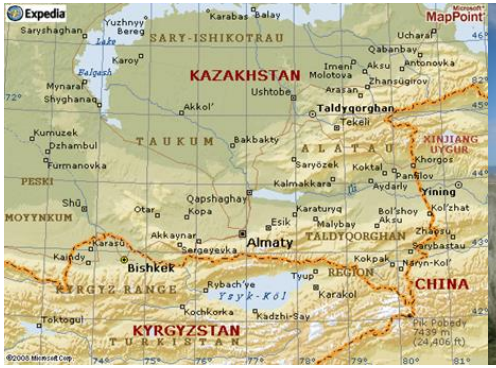
New Crop for temperate regions of the world



TO = Taraxacum Officinale

TKS = Taraxacum "Koksaghyz" from Gene Banks

EU-PEARLS FP7



Collecting TKS in Kazakhstan

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Research Strategy – how do we get fro 200 -750 Kg

RUBBER genes

Molecular breeding

VIGOUR genes

Kazakhstan dandelion, TKS, 200 Kg NR / ha
2x = 16

Sexual, outcrosser

1250 Mb

Common dandelion, TO
2x = 16

Sexual, outcrosser

825 Mb

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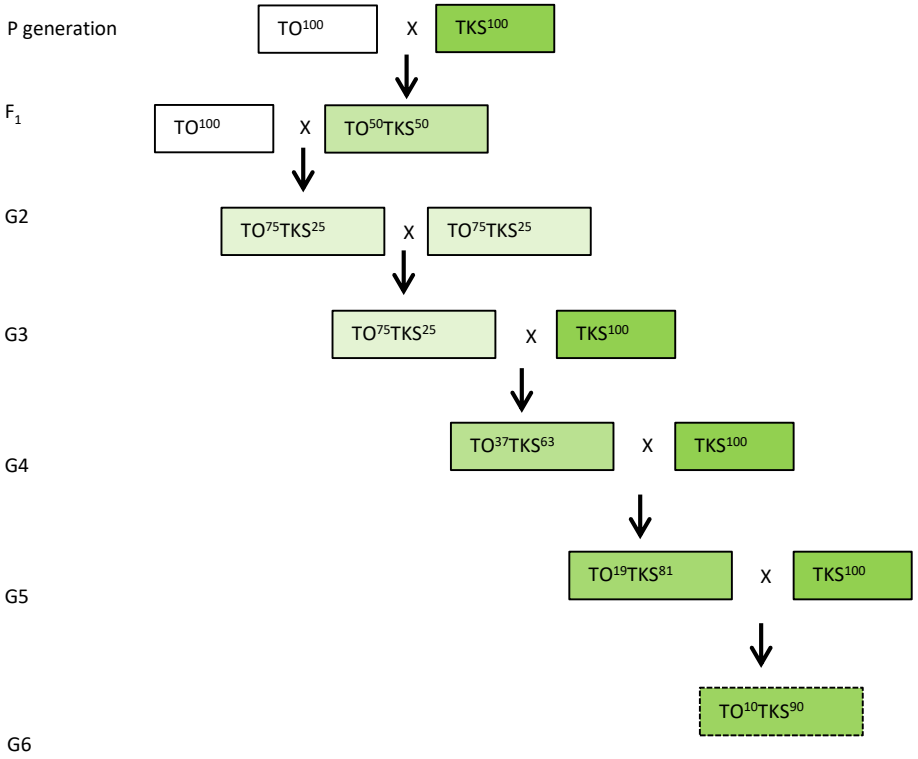
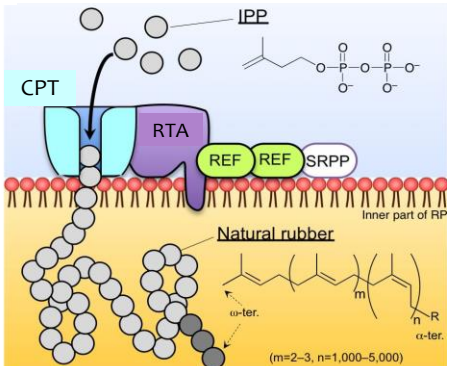
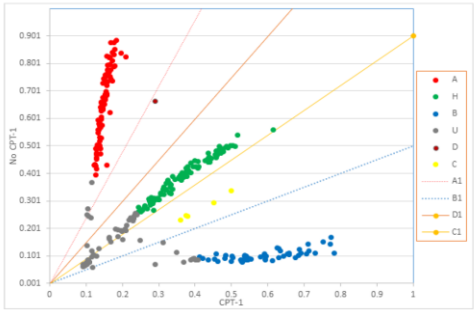
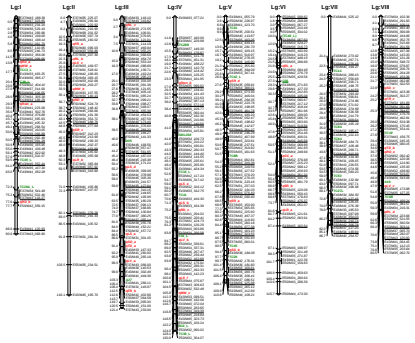
Molecular Breeding Tools & Perseverance









Alternative Natural Rubber Crop

IP

United States of America
United States Patent and Trademark Office

FLEXILIS

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Registered Apr. 19, 2016
Int. Cls.: 31, 42 and 44

TRADEMARK
SERVICE MARK
PRINCIPAL REGISTER

KEYGENE N.V. (NETHERLANDS LIMITED LIABILITY COMPANY)
AGRO BUSINESS PARK 90
NL-6708 PW WAGENINGEN, NETHERLANDS

FOR: AGRICULTURAL AND AQUA CULTURAL CROPS AND HORTICULTURAL AND FORESTRY PRODUCTS, NAMELY, LIVE PLANTS AND FLOWERS; LIVE RUBBER CONTAINING PLANTS; SEEDS, BULBS AND SEEDLINGS FOR PLANT BREEDING, INCLUDING BREEDING OF RUBBER CONTAINING PLANTS; LIVE PLANT CUTTINGS AND LIVE PLANT PARTS INCLUDING THOSE FOR RUBBER CONTAINING PLANTS, ALL OF THE FOREGOING EXCLUDING LIMBER PINE AND SIBERIAN CRAB APPLE, IN CLASS 31 (U.S. CLS. 1 AND 46).

FOR: SCIENTIFIC RESEARCH RELATING TO PLANT BREEDING, INCLUDING BREEDING OF RUBBER CONTAINING PLANTS, EXCLUDING LIMBER PINE AND SIBERIAN CRAB APPLE, IN CLASS 42 (U.S. CLS. 100 AND 101).

FOR: PLANT BREEDING; CULTIVATION OF RUBBER CONTAINING PLANTS FOR OTHERS; AGRICULTURE AND HORTICULTURE SERVICES, NAMELY, SELECTION AND PROPAGATION OF PLANTS AND CROPS, INCLUDING RUBBER CONTAINING PLANTS, ALL OF THE FOREGOING EXCLUDING LIMBER PINE AND SIBERIAN CRAB APPLE, IN CLASS 44 (U.S. CLS. 100 AND 101).

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EVELYN BRADLEY, EXAMINING ATTORNEY

Director of the United States
Patent and Trademark Office

Product Trademark

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(54) Title: RUBBER PRODUCING TARAXACUM PLANT

(57) Abstract: The present invention relates to a method for obtaining *Taraxacum* plants of considerable size and substantial rubber content, preferably by providing *Taraxacum* plants having a relatively large genome size and/or having a specific percentage of *Taraxacum koksaghyz* (TKS) derived genes and a specific percentage of *Taraxacum officinale*(TO) derived genes; selecting these plants for the presence or absence of certain markers;and subsequently selecting the plantson plant size, and on genome size.

Process patent

PBR on varieties

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Results Yield

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Collaboration & Partnership

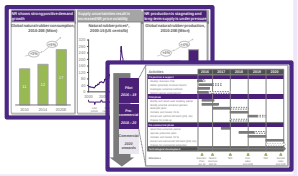
2008
Launch
EU-Pearls project

2013
Collaboration with Kultevat (US)

2014
Launch Drive4EU project

2014
Long-term strategic partnership KZ

2016
Feasibility study business plan Spring Associates



Organization	Country	Work package
Wageningen UR		Project leader
Institute of Batony		R&D, breeding
Rusthoeve		Agronomy
InExCB-KZ**		Agronomy
Agri. & Fisheries R. Inst.		Agronomy
Tereos Syral		Extraction
GEA westfalia seperator		Extraction
Netzsch		Extraction
Joanneum Research		Exploitation
QEW engineered rubber		Manufacturing
Mitas		Manufacturing
Apollo Vredestein		Manufacturing

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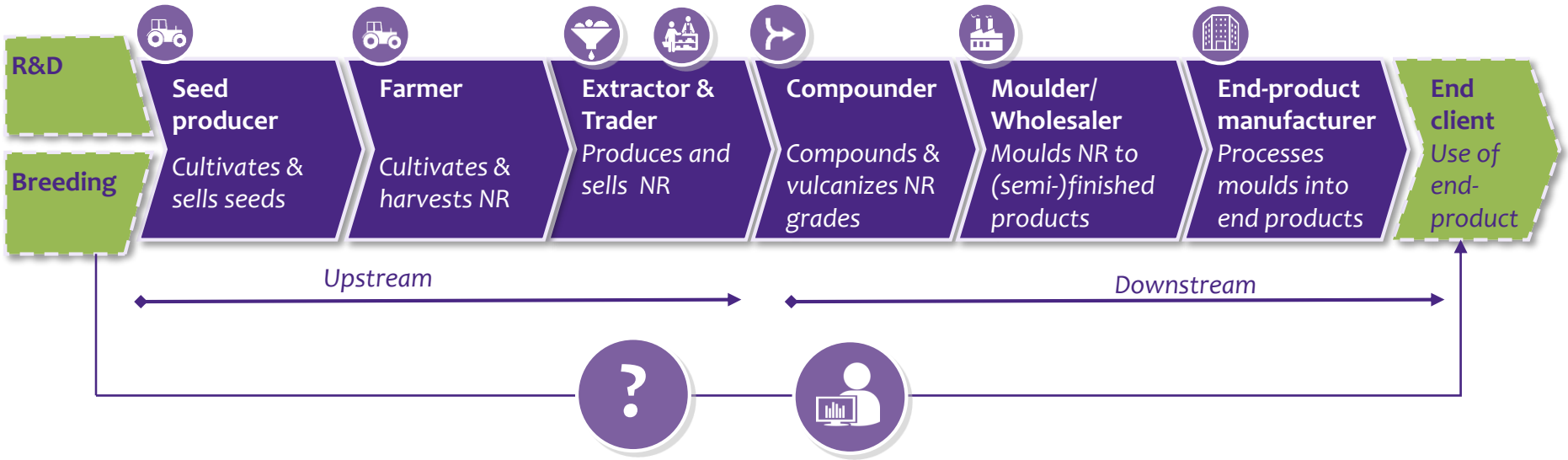
business plan & value chain



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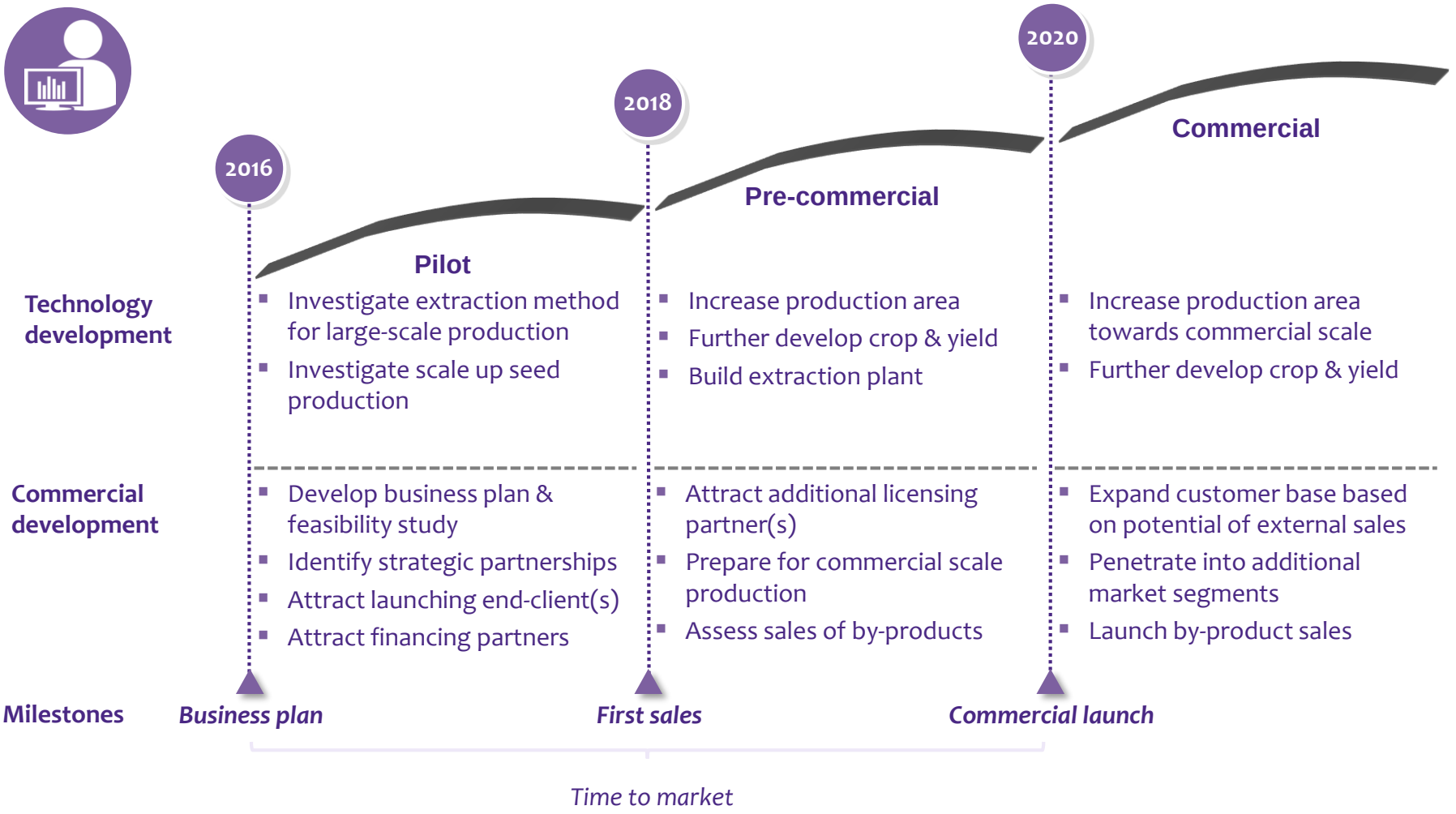
Scale up and phasing



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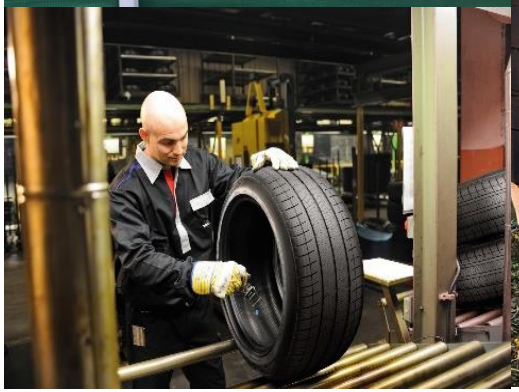
Seed production, scale up & applications



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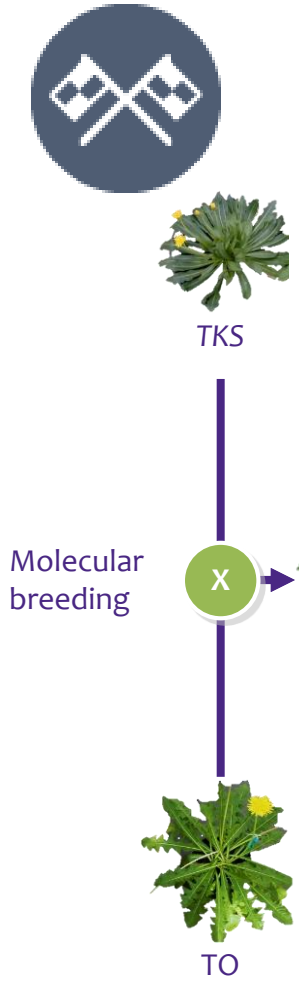
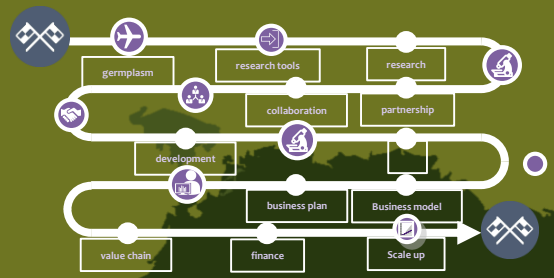
Summary



Dry weight (% of total)	Product	Description	Target Yield (t/ ha)	Example applications
5-15%	NR	▪ Latex, is directly processed into dry rubber during extraction	0.8	▪ Footwear ▪ Sports goods ▪ Airplane tyres ▪ Tubes & hoses ▪ Bridge bearings
30-40%	Inulin	▪ A low-calorie sweetener that is currently produced from chicory	2.6	▪ Processed foods ▪ Fuel (as ethanol) ▪ Bioplastic building blocks
50-60%	Biomass	▪ Remaining parts of the plant, which can be used as a source of energy	4.1	▪ Feed ▪ Biogas ▪ Soil amendment ▪ Hardboard overlay

Goals and learnings?



Demonstrated the value of genomics assisted breeding for domestication of a novel crop.

Developed efficient collaborations across the entire value chain.

Steered developments based on a sound business plan.

Established valuable partnerships.

Developed a new crop & a novel source of NR!