

Customizable CBD:THC ratio in Hemp



20
years



*Our vision is to provide products by **phytoinspiration**
for a future worth living!*

Phytowelt's R&D services

Platform technologies



phytodiversity



phytomining

Plant Biotechnology

Utilisation of
biodiversity

Industrial Biotechnology

Biosynthesis of
high-value products

Experience since 1998

Technologies developed out of
phytomining and *phytodiversity*



phytomass



phytoediting

Biorefinery Concept

Utilisation of renewable
raw materials

Genome-Editing

Supported evolution
of bacteria and plants

Terpenes & Phenylpropanes

**Flavors &
Fragrances**

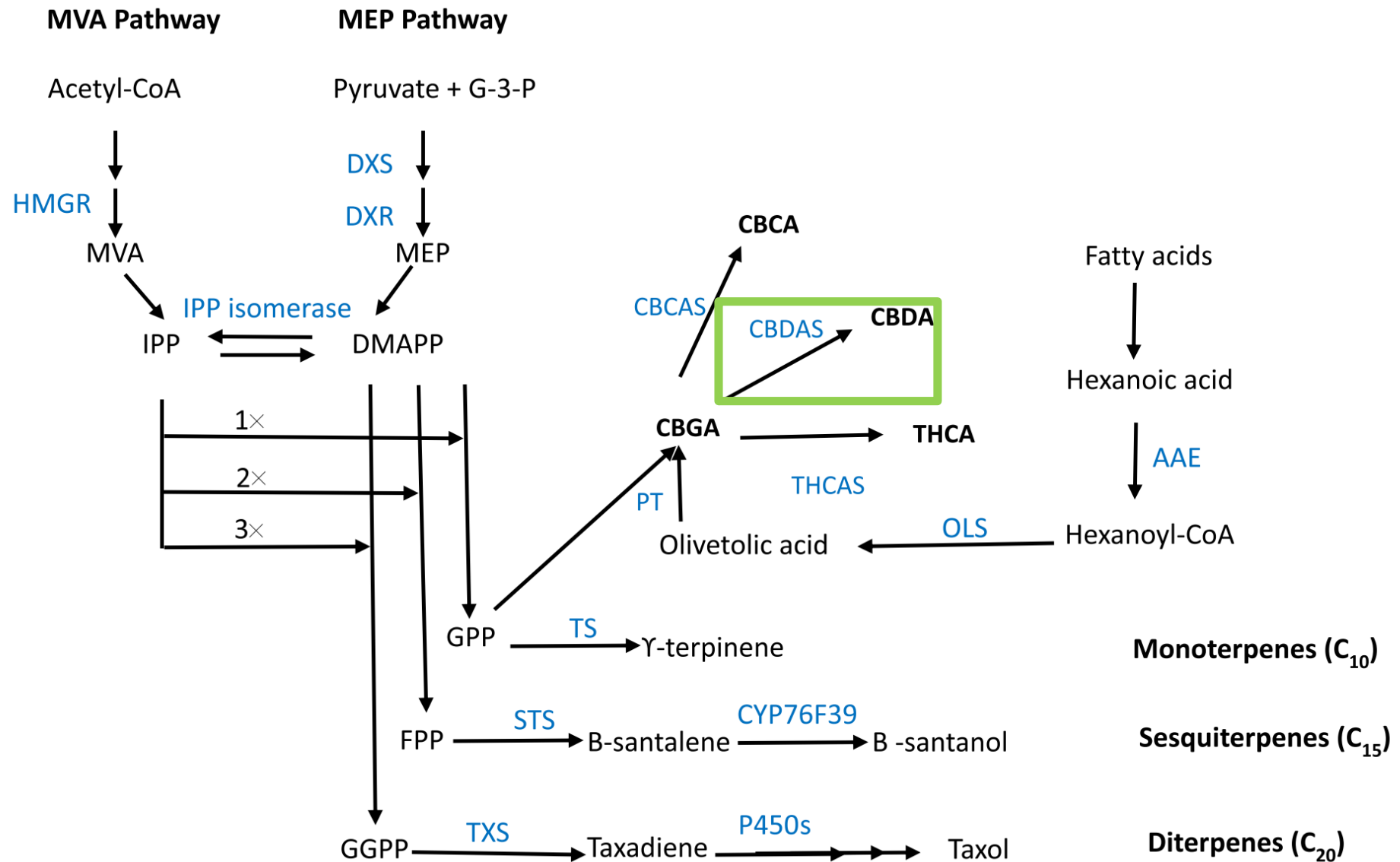
**Plant
breeding**

**Active
ingredients**

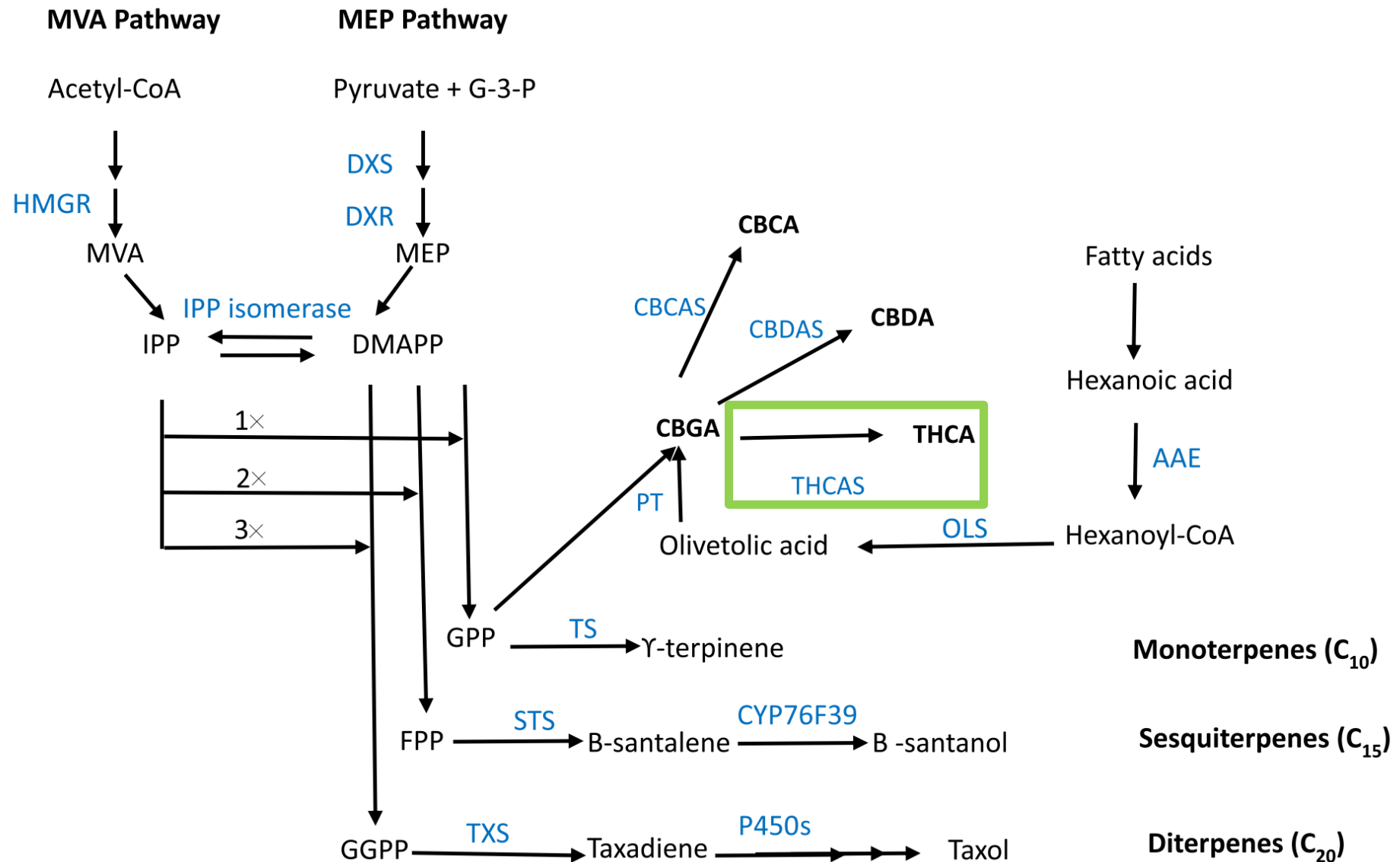
**Food
supplements,
Cosmetics,
Adhesives**

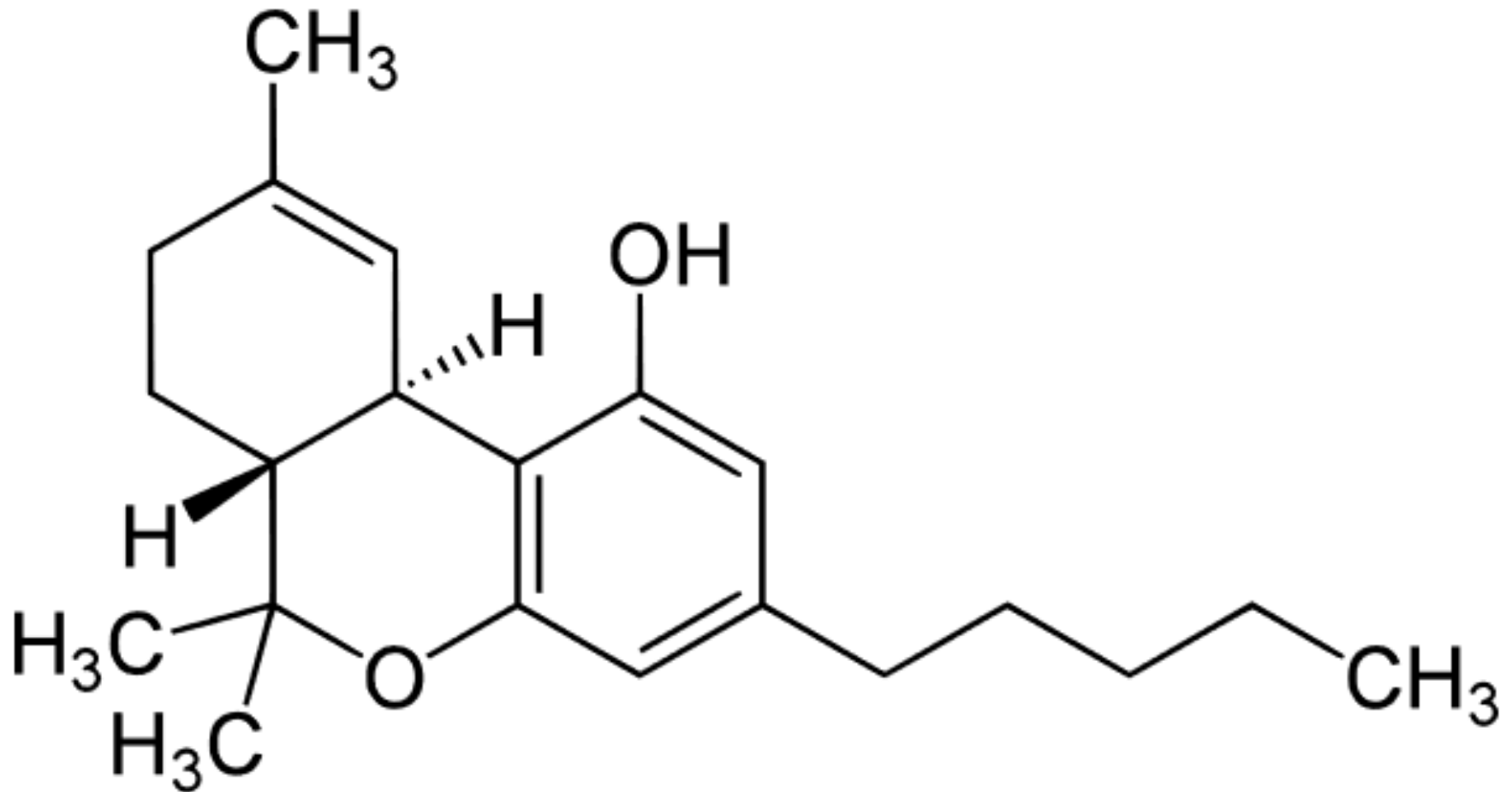


Phytowelt's expertise for Cannabis



Phytowelt's expertise for Cannabis

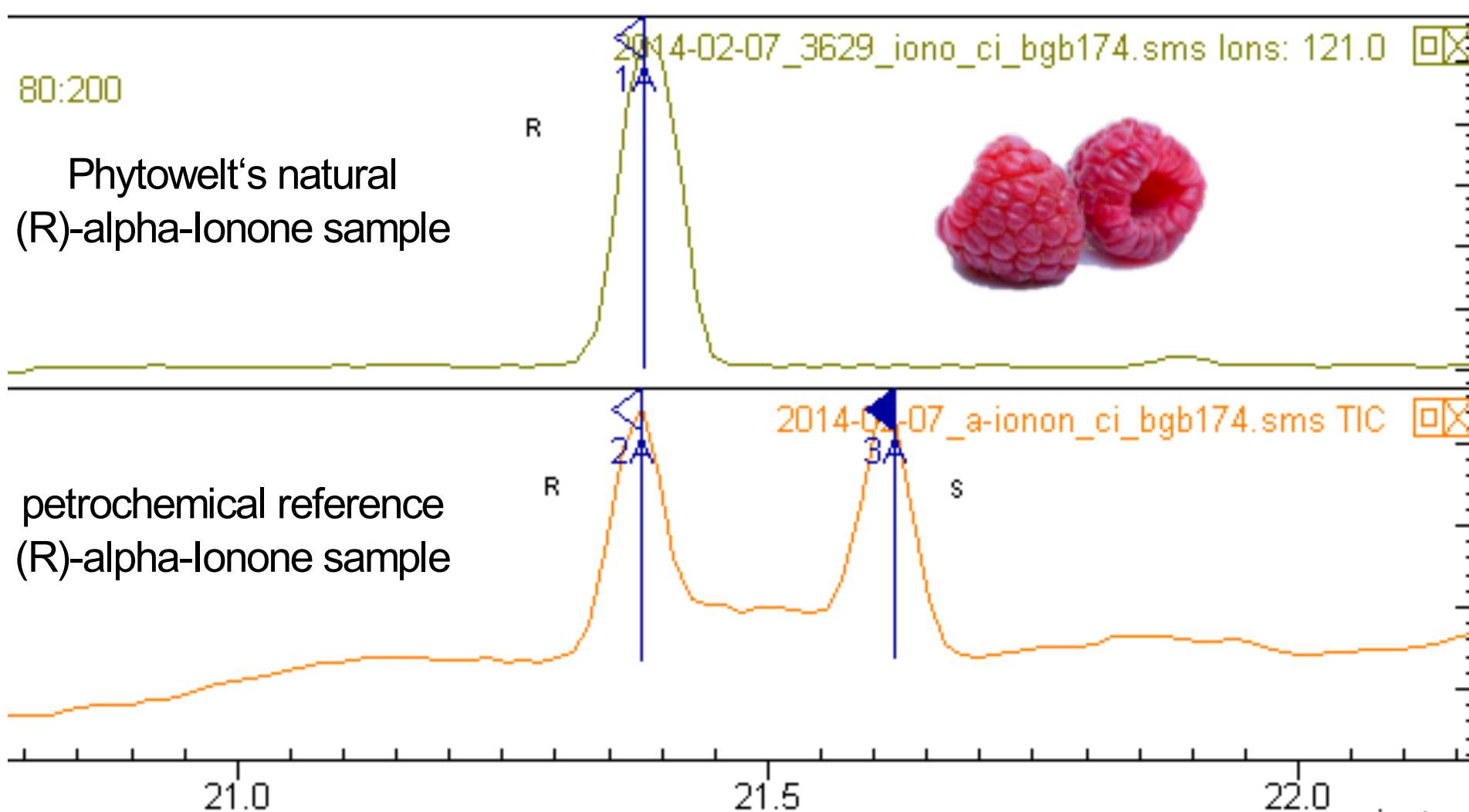




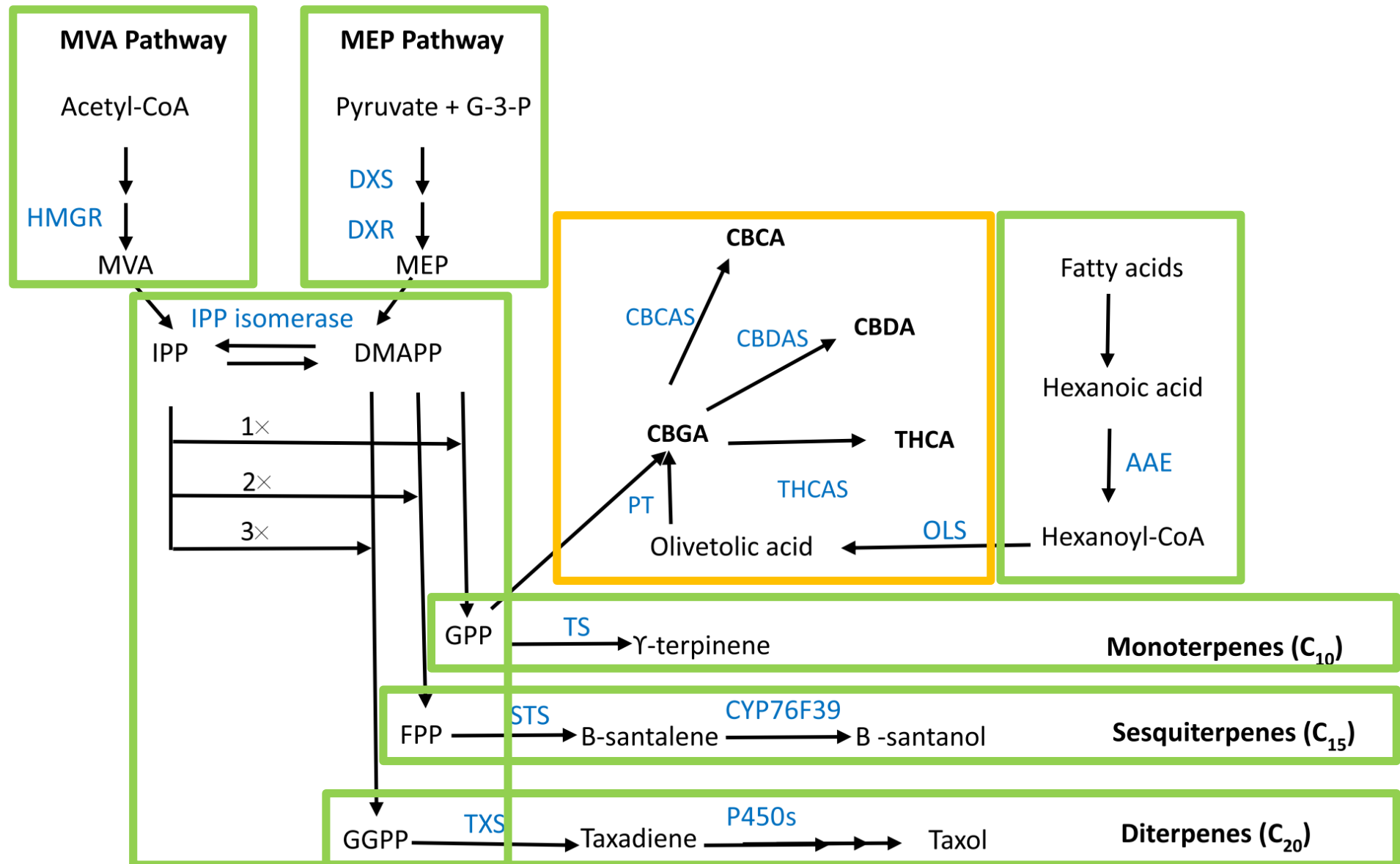
By Yikrazuul - Own work, Public Domain,
<https://commons.wikimedia.org/w/index.php?curid=5951266>



Chiral pure (R)- α -Ionone



Phytowelt's expertise for Cannabis



Grof, 2018



Service Portfolio

phytodiversity

Virus Elimination

Mass Reproduction

Mother Plant Building SEE

Meristem Culture (Rejuvenation)

Acclimatisation of
in-vitro Materials

Consultation

Implementation

Embryo Rescue

Cryopreservation

Protocol development

Mutagenesis

Organogenesis

Protoplast Fusion, Culture
and Plating Techniques

Anther and Microspore Culture

Double haploid breeding

Micrografting

Somatic Embryogenesis

Polyploidisation

Horizontal Genetransfer

Initiation and Cultivation of
Calli and Cell Suspension



Plants we worked with successfully

Poaceae/ Barley, Wheat, Ryegrass

phytodiversity

Salicaceae/ Poplar

Myrtaceae/ Eucalyptus

Hydrangeaceae/
Hydrangea

Laminaceae/ Mint

Violaceae/ Viola

Fabaceae/ Clover

Apiaceae/
Carrot

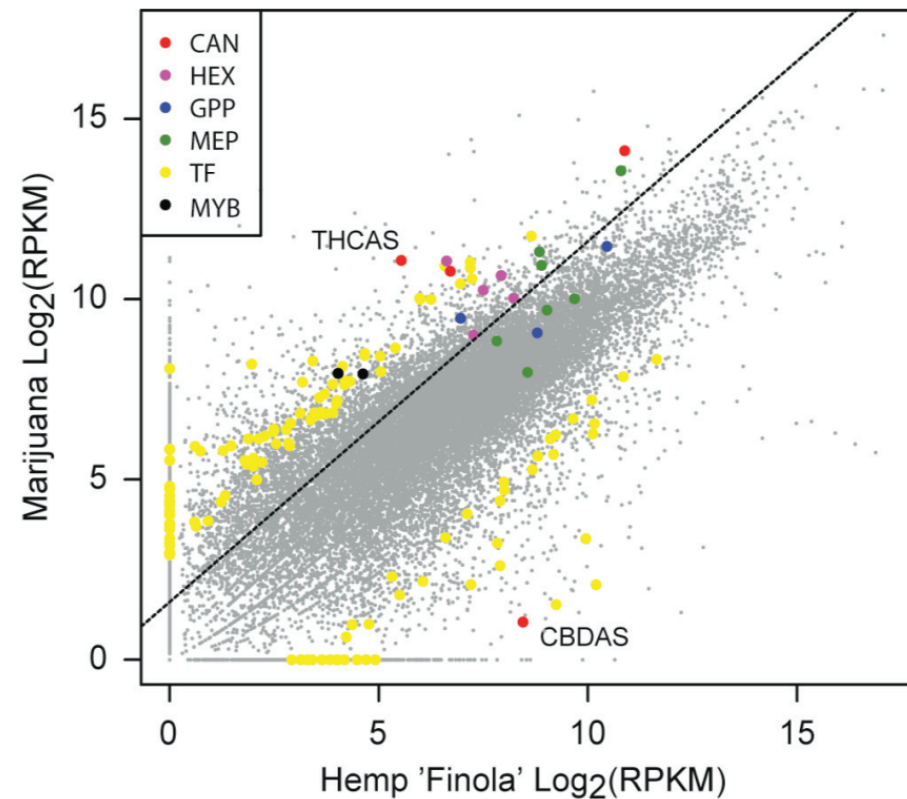
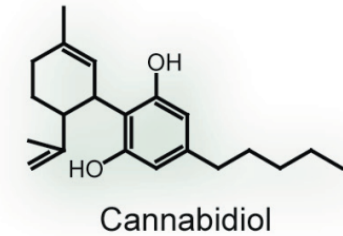
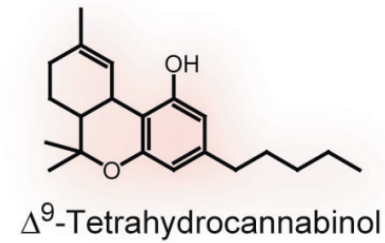
Brassicaceae/
Rapeseed

Solanaceae/
Potato



**More than 40 species
out of 10 families**

Main differences in Cannabis varieties



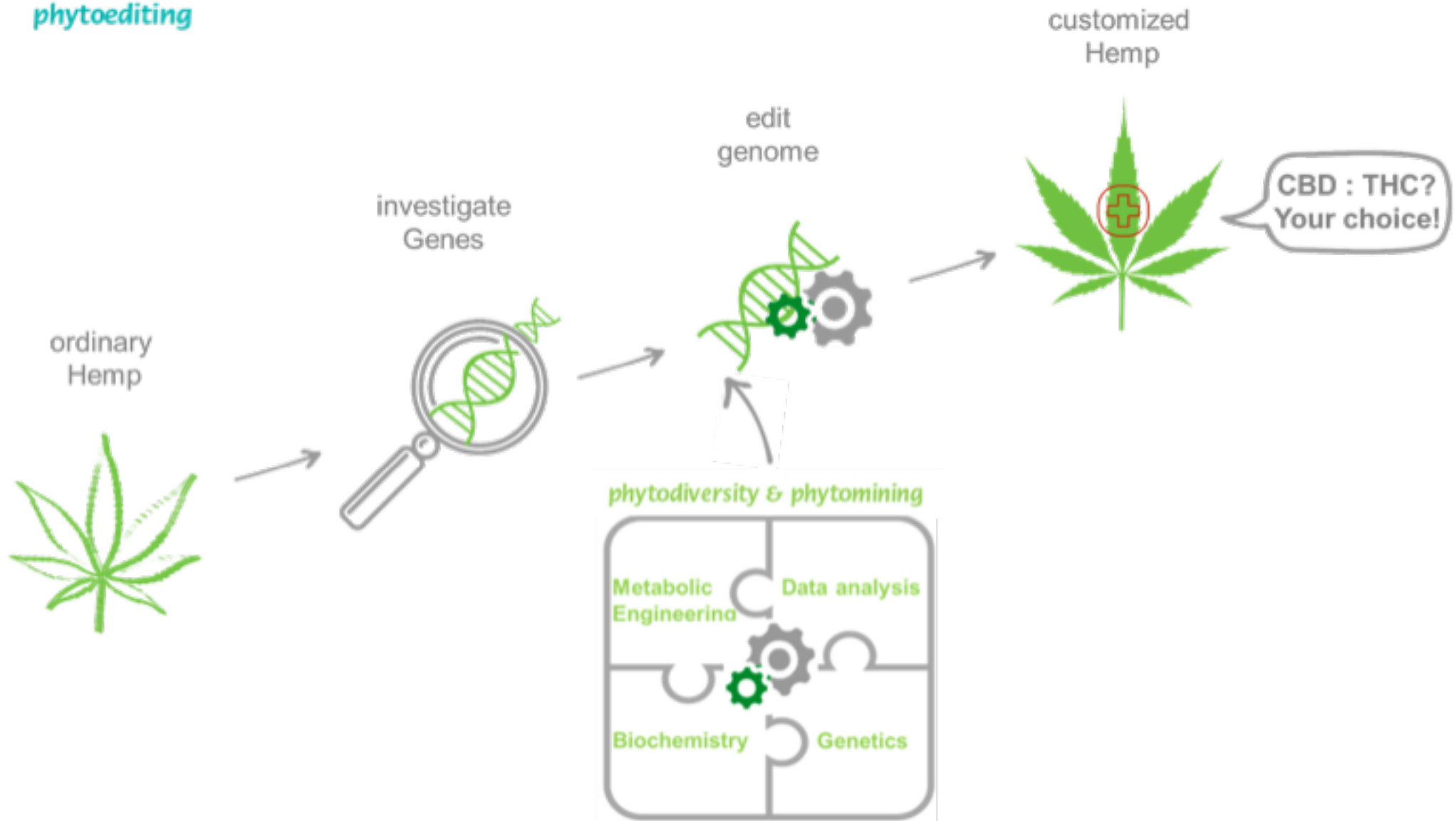


Your desired THC:CBD ratio is not available?



phytoediting

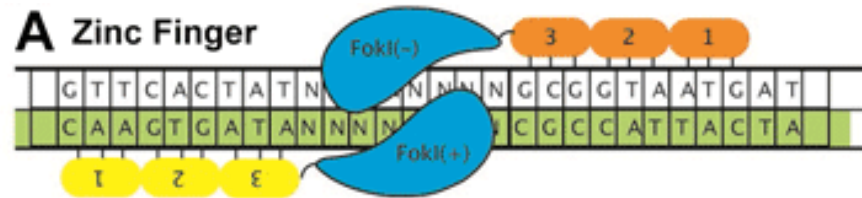
The Solution: Genome Editing



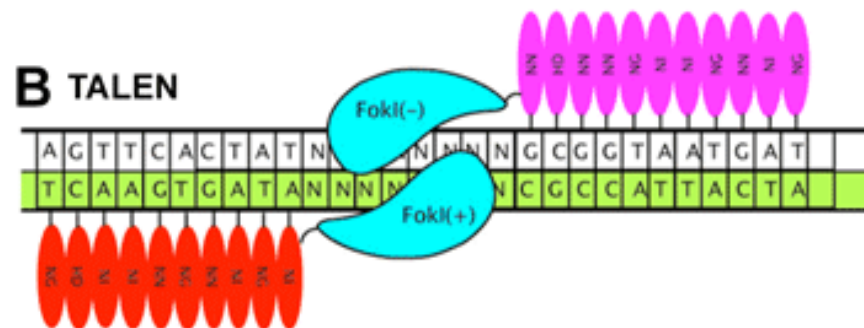


Tools for genome editing/ targeted mutation

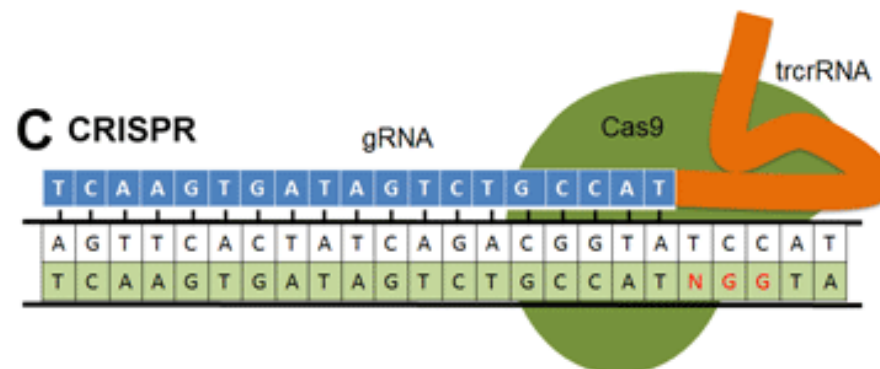
phytoediting



Zink-finger-Nukleases (Znf):



TALEN:
Transcription activator like
effector nuclease



CRISPR/Cas9:
Clustered regulatory interspaced
short palindromic repeats



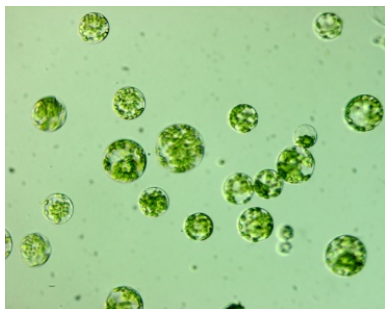
phytoediting

Example: TALEN approach (Potato)

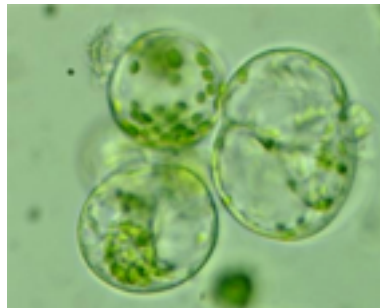


phytowelt
GreenTechnologies GmbH

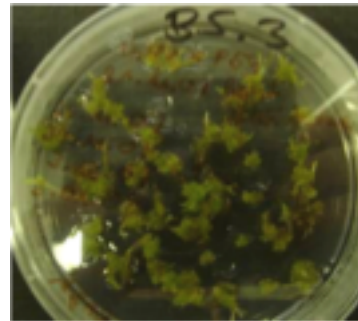
Transient TALE-
Expression
TALE-uptake



Isolated protoplasts



Cell division



Shoot-Induction



Root-Induction

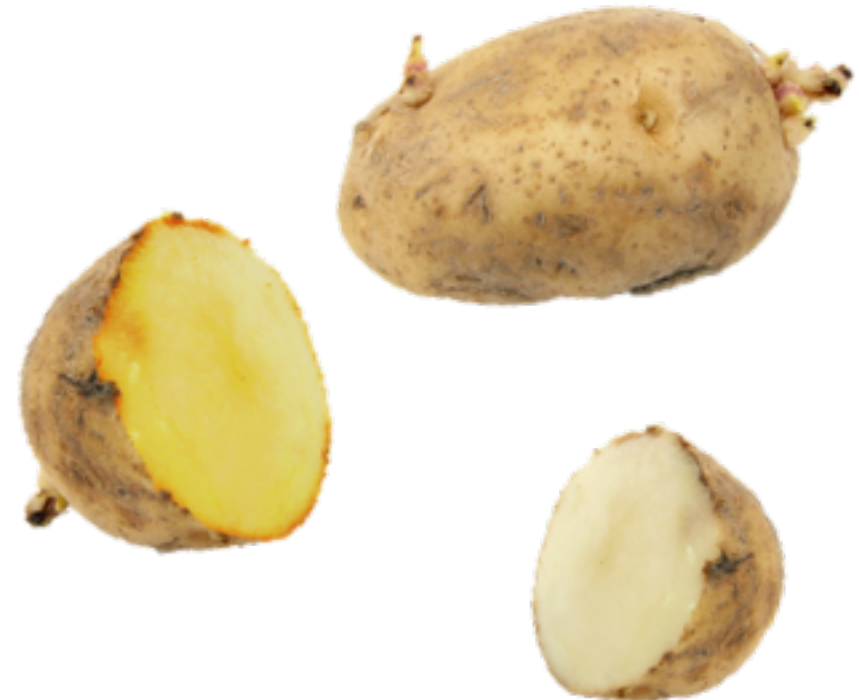
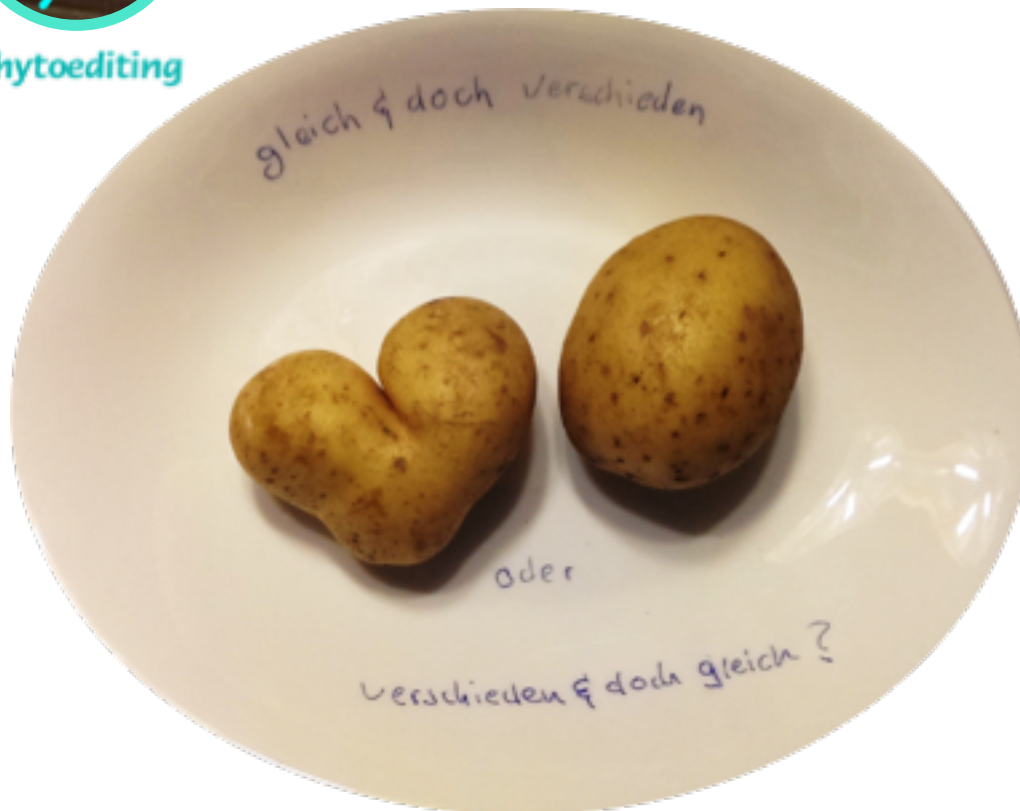


New variety



phytoediting

Example: TALEN approach (Potato)



Target-Sequenz of TALEN Heterodimers

ZEP2 allele prod	165	cgtggacttcccgtagacaagagtc	catcagccgcgcatgactttgcagcagatc	ccttgccgctgctgttggggaggata	caattatgaatgaaagtaa
pGJ2720-ZEP1	392	cgtggacttcccgtagacaagagtc	catcagccgcgcatgactttgcagcagatc	ccttgccgctgctgttggggaggata	caattatgaatgaaagtaa
PGJ2720:ZEP2	153	cgtggacttcccgtagacaagagtc	catcagccgcgcatgactttgcagcagatc	ccttgccgctgctgttggggaggata	caattatgaatgaaagtaa
Mini13 C9-pE	976	cgtggacttcccgtagacaagagtc	catcagccgcgcatgactttgcagc	ttggggaggata	caattatgaatgaaagtaa
Mini13 C9-RP	228	cgtggacttcccgtagacaagagtc	catcagccgcgcatgactttgcagc	ttggggaggata	caattatgaatgaaagtaa
Mini1 C7-pE	994	cgtggacttcccgtagacaagagtc	catcagccgcgcatgactttgcagcagatc	ccttgccgctgctgttggggaggata	caattatgaatgaaagtaa
Mini1 C7-RP	226	cgtggacttcccgtagacaagagtc	catcagccgcgcatgactttgcagcagatc	ccttgccgctgctgttggggaggata	caattatgaatgaaagtaa

16 Bp Deletion in zep2



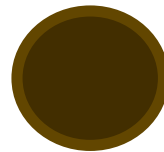
Somatic Hybridization

phytodiversity



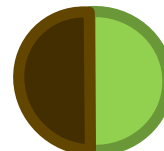
Cell 1

Protoplast fusion
of cells with various
desired properties



Cell 2

Beneficial Crop Plant



Hybrid





Example: Higher yield (Poplar)

phytodiversity

Line	trunk circumference (cm above the ground)				mean values	
	2,5 year old		4 year old		height cm 4 year old	weight kg 4 year old
	20cm	130 cm	20cm	130 cm		
P10 control	11,7	8,2	24,8	13,2	450	8,4
P10xP31 81.1 (Helga Ninnemann)	28,4	13,5	39,5	24	658	17,9
P10xP31 92-1 (Johann Welters)	29,5	19,3	36	23,4	650	17,9

Phytowelt's varieties { P10
P10xP31 81.1
P10xP31 92.1



Summary

- ✓ Design your own unique, exclusive hemp variety:
 - ✓ address changing market demands
 - ✓ giving you a competitive edge
- ✓ Choose e.g. only CBD:
 - ✓ Superfood
 - ✓ Medication
- ✓ No legal issues
- ✓ Higher purity
- ✓ Reliability: **controlled CBD/THC ratio** compared to natural hemp varieties

phytowelt - products by **phytoinspiration**



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