
Introducing
DutchTrig®

Robert Prins

- Senior adviser Disease & Pest Management, *idverde Bomendienst*
- DutchTrig NL/DLD project manager
- EAC European Tree Technician (ETT)

OUR PARTNERS

- **Production** of DutchTrig by Wageningen University & Research
- **Quality control** by University of Amsterdam

WAGENINGEN
UNIVERSITY & RESEARCH

UNIVERSITY
OF AMSTERDAM

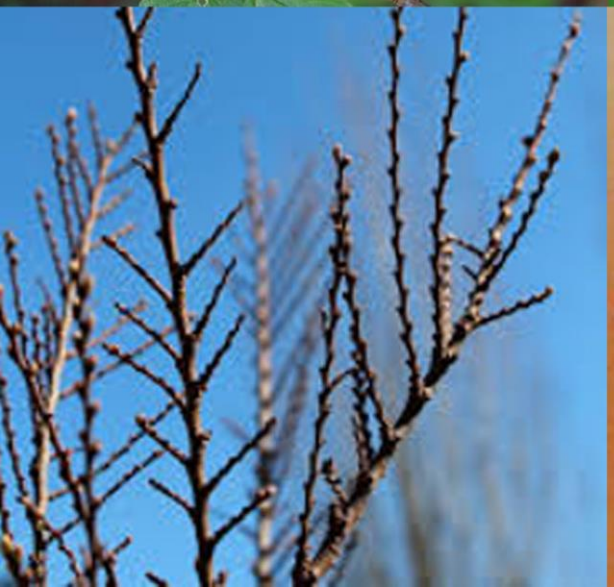
TODAY

Dutch Elm Disease

- History
- Characteristics and lifecycle

Solution

- Strategy & trials
- Vaccination
- Research and results
- Experiences worldwide



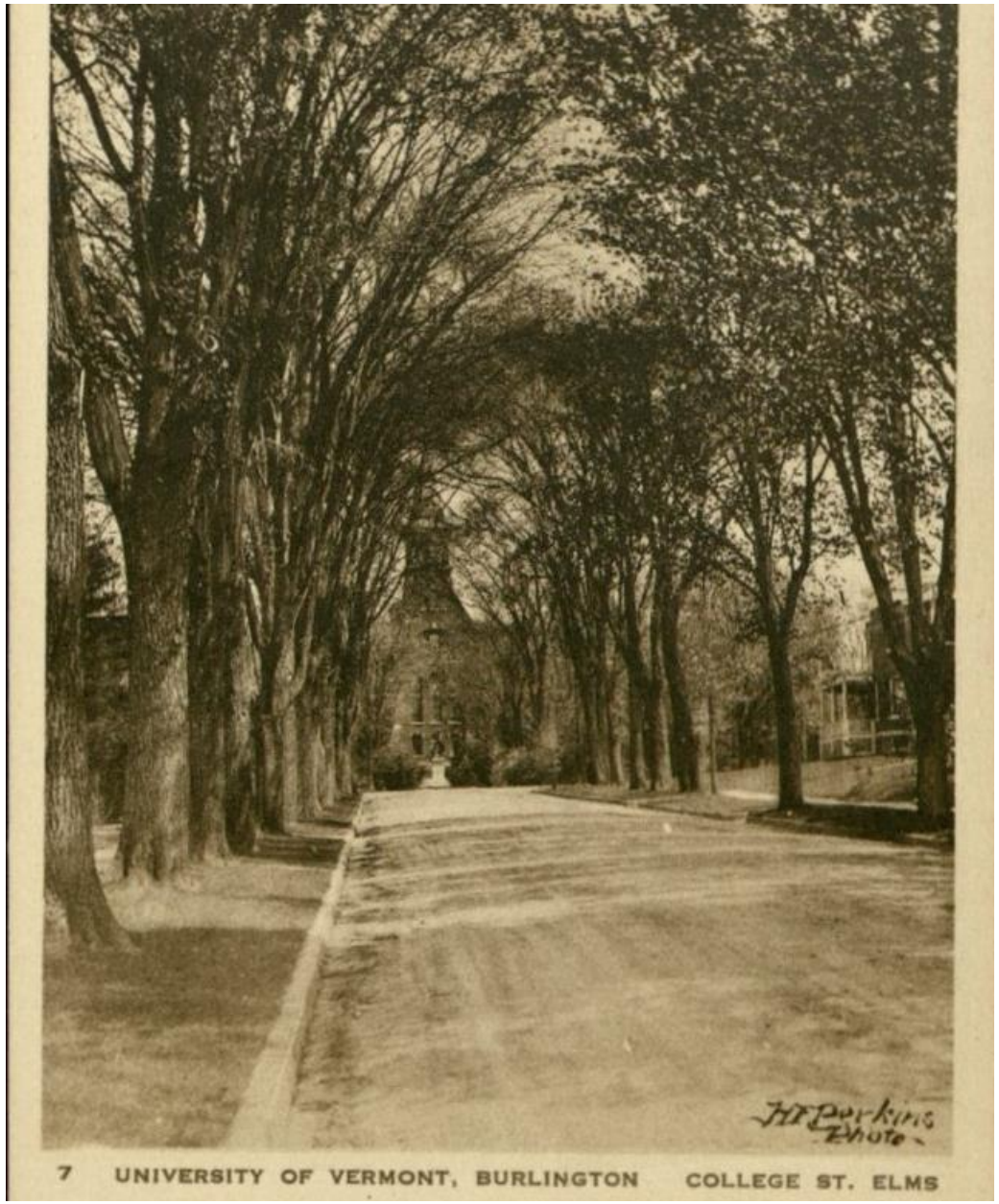
CHARACTERISTICS OF THE ELM

- Skewed leaf base
- Vase-shaped tree
- Characteristic seeds
- Young elm, opposite standing branches
- Older elm, scattered standing branches

HISTORY OF DUTCH ELM DISEASE

Elms in Salem, Massachusetts. *Source: New England historical society*

HISTORY OF PLANTING ELMS



Burlington, USA. Planted in 1876

Amsterdam ca. 1715

Source: Universität München, Lehrstuhl für Forstbotanik

DUTCH ELM DISEASE

- 1910: 1st Epidemic between river Seine (France) and Dutch province Noord-Brabant
- By 1930: 421.000 elms (34 %) died in Netherlands
- In Europa: 10-40 %
- 1970-1980: Ophiostoma novo-ulmi

DUTCH ELM DISEASE

- Became the most devastating tree disease ever

DUTCH ELM DISEASE

- Himalayan origin (not Dutch..)
- 1919-1921: Marie Beatrice Schwarz and Christine Buisman discover and identify fungi Ophiostoma ulmi as the reason for dying elms

Christine Buisman. *Source: www.wikipedia.nl*

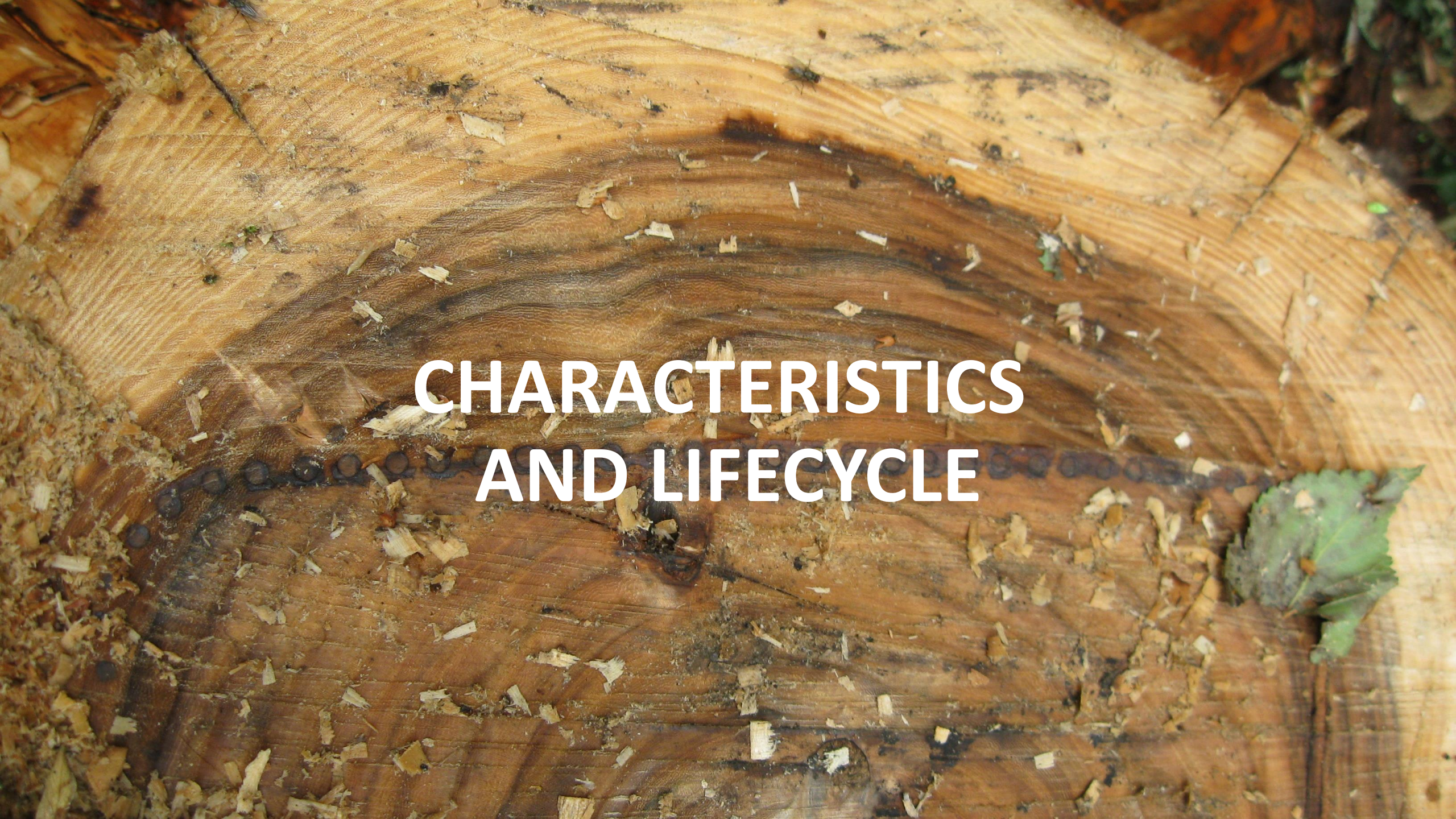
IEP NAAR CHRISTINE BUISMAN GENOEMD.

Het Iepziekte Comité heeft besloten, ter eere van de nagedachtenis van dr Christine Buisman, die zoo uitnemend werk heeft verricht bij het onderzoek naar de oorzaak en de bestrijding van de iepziekte en die daarbij een tegen deze ziekte in hooge mate resistente iep heeft gevonden, welke tot nu toe als Iep no. 24 werd aangeduid, deze belangrijke aanwinst voortaan den naam te geven van „Iep Christine Buisman".

Aan allen, die deze iep in catalogi, geschriften of correspondentie noemen, wordt daarom verzocht, voortaan dezen naam te gebruiken.

Source: WUR eDepot

Picture: M.F. Brown and H.G. Brotzman



CHARACTERISTICS AND LIFECYCLE

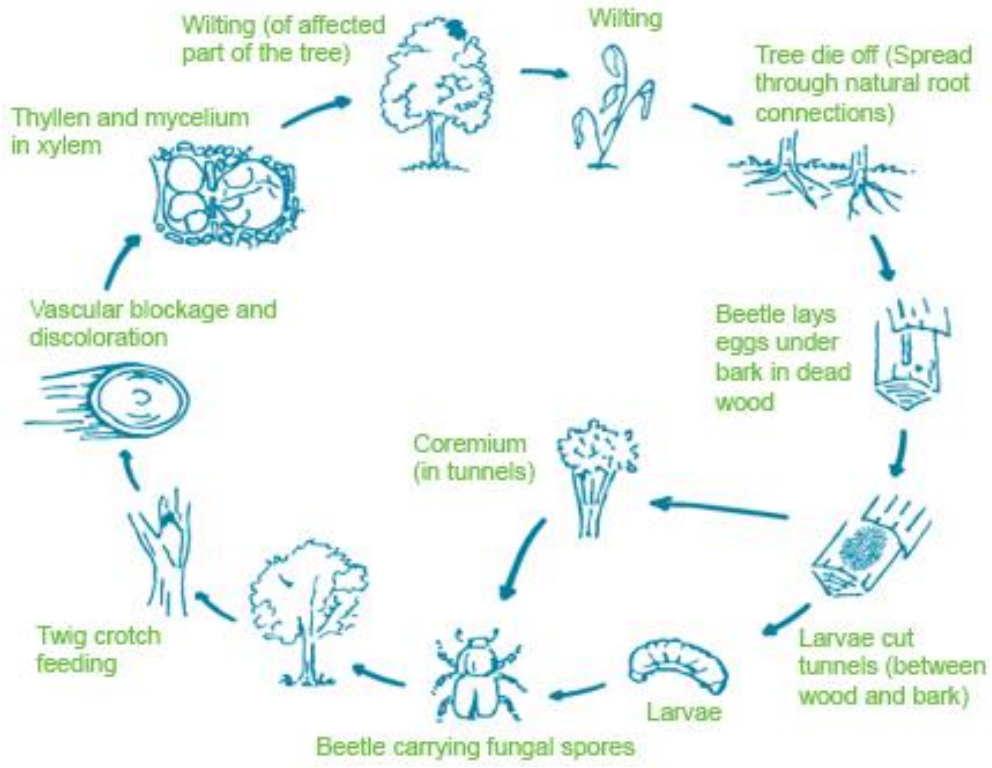
CHARACTERISTICS

- Upon infection, the tree's natural defense systems compartmentalize the growing fungus by sealing off infected vascular bundles with thyllae
- Unfortunately, the fast-spreading fungus causes the tree to over-produce these blockages, effectively choking off transport of water and nutrients

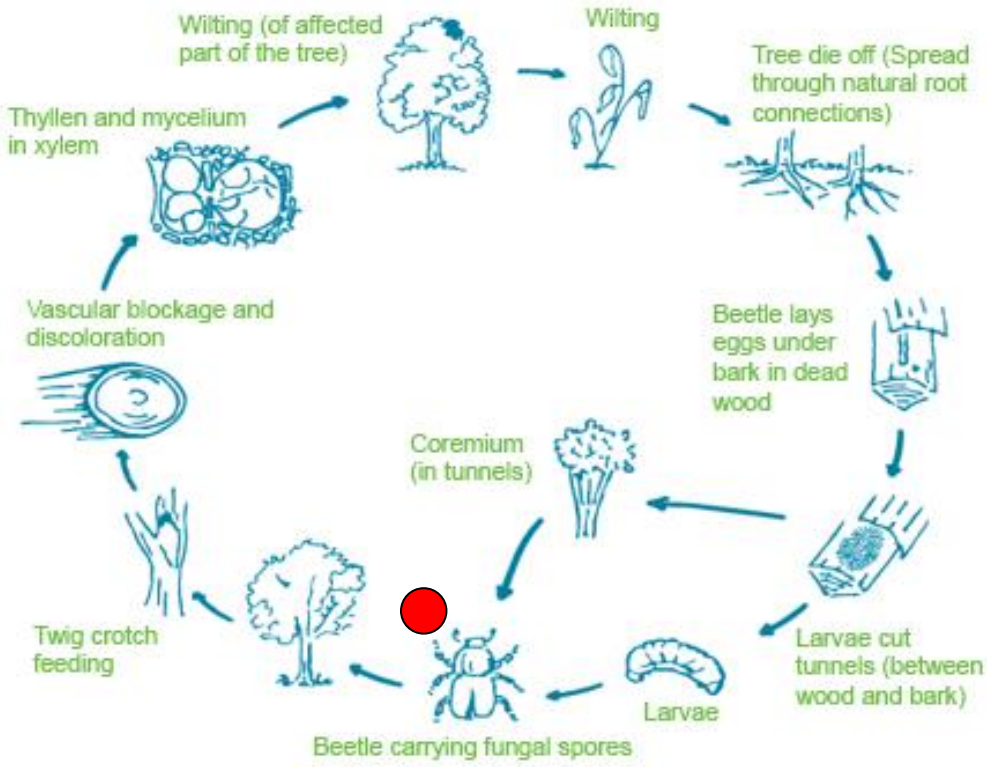
Ophiostoma novo-ulmi is a fungal infection of the vascular tissues of elm

Characteristics DED

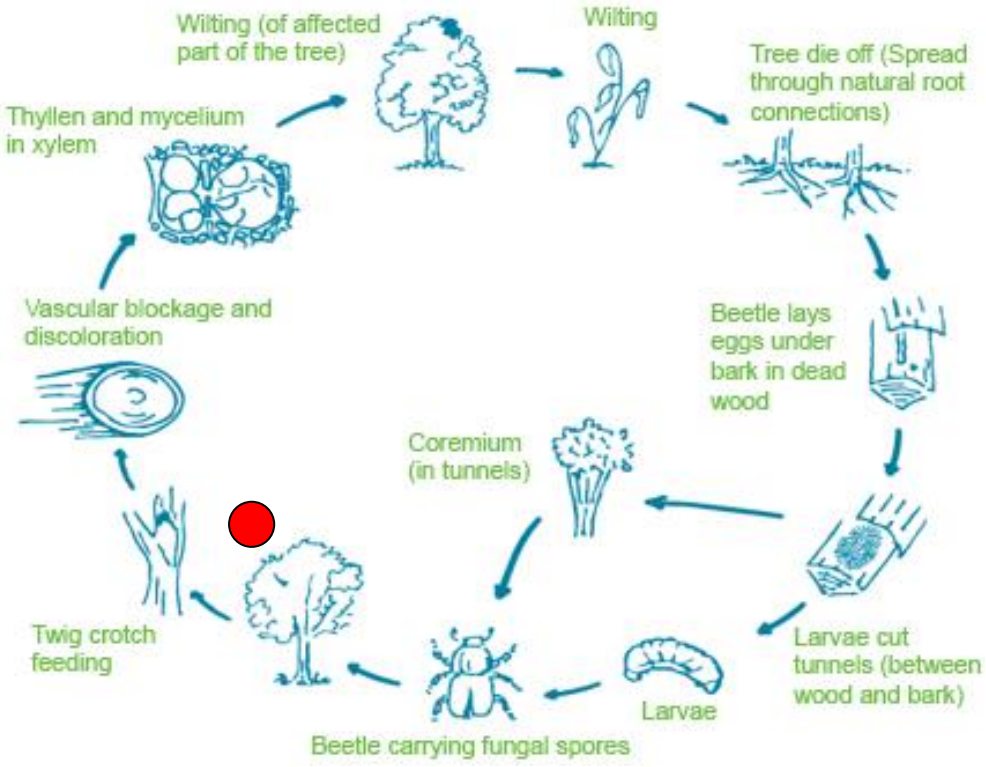
DED LIFECYCLE



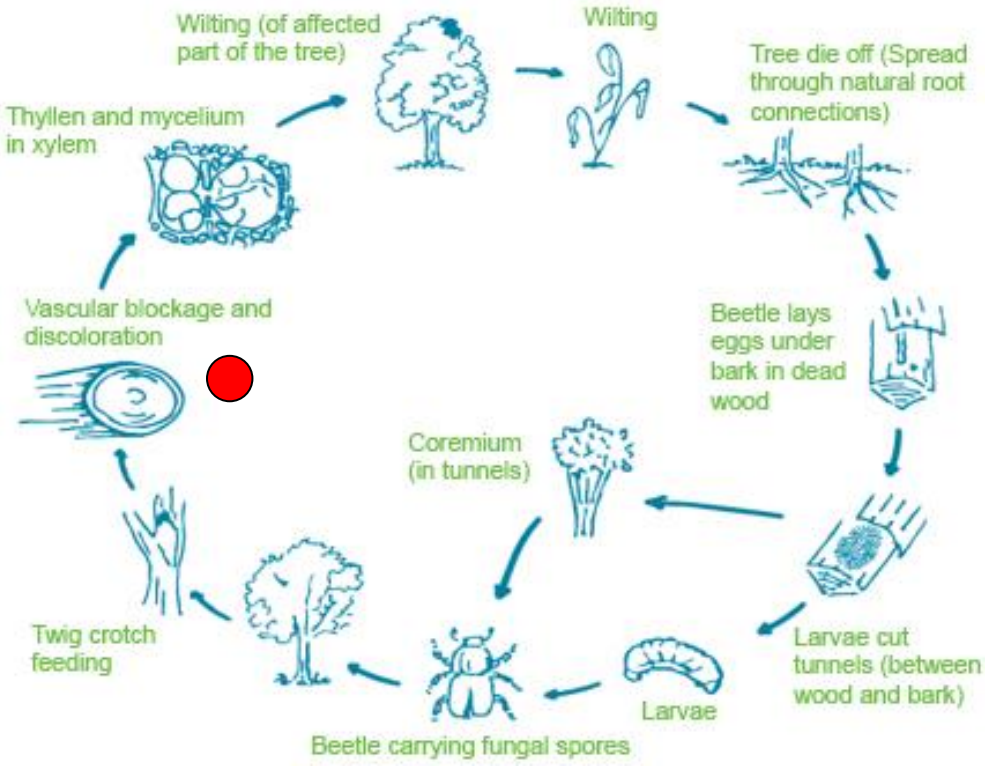
DED LIFECYCLE
Beetle



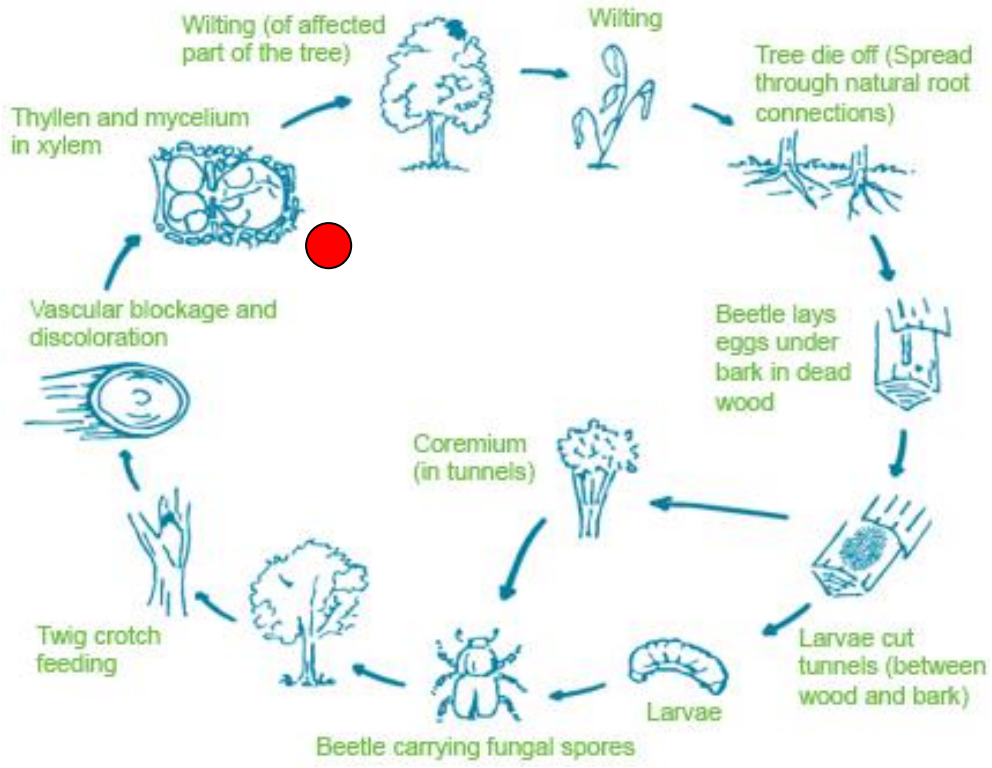
DED LIFECYCLE
Beetle

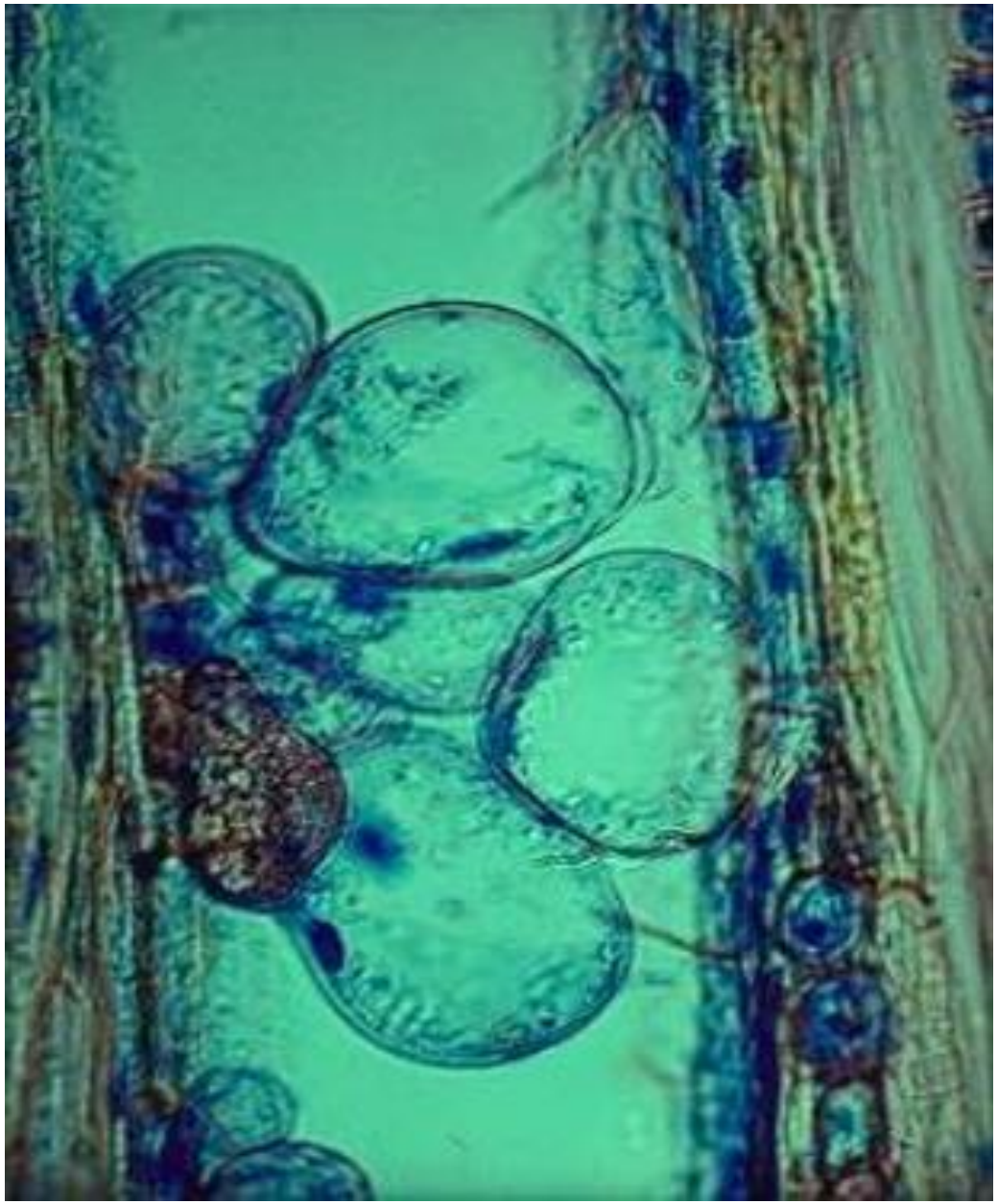


DED LIFECYCLE
Vascular damage

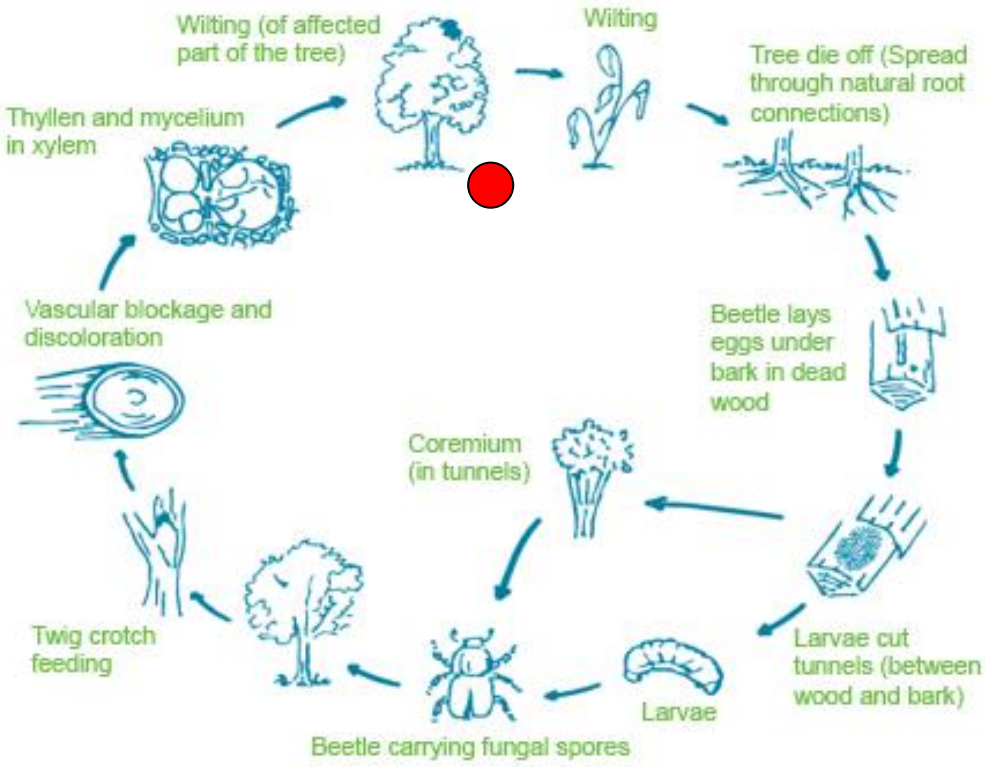


DED LIFECYCLE
Cel level damage

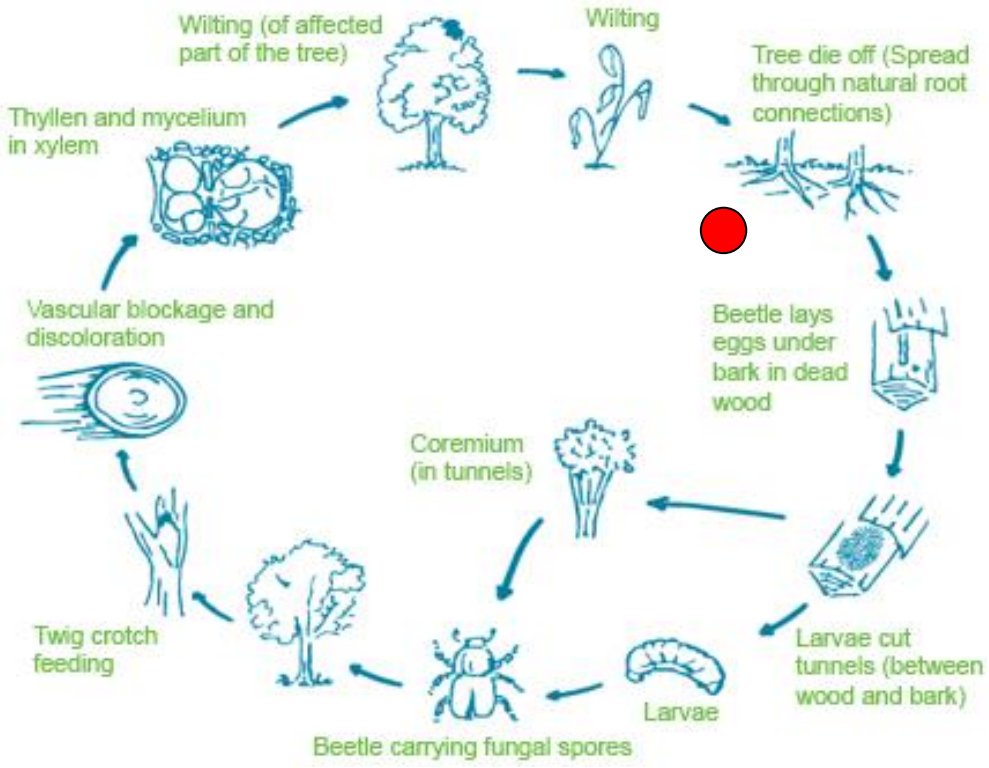


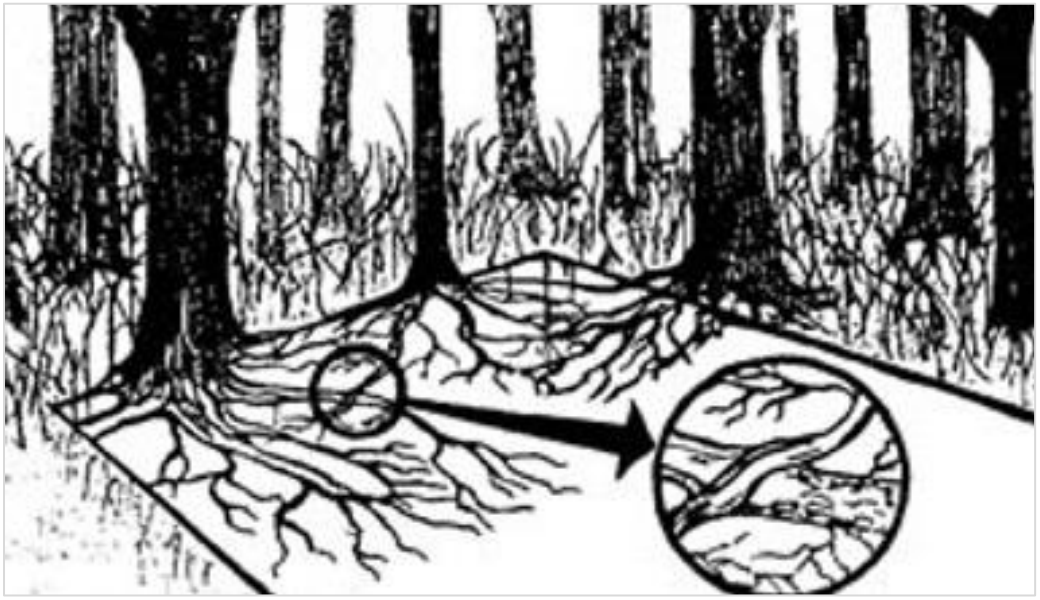


DED LIFECYCLE
Wilting

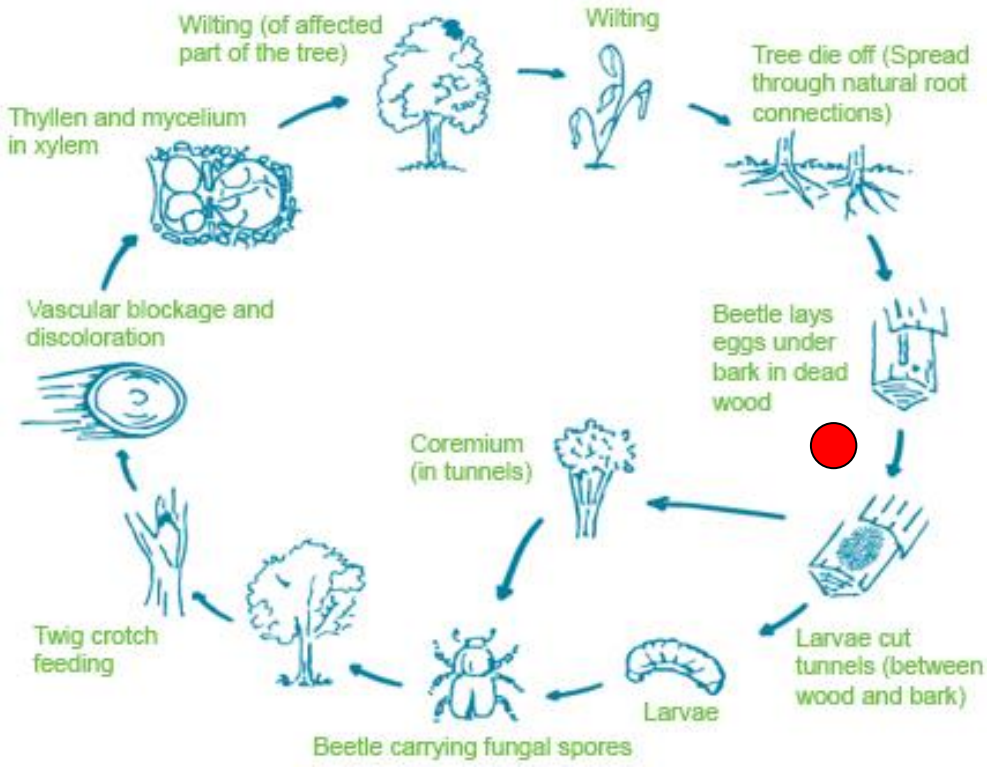


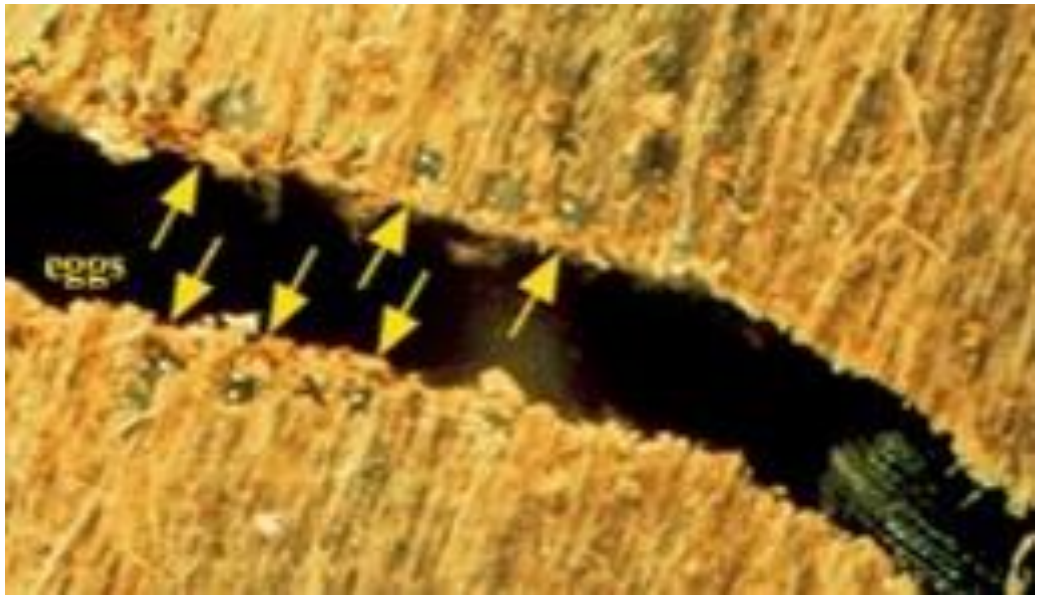
DED LIFECYCLE
Spread by root contact



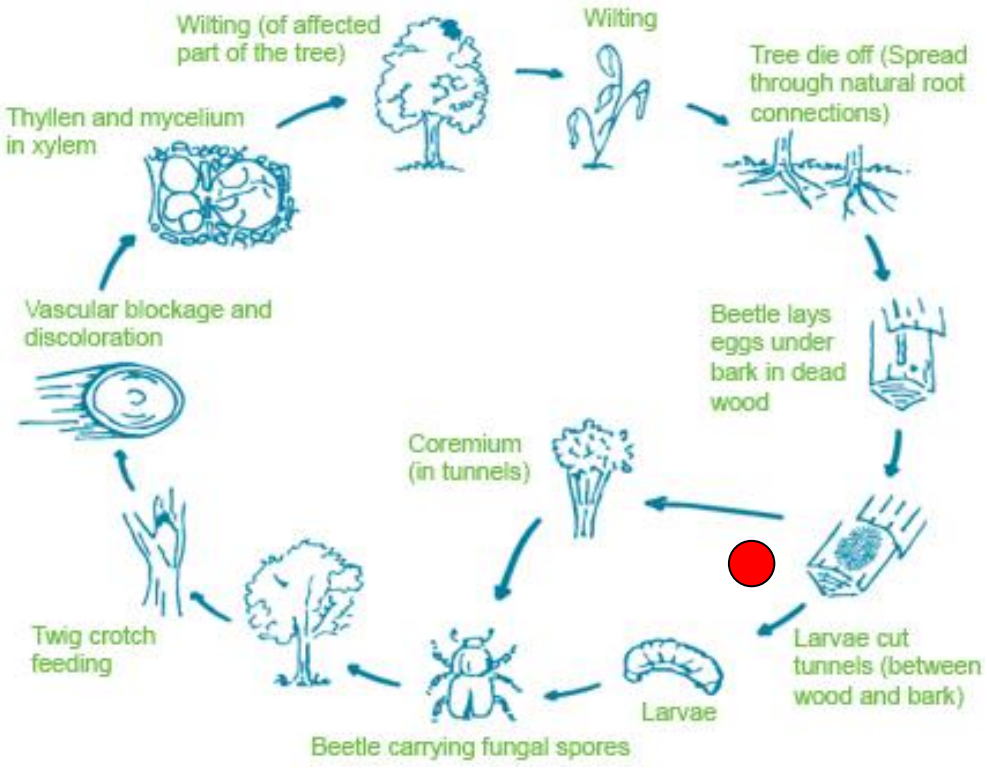


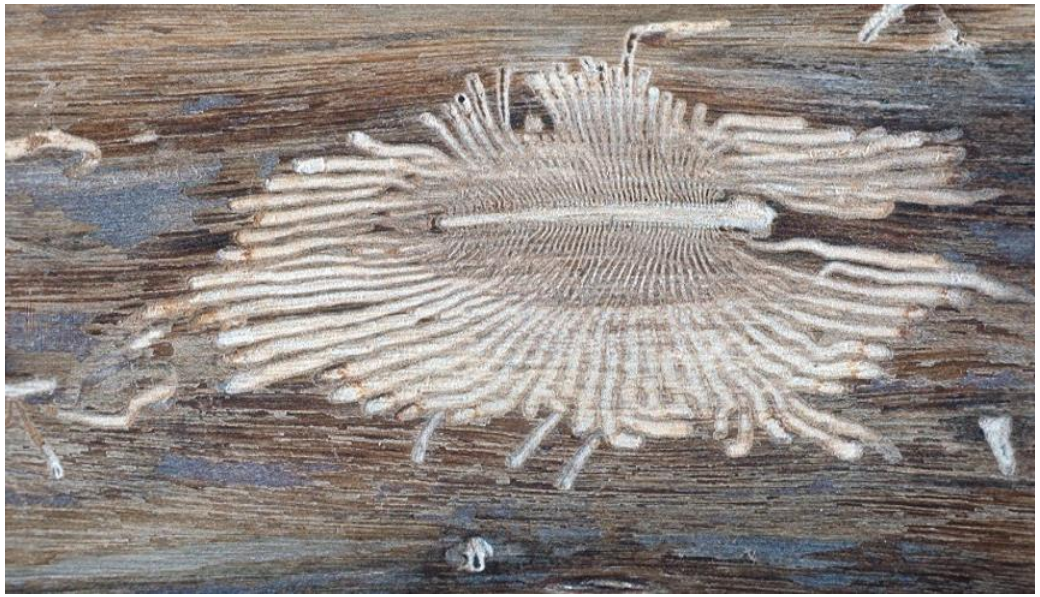
DED LIFECYCLE
Eggs under bark



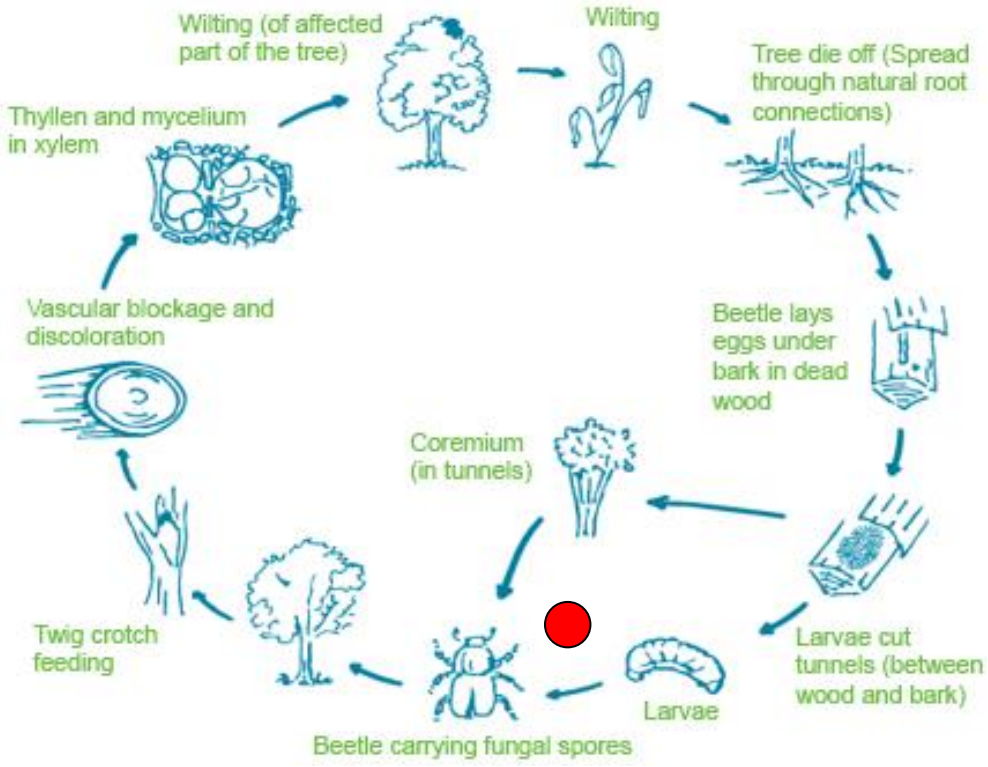


DED LIFECYCLE
Corridors under bark





DED LIFECYCLE
Larva



ANY OPTIONS?

- **Long term**
  New, more resistant Elms

- **Option for current trees**
  Saving trees and their ecosystem services/values

ECOSYSTEM SERVICES OF ONE ELM TREE

- Carbon seuestrated: 2.422 kg
- Carbon capture: 62 kg/year
- Avoided waterflow: 500L/year
- Oxygen production: 45kg/year
- Particulate matter/fine dust: 225 g/year

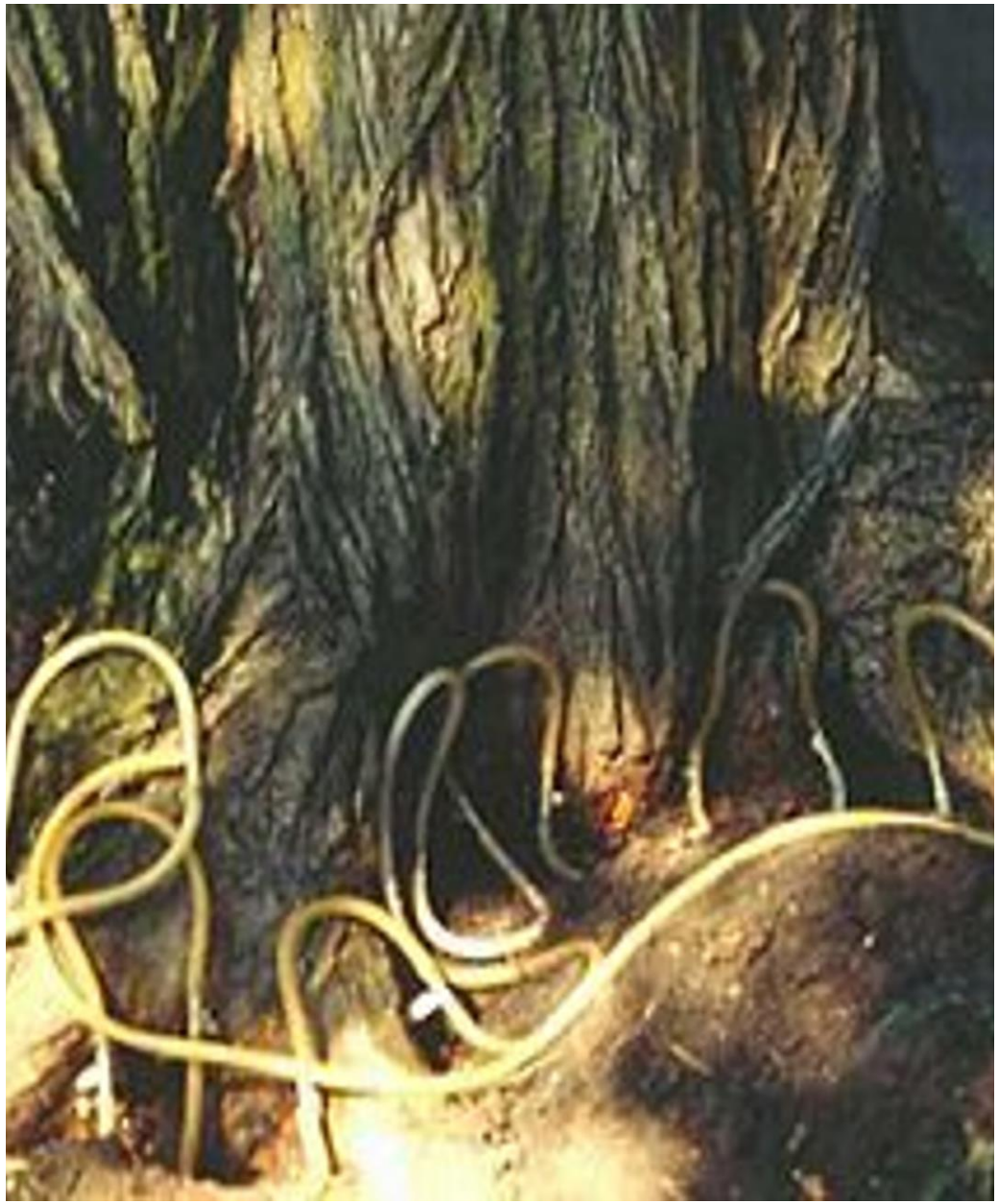

SAVING CURRENT TREES
TRIALS

WHAT HAS BEEN DONE?

- 1930-1940 Royal order
- National program
- 1969: Alarming messages from UK
- New catastrophy in 70‘s
- Ending of programm (€)
- University Amsterdam (and Utrecht)

WHAT HAS BEEN DONE WORLDWIDE?

- DED has long been thought to be virtually unstoppable and unpreventable
- Variable and costly experiments in treatment have included
  - Root zone chemical macroinjection
  - Spraying
  - Sanitation
  - Etc.



WHAT HAS BEEN DONE WORLDWIDE?

- Options? Aside from letting it run its course!
- Chemical fungicide ‘life-support’ combined with heavy sanitation
- These options were costly, chemical-intensive and variable


VACCINATION

AIM OF VACCINATION

- **Prevent** elms from dying
- **Eliminate** use of chemicals
- **Limit** damage of trees
- **Treat** large numbers of elms

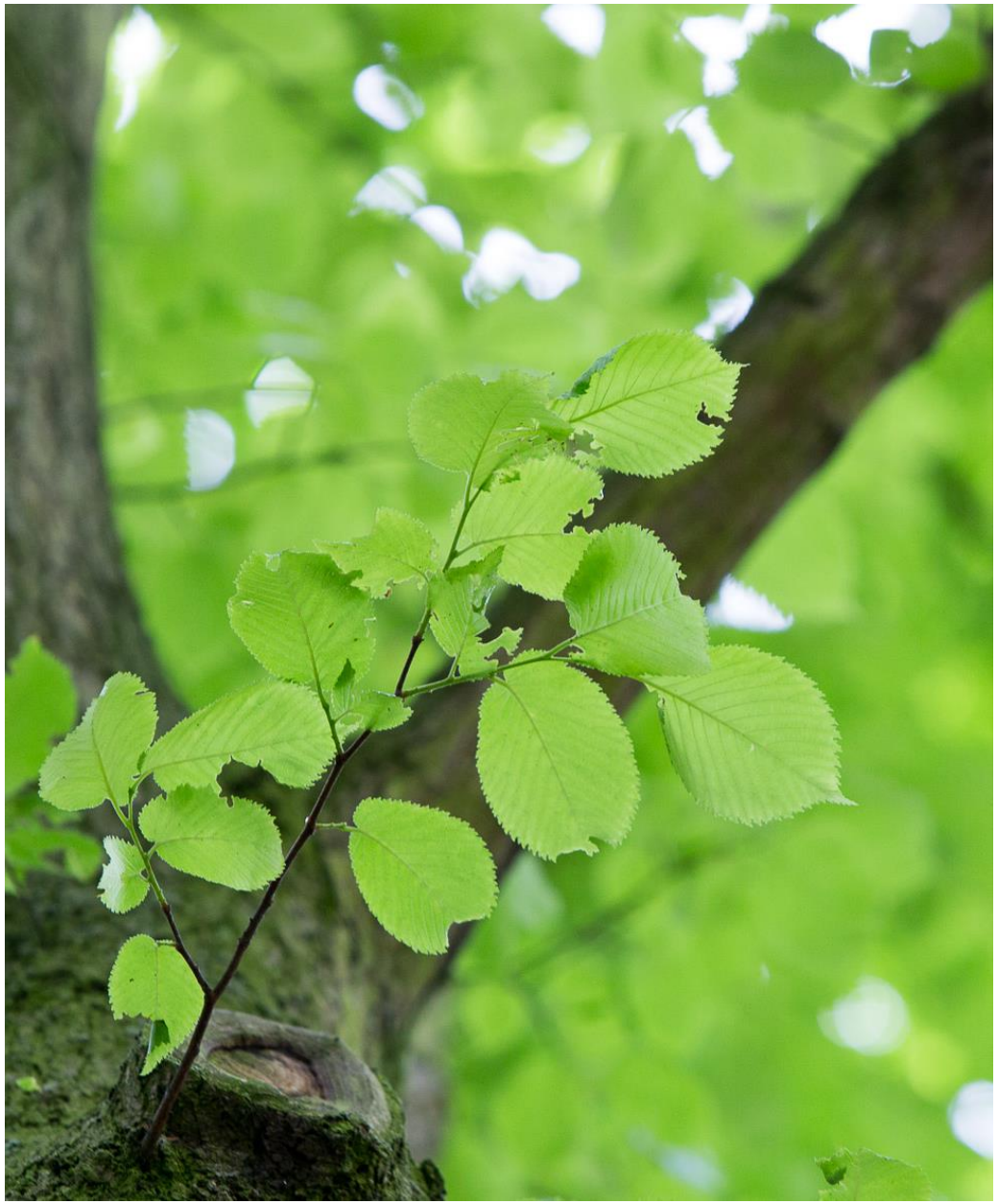
BACKGROUND

- Biological control
- As early as 1933, Chester claimed that “the fact of acquired immunity by plant vaccination has been satisfactorily proved”
- He used the term “vaccination” to include various methods of biological plant therapy
- Possibility to vaccinate elms was discovered in 1980. However only with Ophiostoma ulmi
- What about **O. novo-ulmi**?

Source: Health Magazine

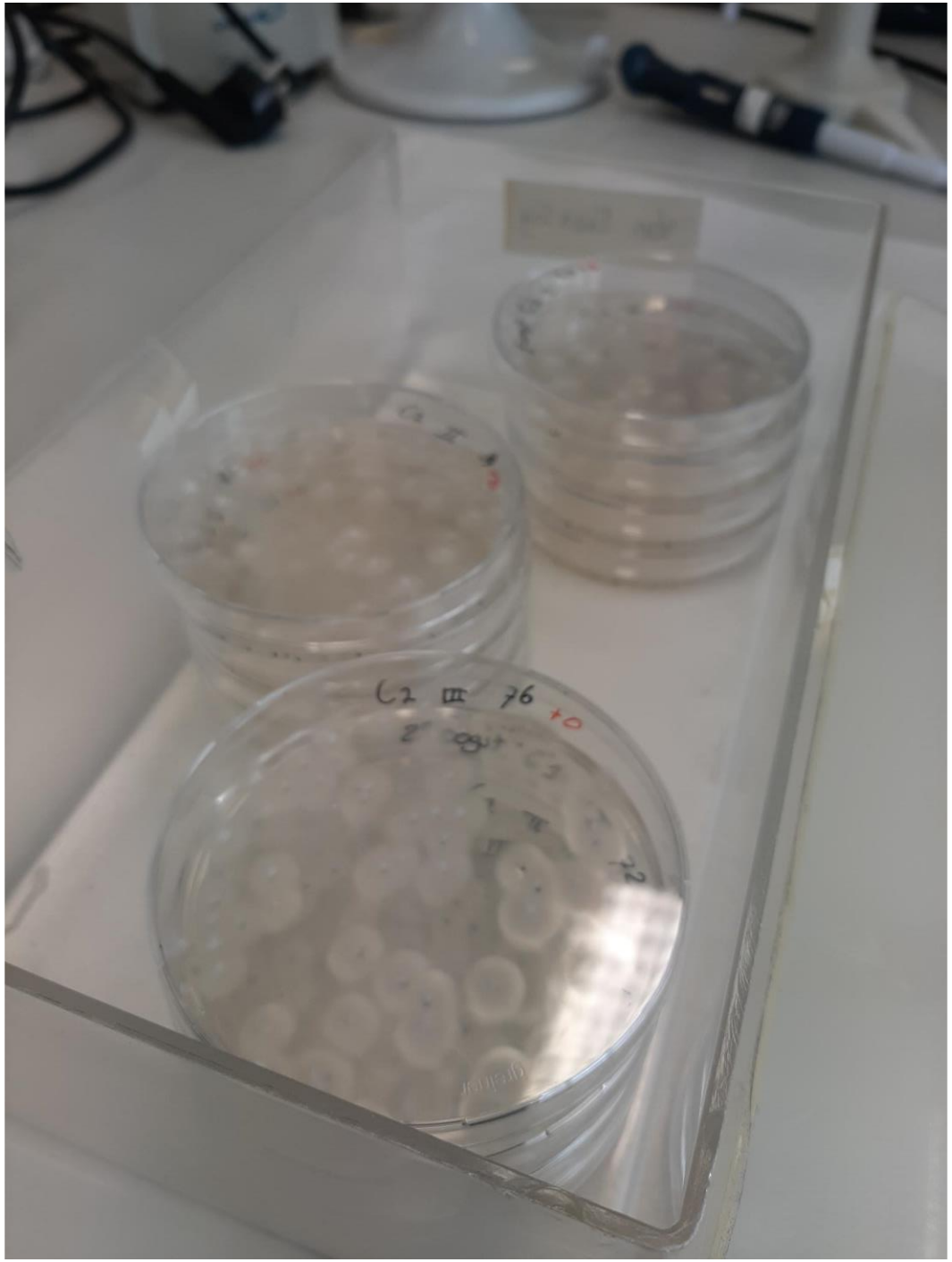
FIRST TRAIL

- Antagonists led to believe it was “induction in the host” challenge inoculation with a strain of the pathogen with low virulence
- Verticillium isolate proved to effectively suppress disease development in both Commelin elms and susceptible field elms



VERTICILLIUM?

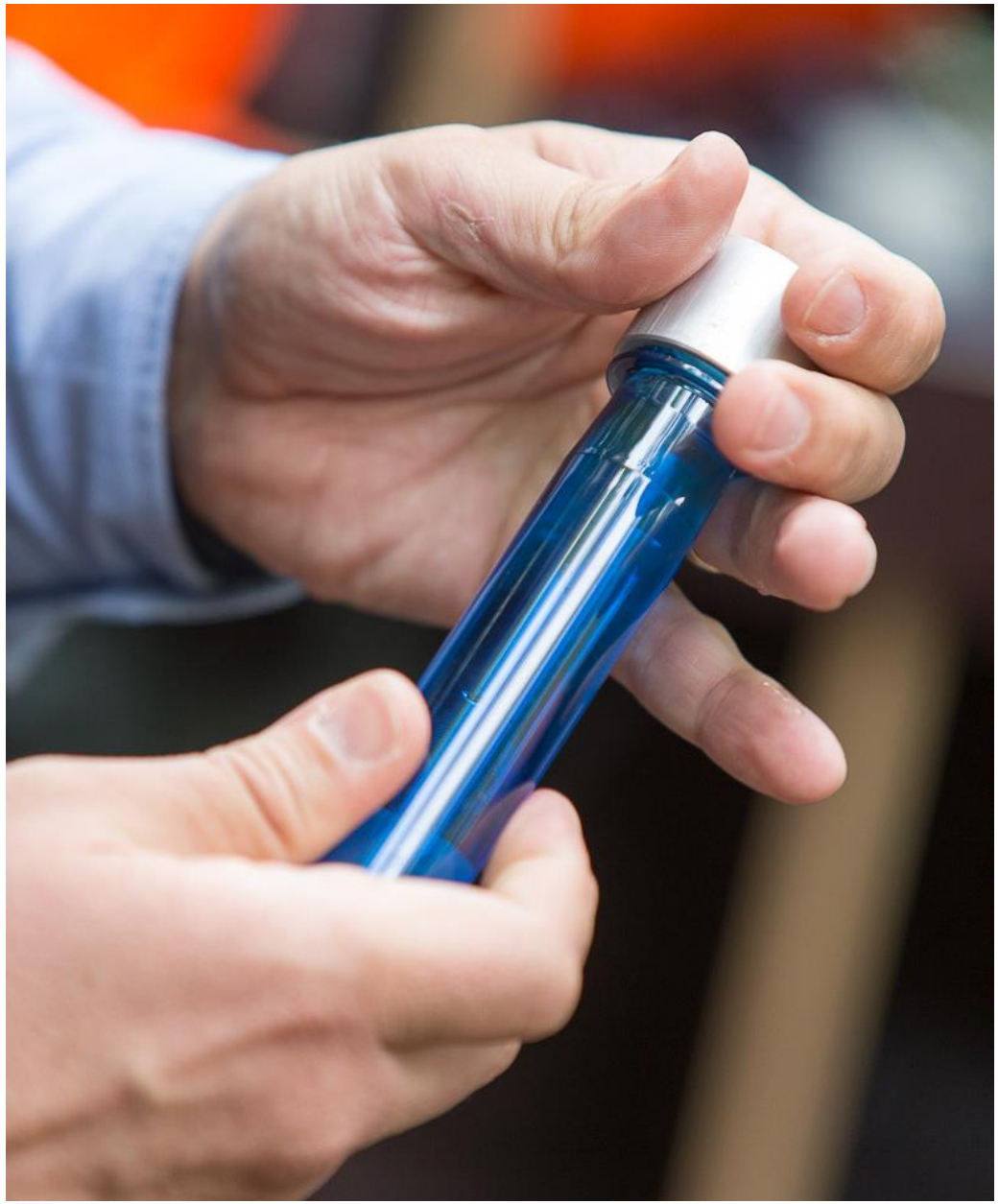
- Verticillium is known to be a vascular wilt disease
- Verticillium isolate: WCS850
  - Common soil organism
  - White (hyaline) variant of Verticillium
- Suspension of conidiospores
- Produced by Wageningen University (WUR)



DUTCHTRIG®

HISTORY DUTCHTRIG

- 1980: Biological control using bacteria
- 1989: Disc. preventative effect Verticillium
- 1991: Injection tool and field testing
- 1992: Registration CTB in The Netherlands
- 1995: USA (reg. 2005)
- 2006: Germany (reg. 2008)
- 2008: Canada (reg.2009)
- 2008: Sweden (reg. 2010)
- 2014: UK (reg. 2016)
- 2016: Norway & Denmark (reg. 2017)
- 2021: New Zealand



HOW DOES IT WORK?

- Upon injection, the vaccine induces (by germinating spores) an immune response from the elm, (known as **induced resistance**), enabling the tree to successfully fend off Dutch Elm Disease with nothing more than its own natural mechanisms, without blocking its own vascular system

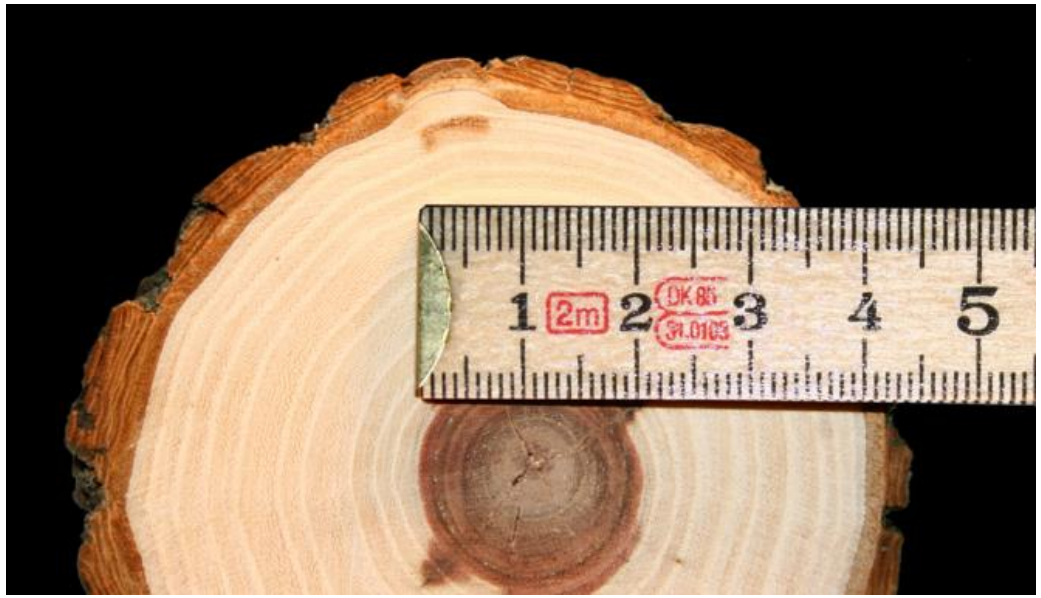
WHEN IS DUTCHTRIG EFFECTIVE?

Effectiveness DutchTrig

- With healthy elms
- With an annual on time(!) application

What endangers the effectiveness?

- Rootgrafts with infected trees
- Injecting infected trees

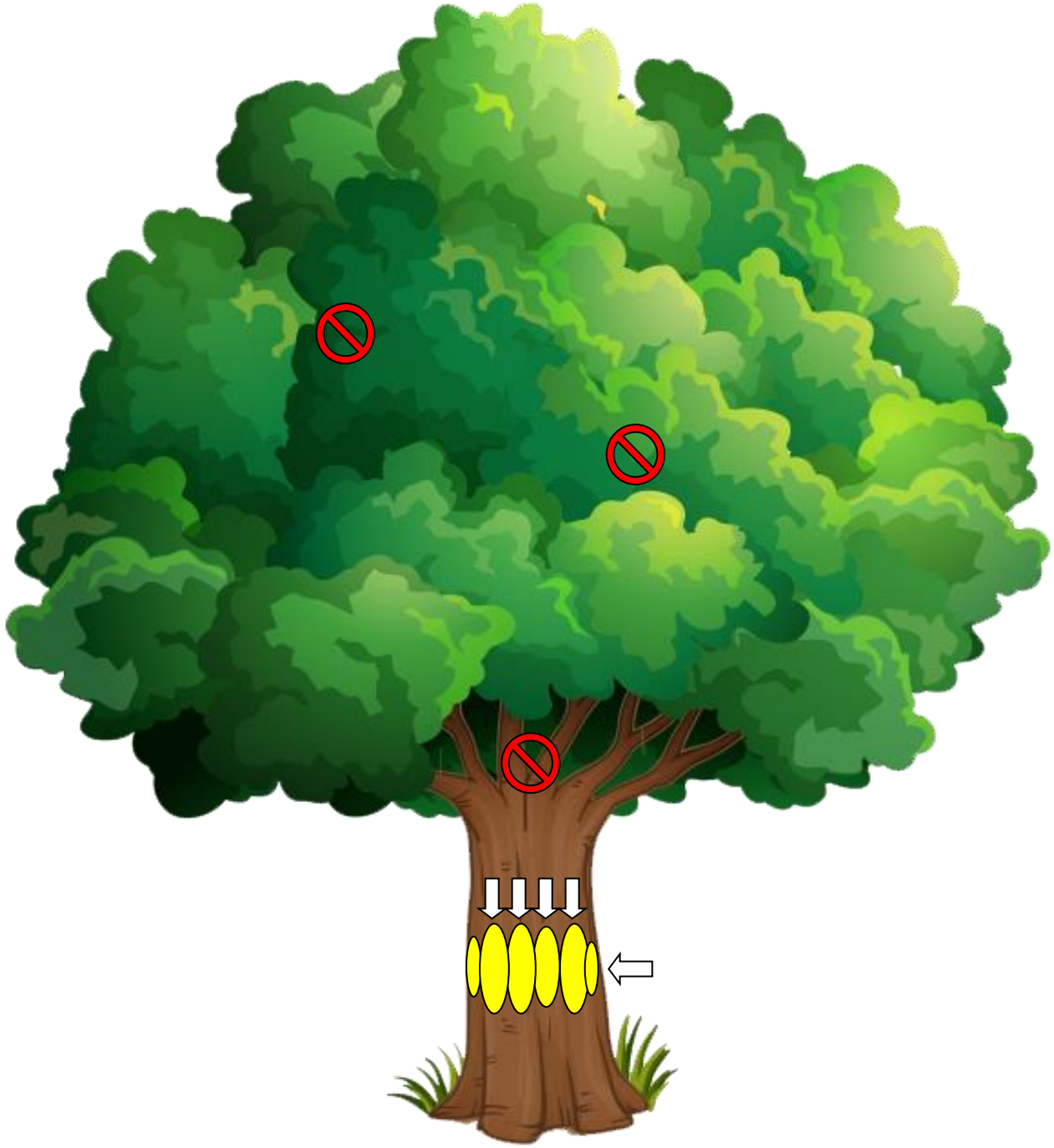


METHOD

- No drilling!
- Use as little vaccine as possible
- Closed injection system
- Use directly on targeted tree only
- Ensure direct uptake by tree
- Minimal wounding
- Speed of application

INJECTION TOOL

- Check for DED signs (on tree and in the area)
- **Push** the chisel in the bark
- **Pull** the trigger once
- **Twist** the gun slightly



INJECTION METHOD

How to inject?

- At convenient height
- Every 4 inches/ 10 cm circumference

When to inject?

- May and June
- From 25% leaf expansion tree is transpiring
- Before beetle infection occurs
- Good physiological wood reaction
- Dry day!

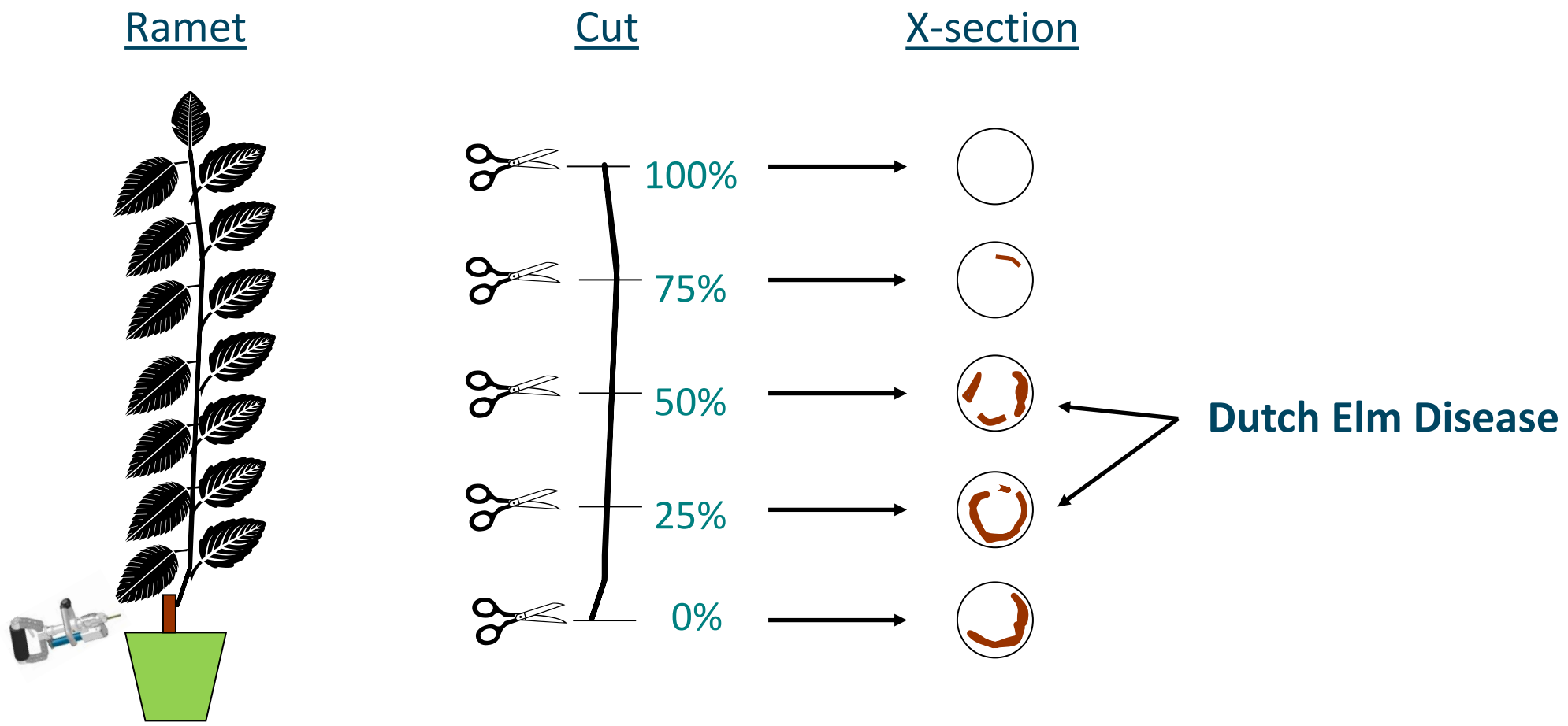
DAMAGE?

EFFICACY OF DUTCHTRIG

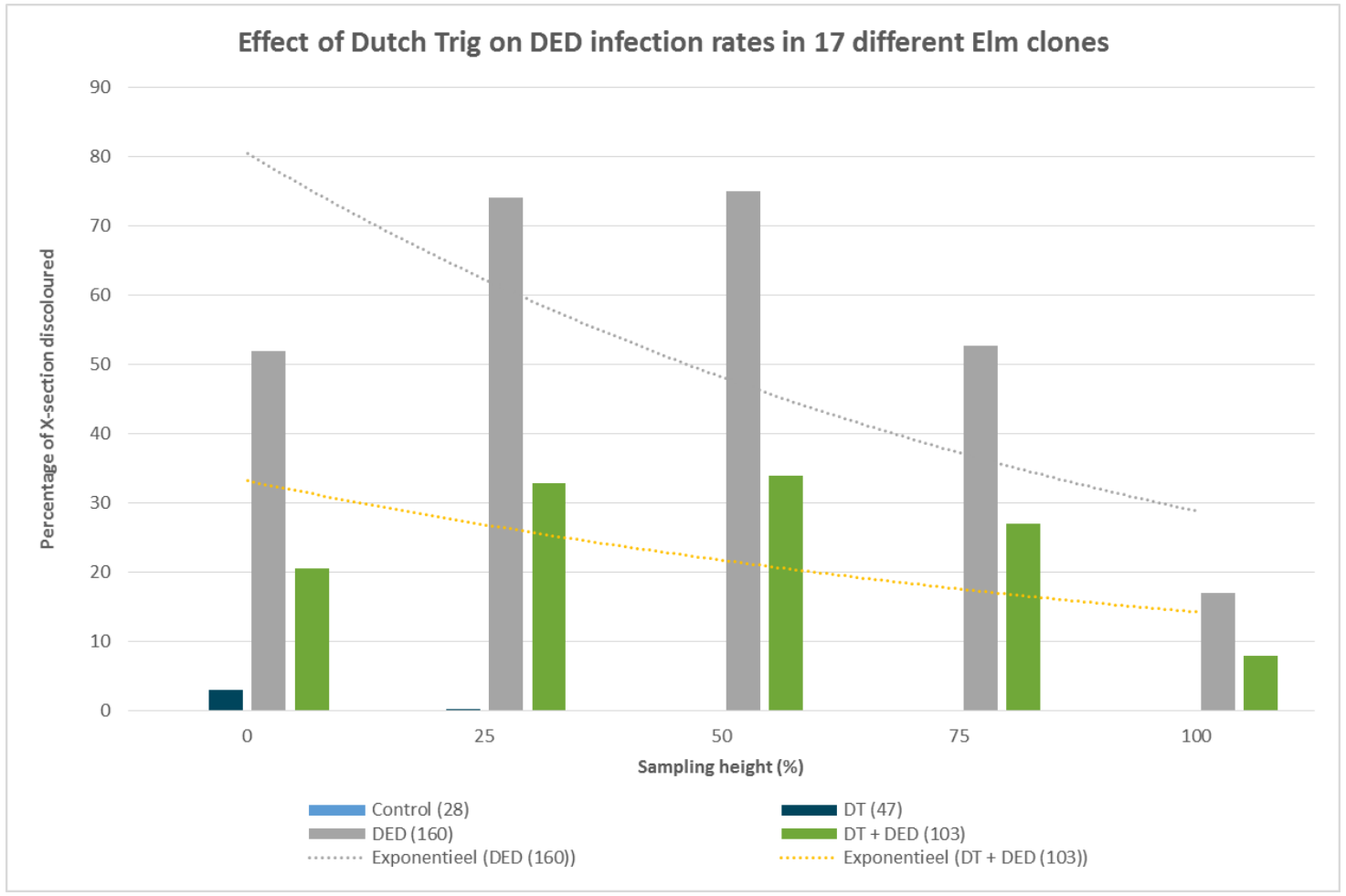
EFFICACY STUDY
University of Wisconsin

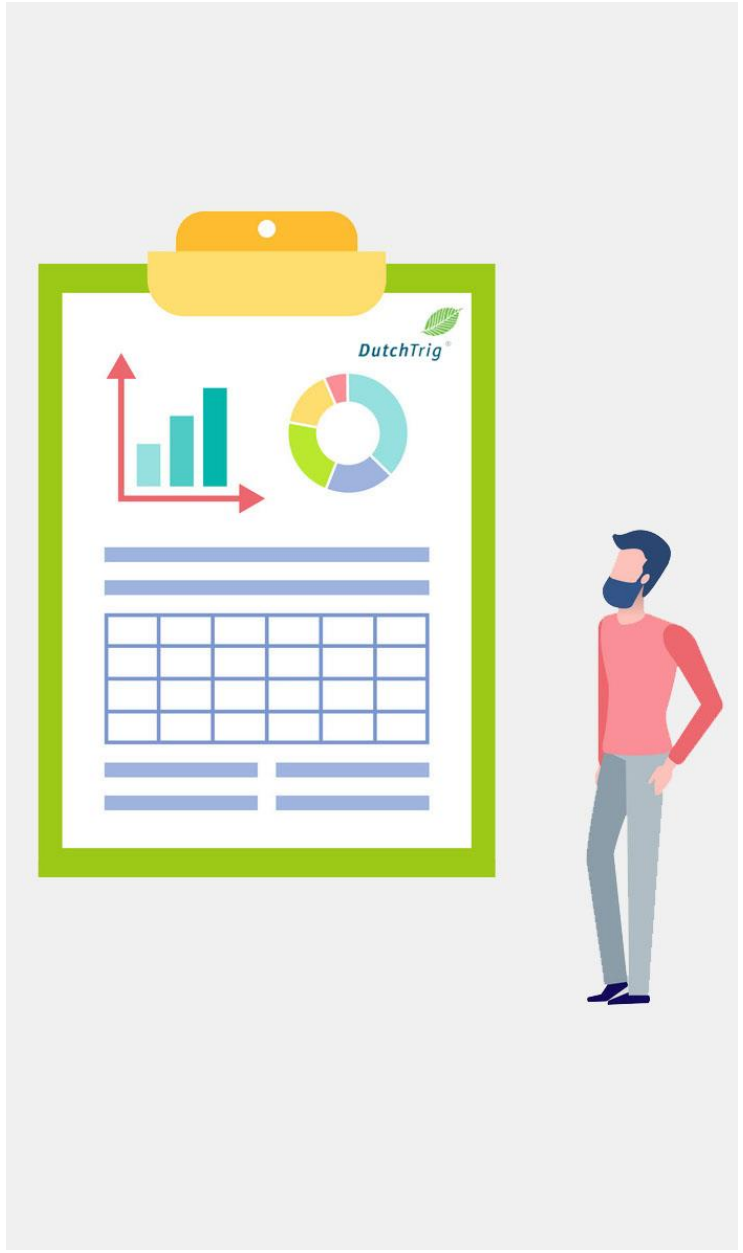
- Controlled Greenhouse Study using 2-year old ‘Ramets’
- 10 ramets per group
- 4 treatment groups:
  - Water (control)
  - DutchTrig
  - Dutch Elm Disease
  - DutchTrig + DED
- 17 different elm clones
- Both strains of DED

MONITORING DED INFECTION RATE

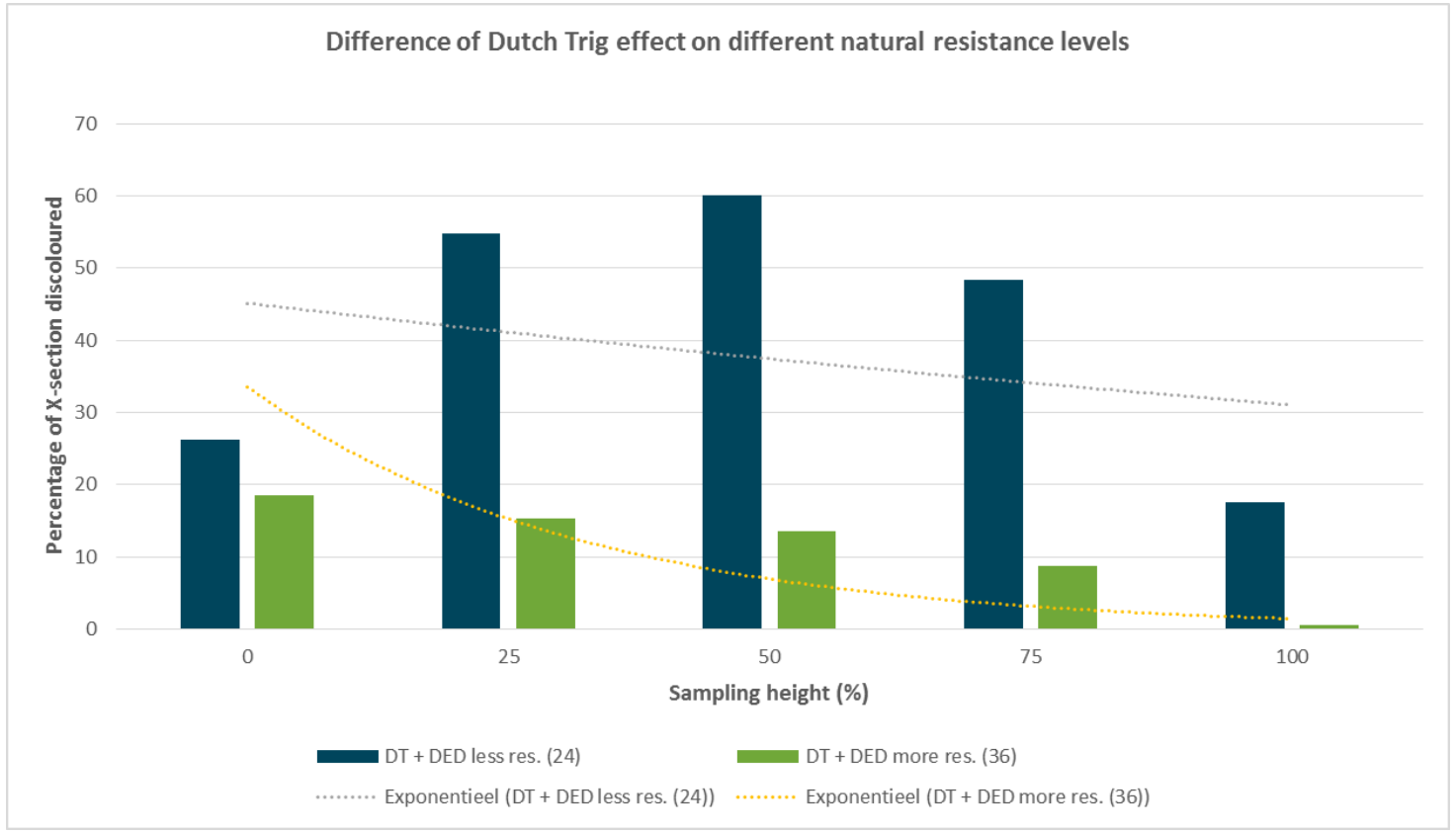


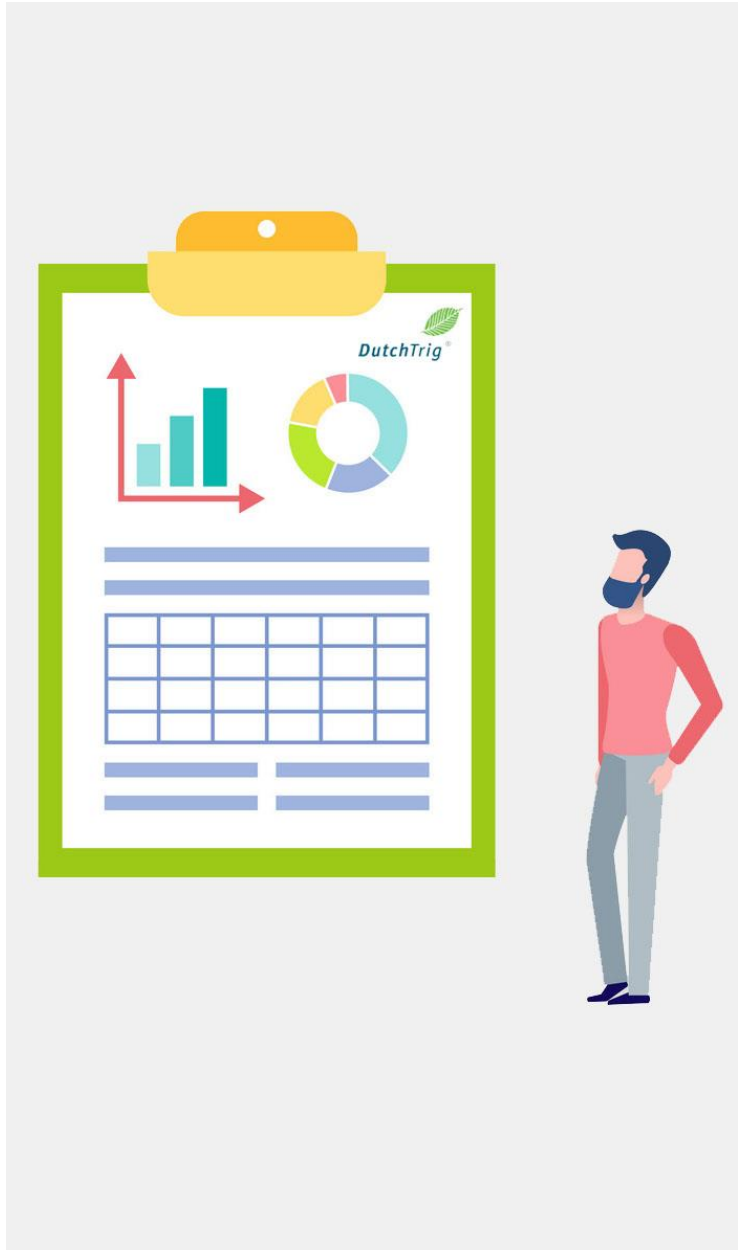
EFFECT OF DUTCHTRIG ON ELM CLONES



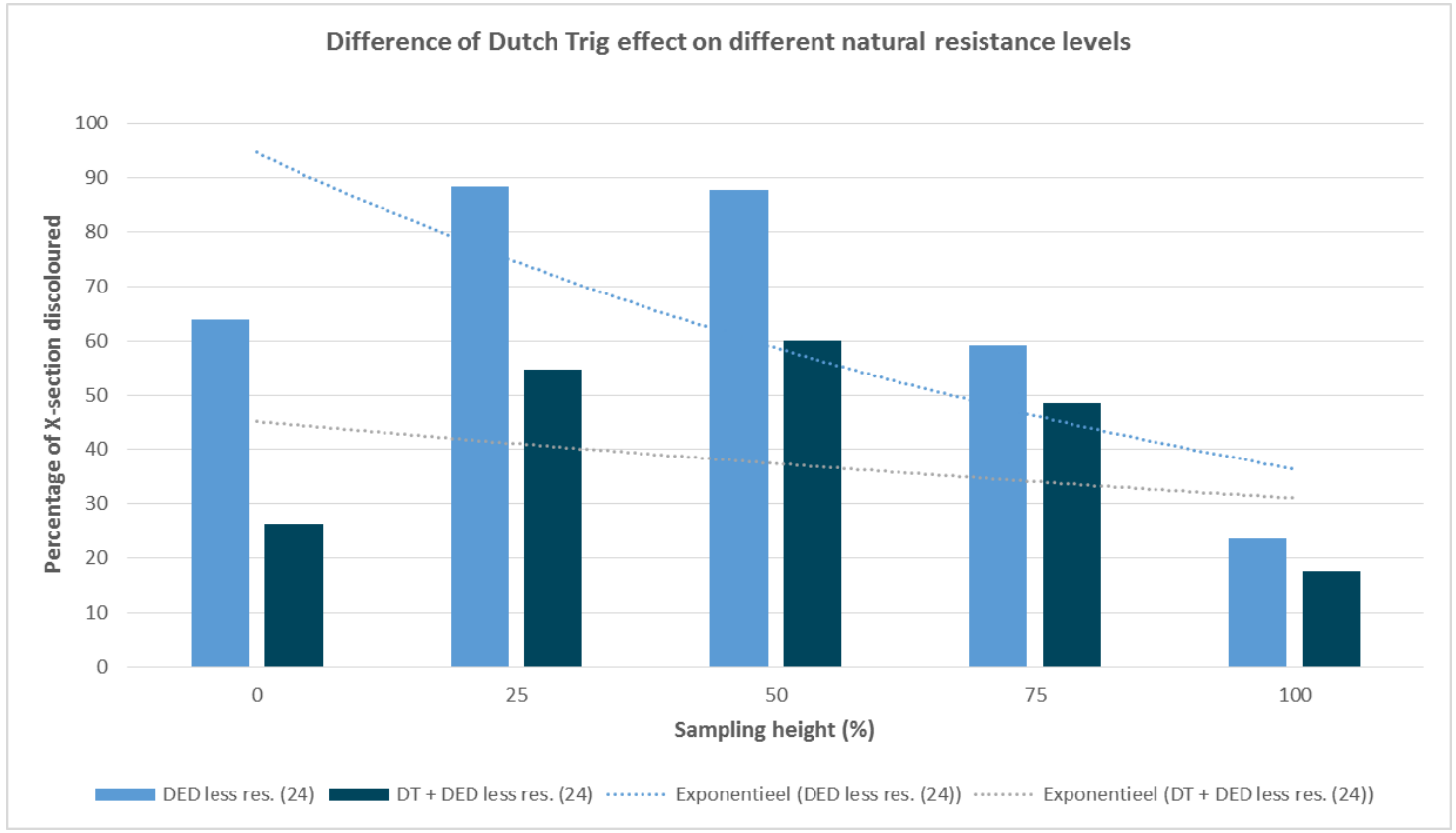


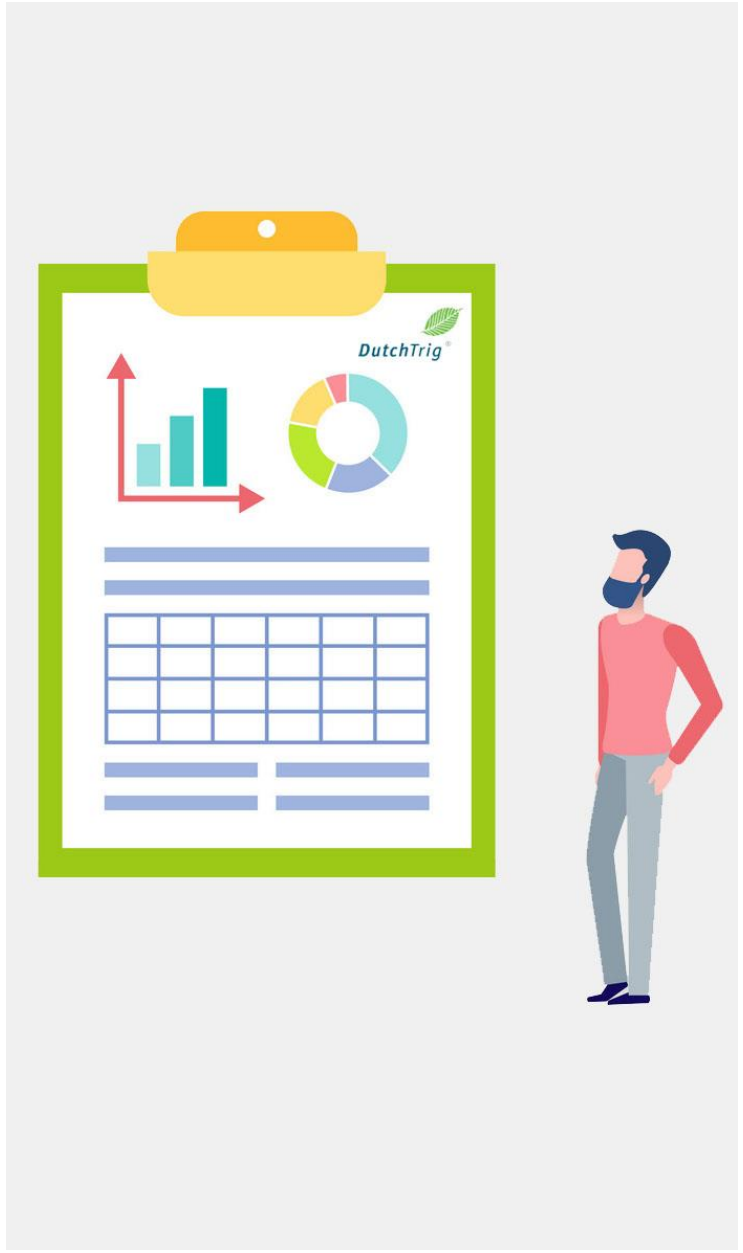
DIFFERENCE ON NATURAL RESISTANCE



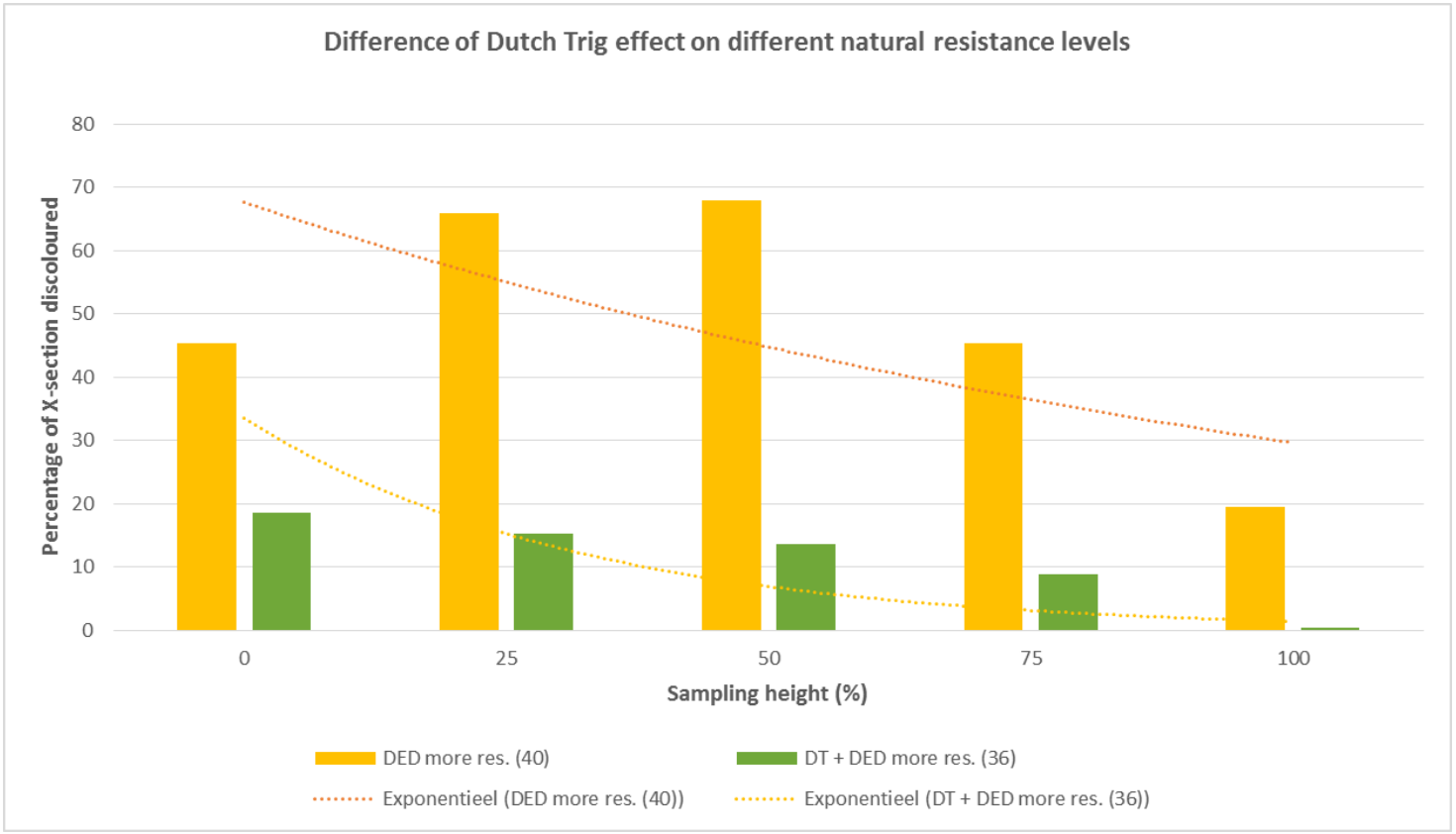


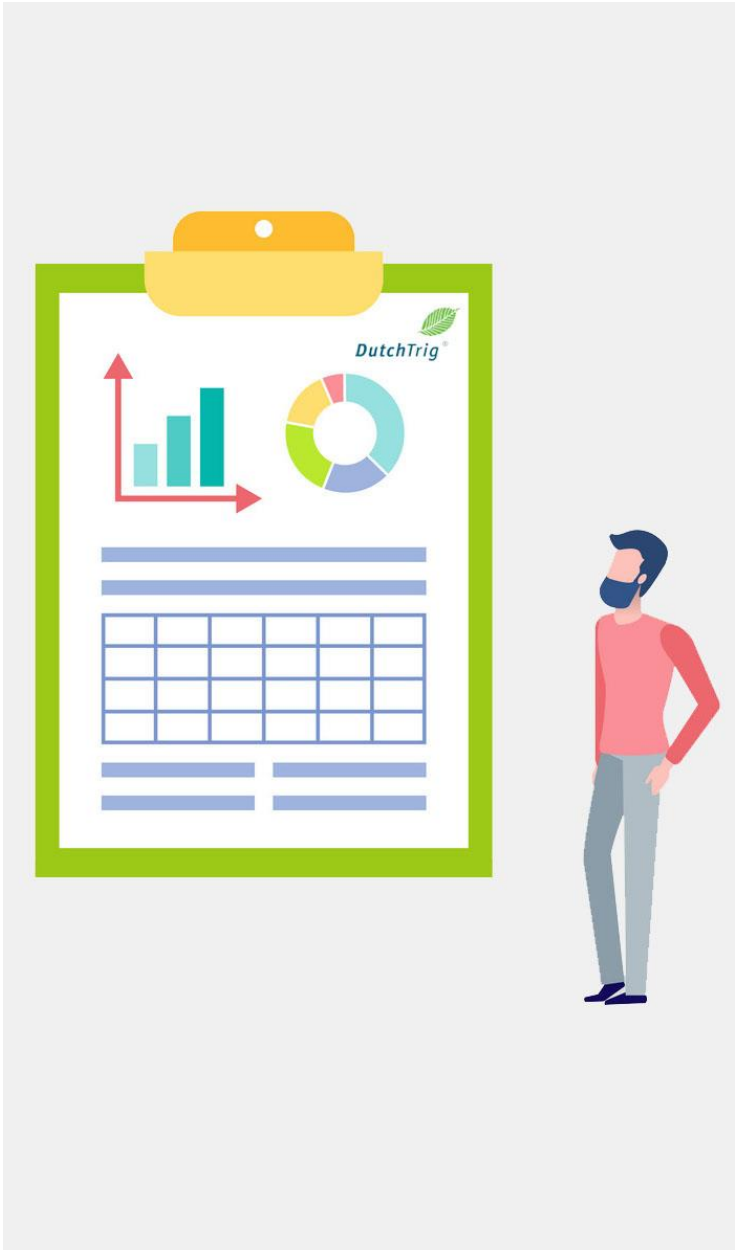
DIFFERENCE ON NATURAL RESISTANCE



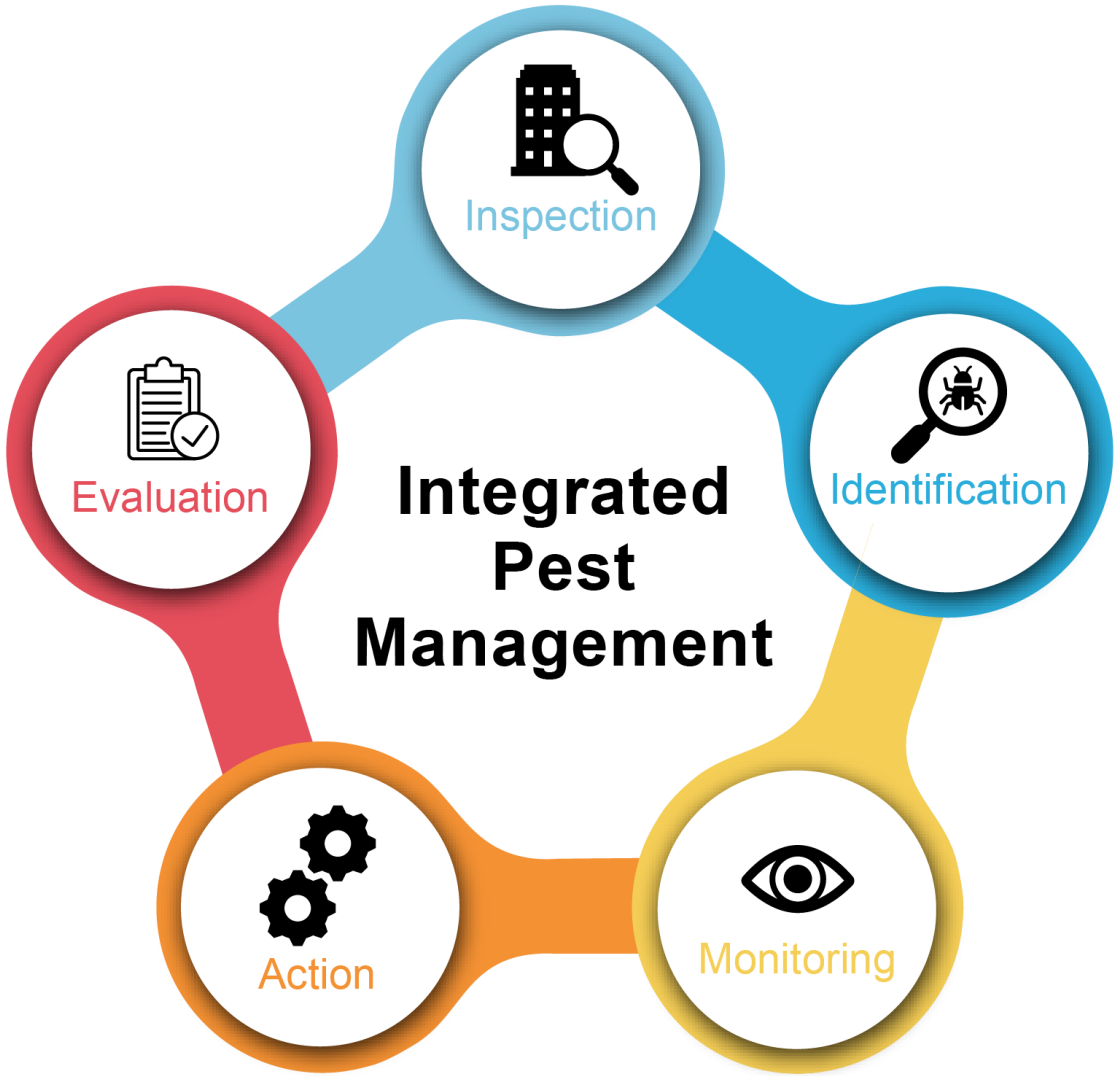


DIFFERENCE ON NATURAL RESISTANCE





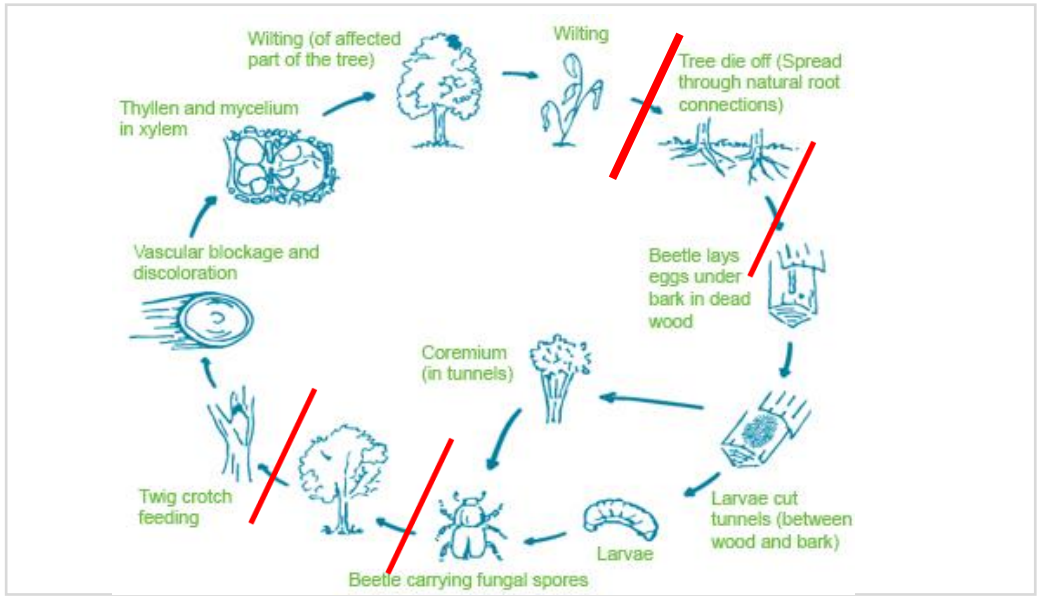

INTEGRATED PEST MANAGEMENT



Source: US Environmental Protection Agency

INTEGRATED PEST MANAGEMENT (IPM)

- FAO definition: “the careful consideration of **all available** pest control techniques and subsequent integration of appropriate measures that **discourage** the development of pest populations and keep pesticides and other interventions to levels that are **economically justified** and reduce or minimize risks to **human health** and the **environment**. IPM emphasizes the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages **natural pest control** mechanisms.“



ELM PROGRAM AS IPM STRATEGY

- Treatments
  - Vaccination
  - Sanitation
  - Rootgrafts
  - Replanting DED-tolerant variaties
  - Monitoring elms and beetles
  - Evaluation
- Combine treatments into DED- program
- Cumulative effect
- Example of Integrated Pest Management

ELM PROGRAM

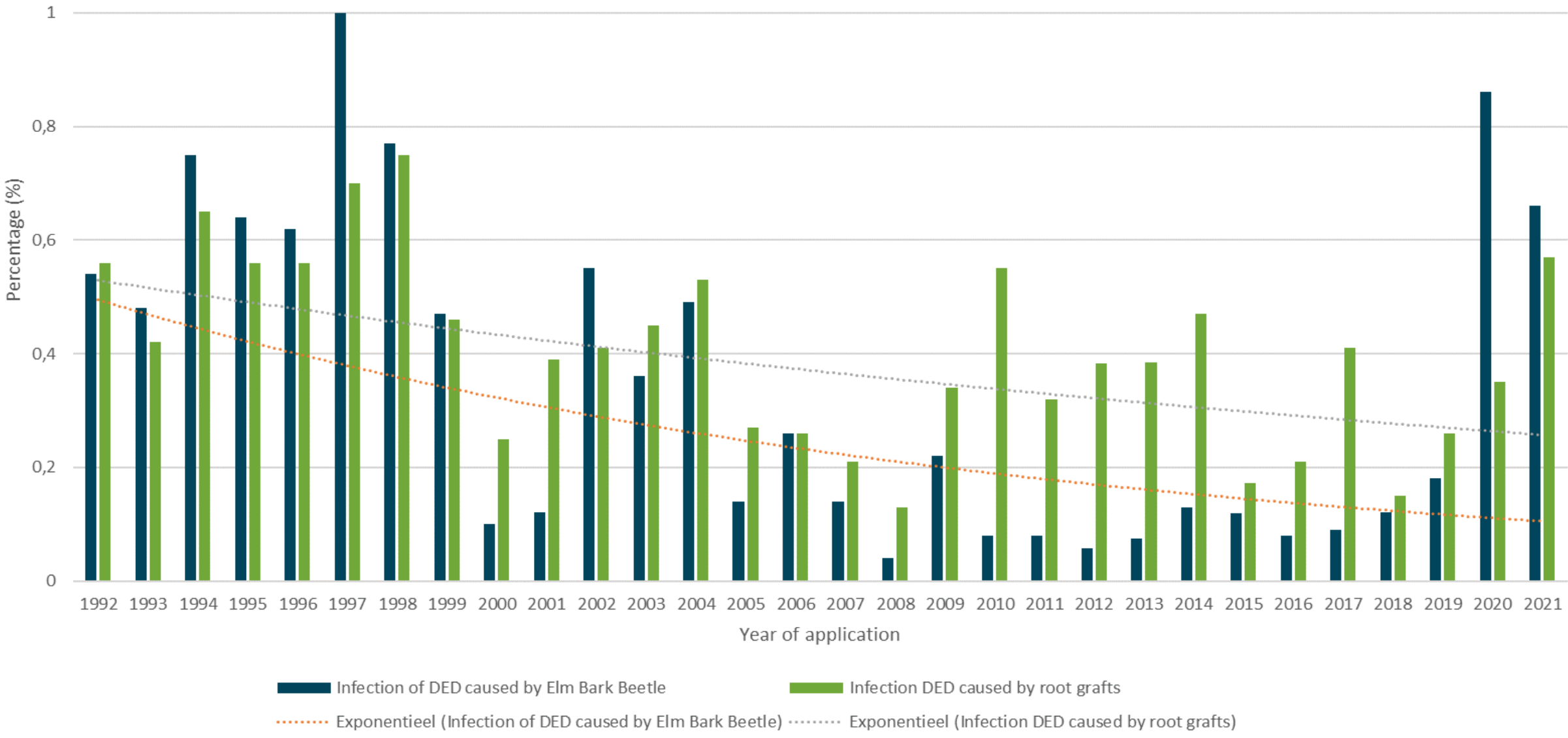
- Data collection
- Sanitation
- Vaccination
- Monitoring
- Replanting
- Education


ELM PROGRAMS WORLDWIDE

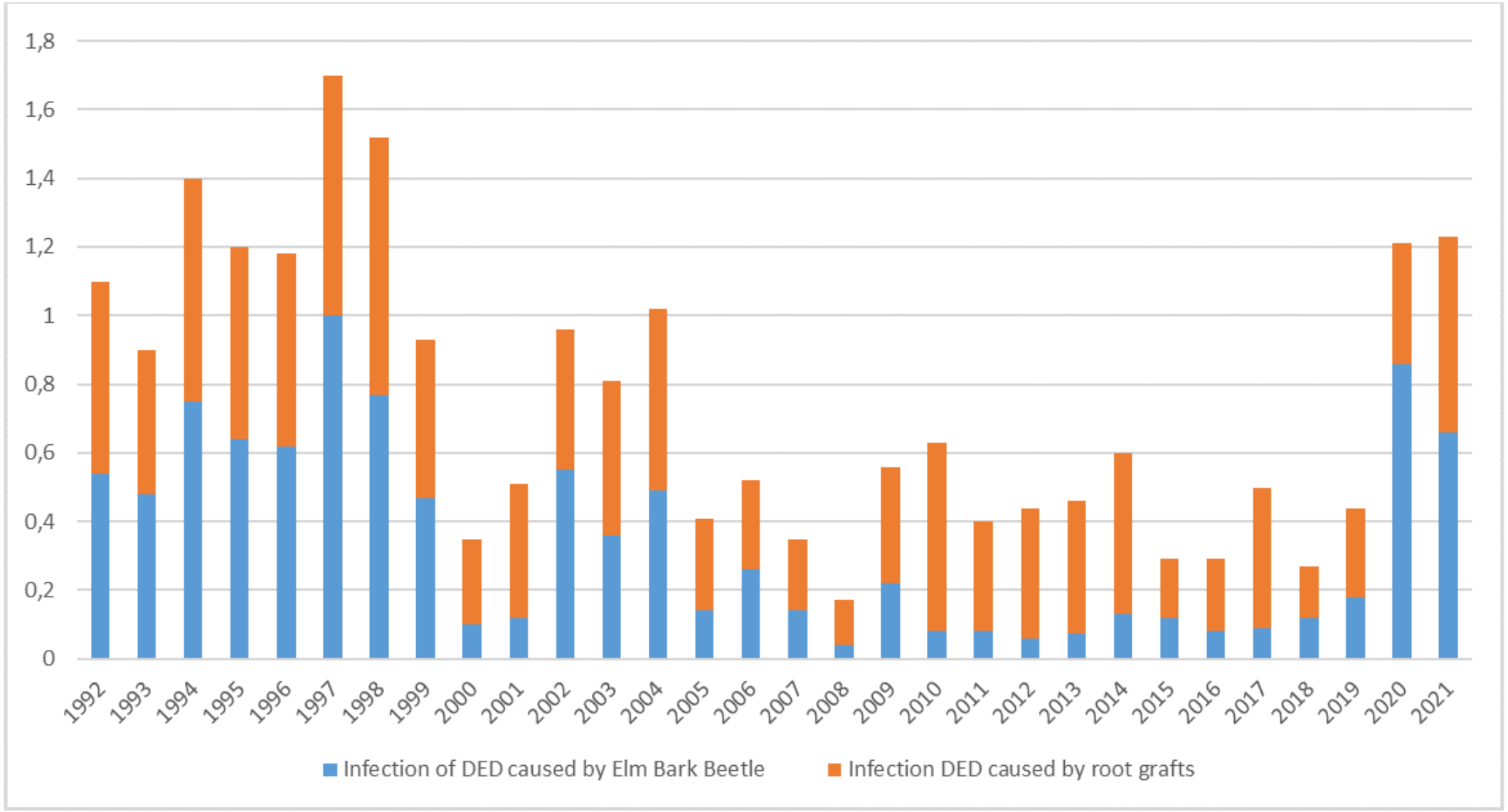
HOW MANY ARE LEFT?

- **Amsterdam:** 31.606
- **Den Haag (the Hague):** 20.000
- **Utrecht:** 4.000
- **Rotterdam:** 7.000
- **Helsinki:** **?**
- **Turku:** **?**

PERCENTAGE DISEASED ELMS

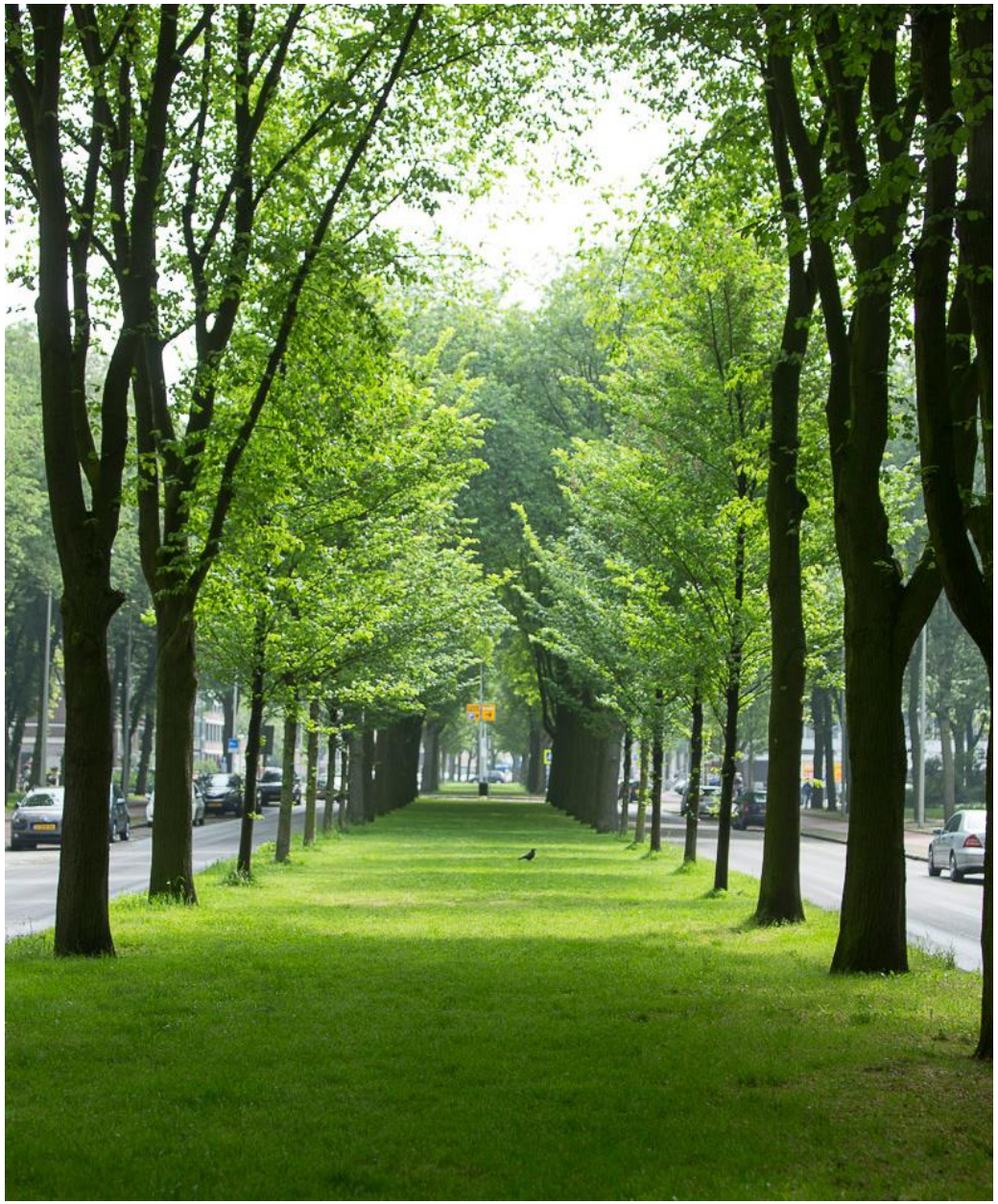


BEETLE VS. ROOTCRAFTED INFECTIONS



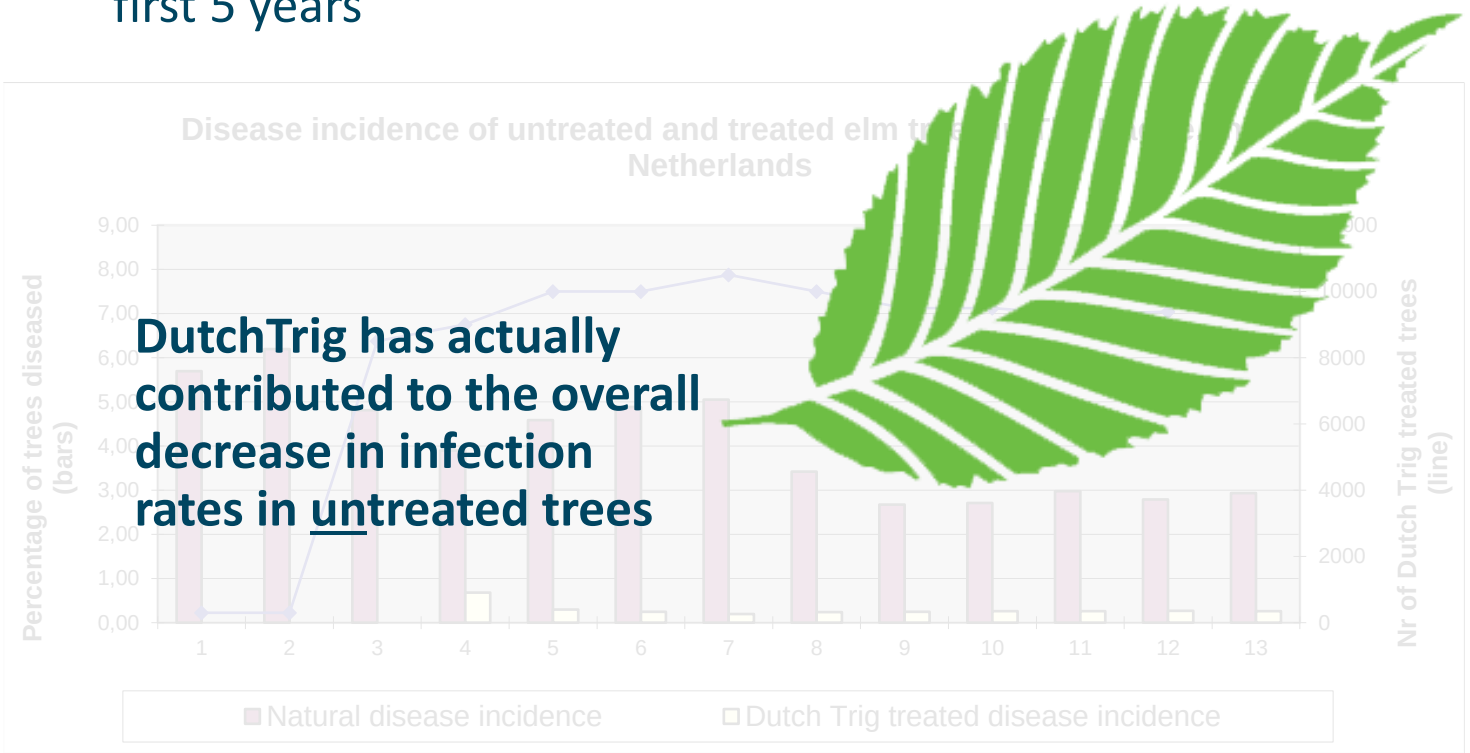
NETHERLANDS
The Hague

- Active approach to retain
- Cost efficient!!
- Aprox. 20.000 elms remain in the city
- +/- 8.000 elms have been treated in The Hague since 1995
- A drop in DED incidence from 7% in the control group to 0.16% in the treated group occurred in the first 5 years

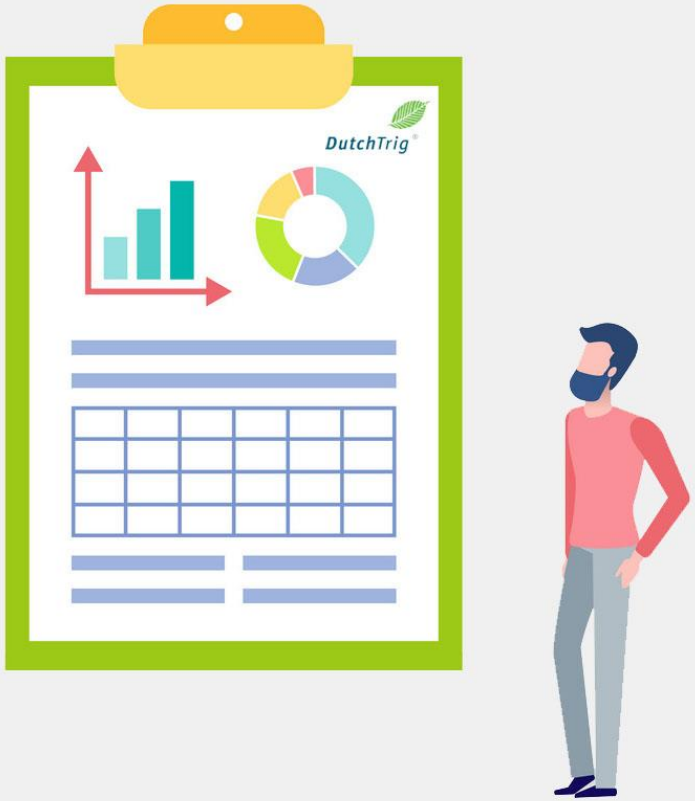


NETHERLANDS
The Hague

- DED incidence from 7% to 0.16% in the treated group in the first 5 years



DutchTrig has actually contributed to the overall decrease in infection rates in untreated trees



SYDNEY
Nova Scotia, Canada

- Started a pilot in 2010
- Total # of elms: 4,000
- # of treated elms: 300 in 2015
- Loss % before program: 8-9%

- Loss % now: < 1%
- Loss in treated group: 1 tree!!
- ++ $ saved!!

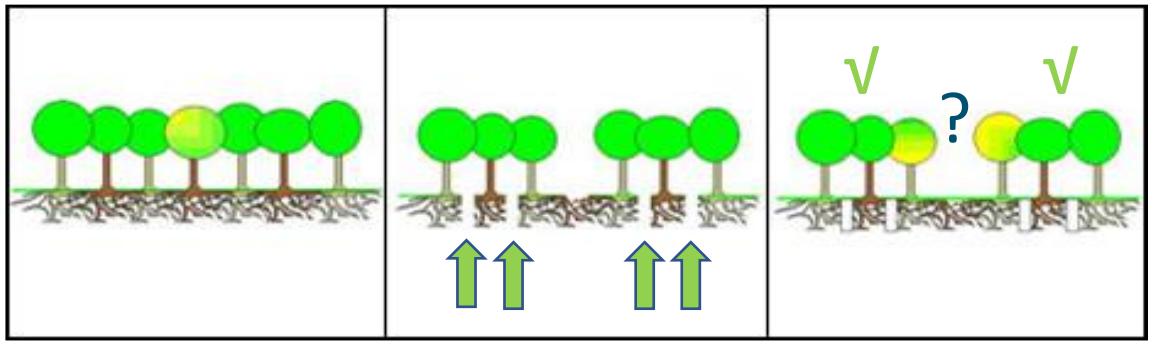
Source: Wikipedia

OVERALL RESULTS

- Loses to less than 1%
- Choice which elms to keep is yours not the beetle
- Invest in saving trees
- Positive message
- Environmental friendly
- Best effect in combination with DED-program!

OVERALL RESULTS

- Disadvantages:
  - Not curative
  - Root-grafts
  - Annually (disadvantage?)



FINAL CONCLUSION
Conservation of values

- Invest in saving trees
- Invest in saving values
- Value increases with age
- Loosing old trees is loosing more value


THANK YOU FOR YOUR ATTENTION
Please check:
www.dutchtrig.com
www.dutchelmdisease.org
Follow us:
@dutchtrig
DutchTrig channel
YouTube