

Plant material overview – why plant improvement matters



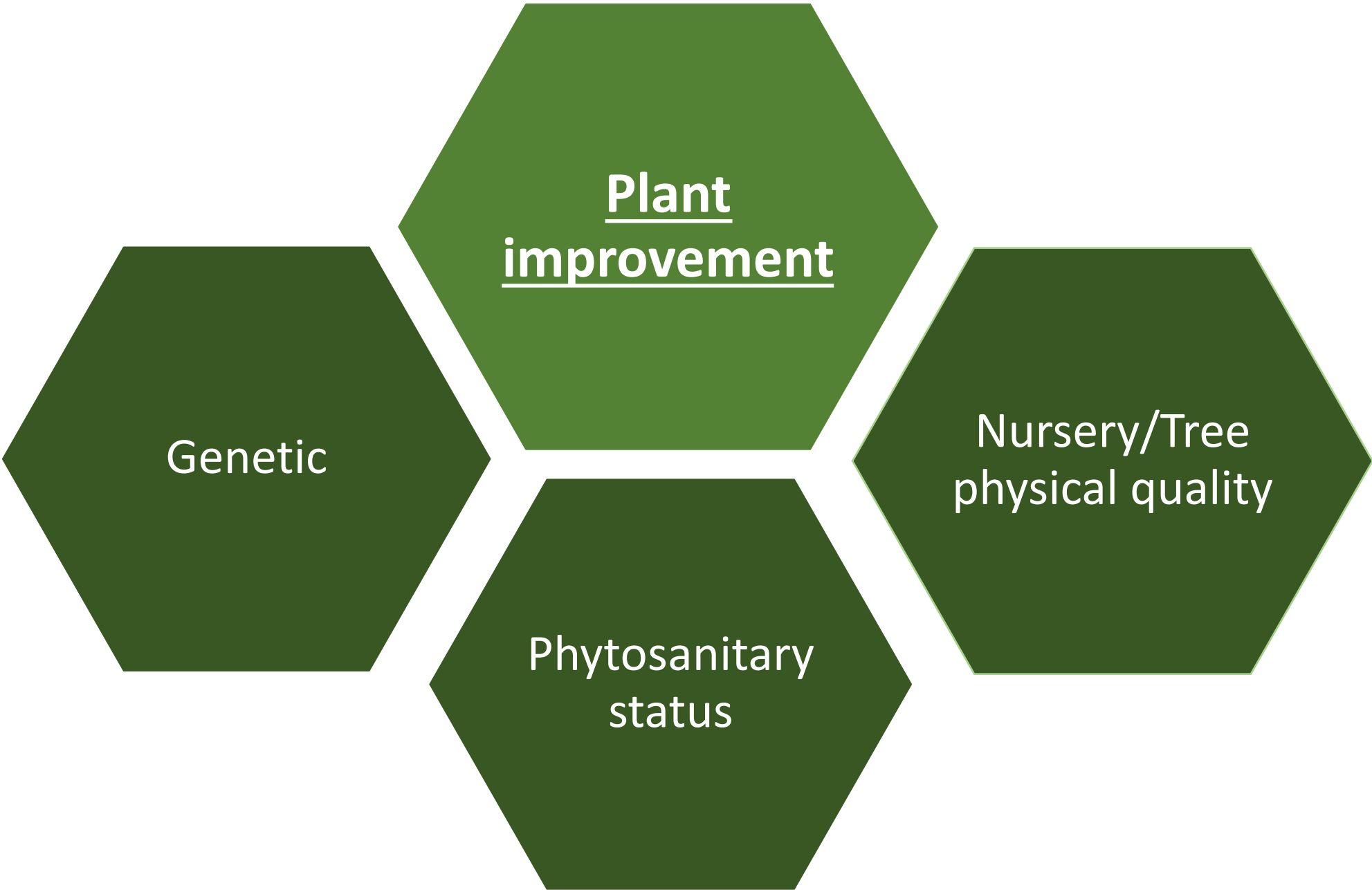
4 June 2024

Hugh Campbell

(GM: Hortgro Technical / Plant Material Manager)



**What is plant
improvement?**



Plant
improvement

Genetic

Nursery/Tree
physical quality

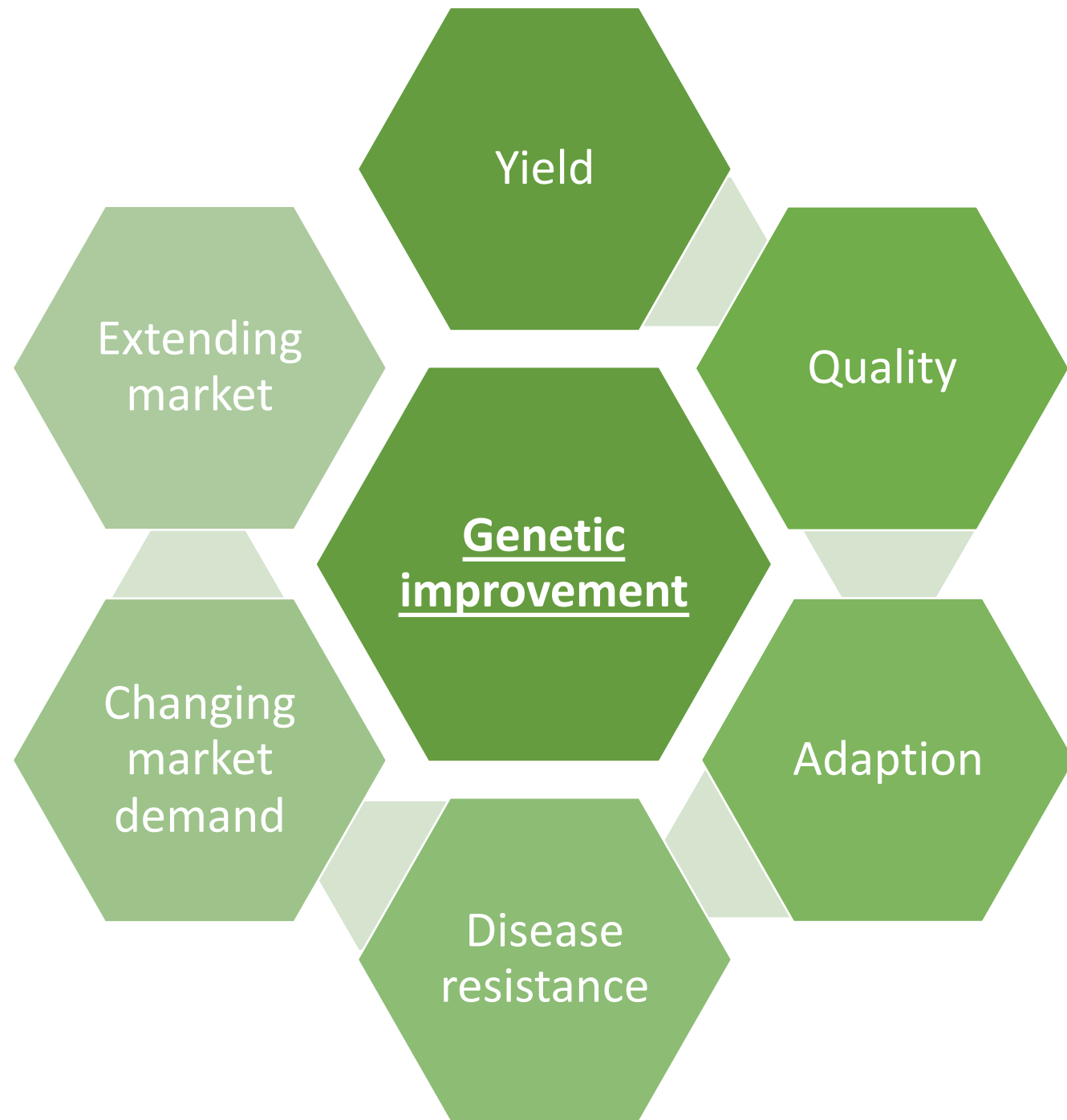
Phytosanitary
status

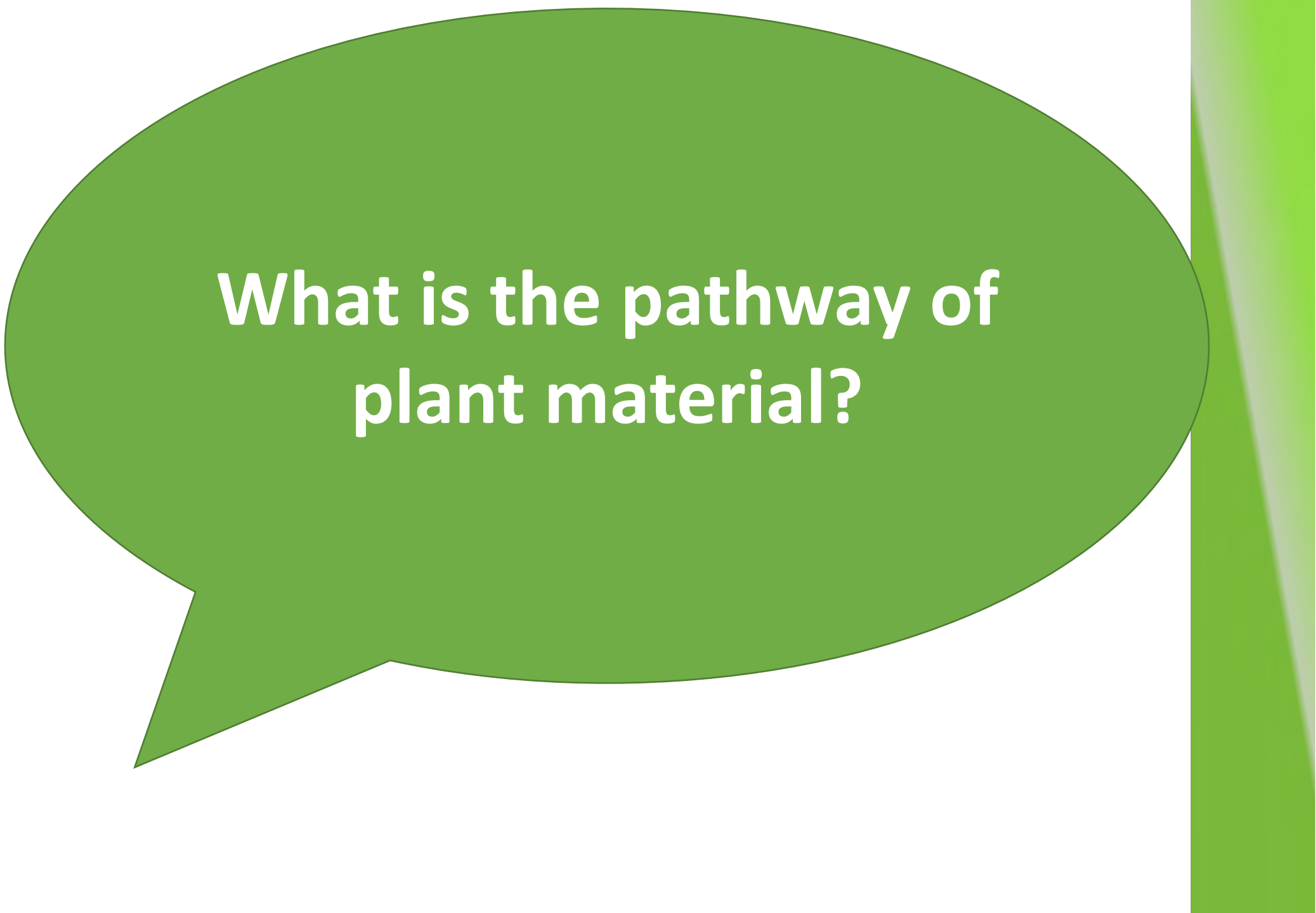
Plant
improvement

Genetic

Nursery/Tree
physical quality

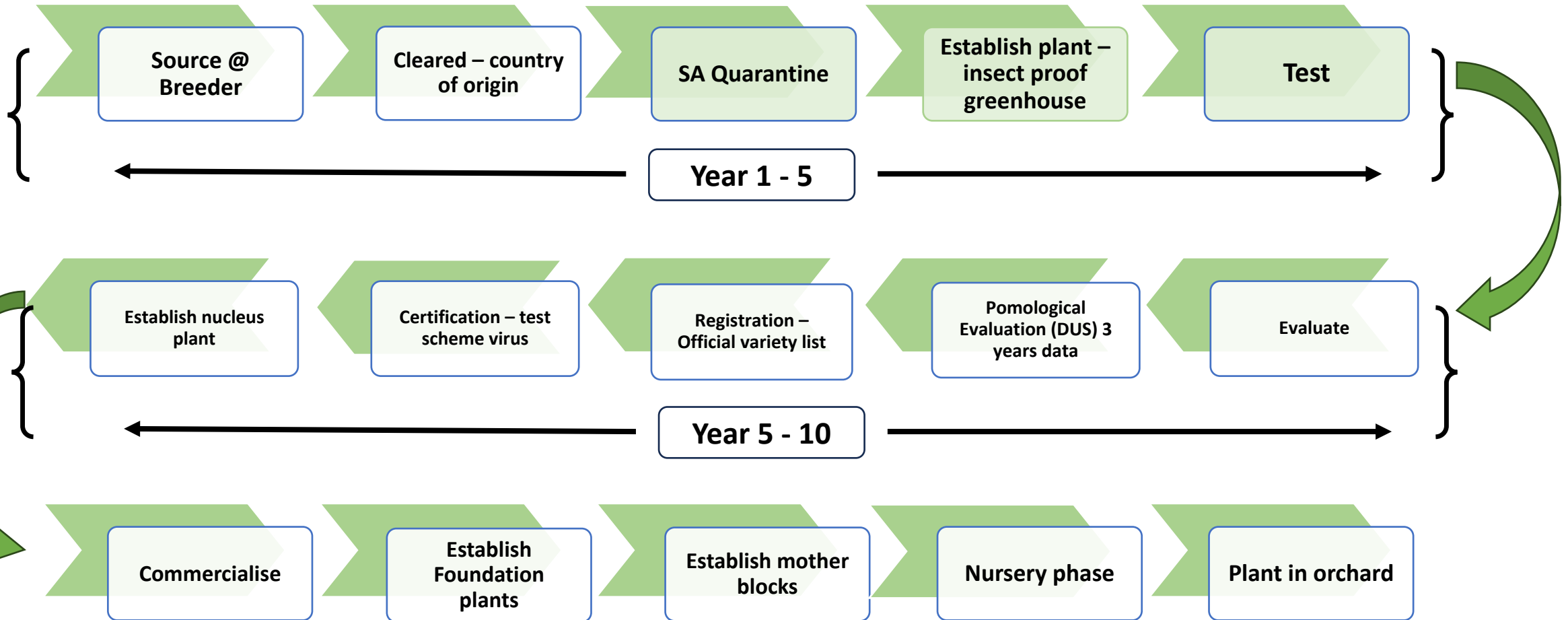
Phytosanitary
status





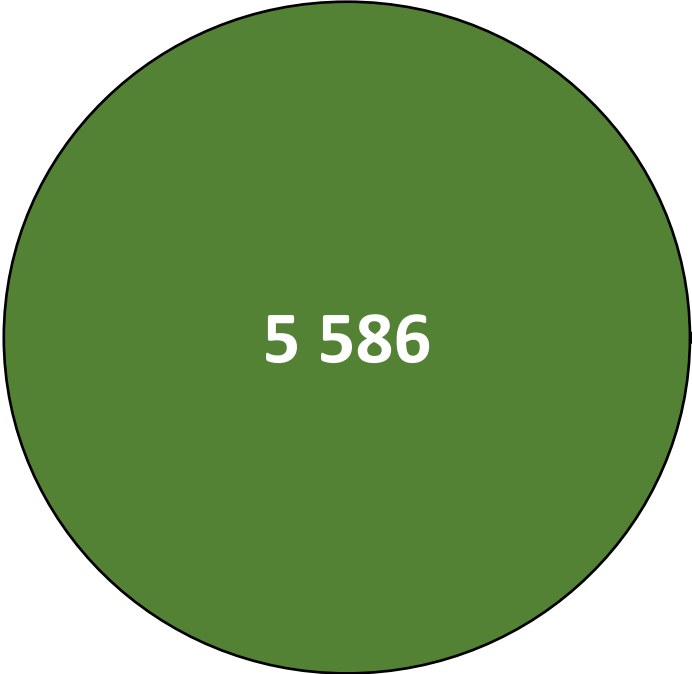
**What is the pathway of
plant material?**

Imported plant material pathway



**Importation of
cultivars
(2002 – 2021)**

Cultivars imported



5 586

Clone applications



309

5,5%

Successful cultivars

?

Per year



279



15

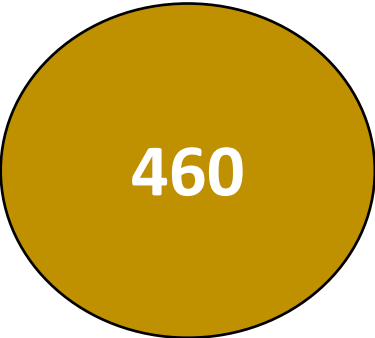
Per year



**Local selections
(2002 – 2021)**

Local Cultivar selection

Clone applications



460



103

22%

Per year



23



5

Per year



**What is industry's role
in cultivar
development?**

Industry's role in cultivar development

Cultivar matrix



Independent evaluation

11x ProHort sites
Screening / Tasting projects



Commercialisation

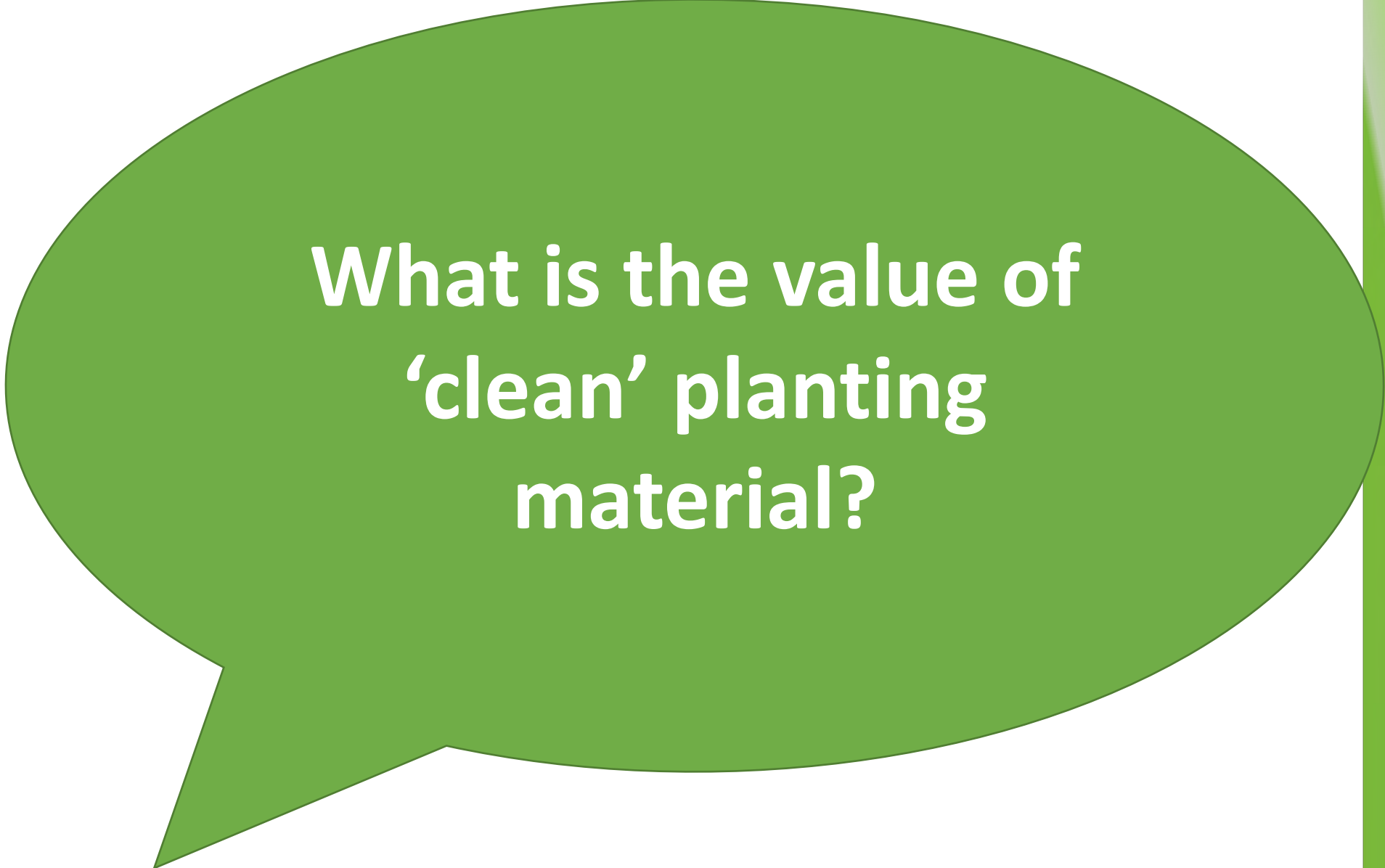


Independent cultivar evaluation



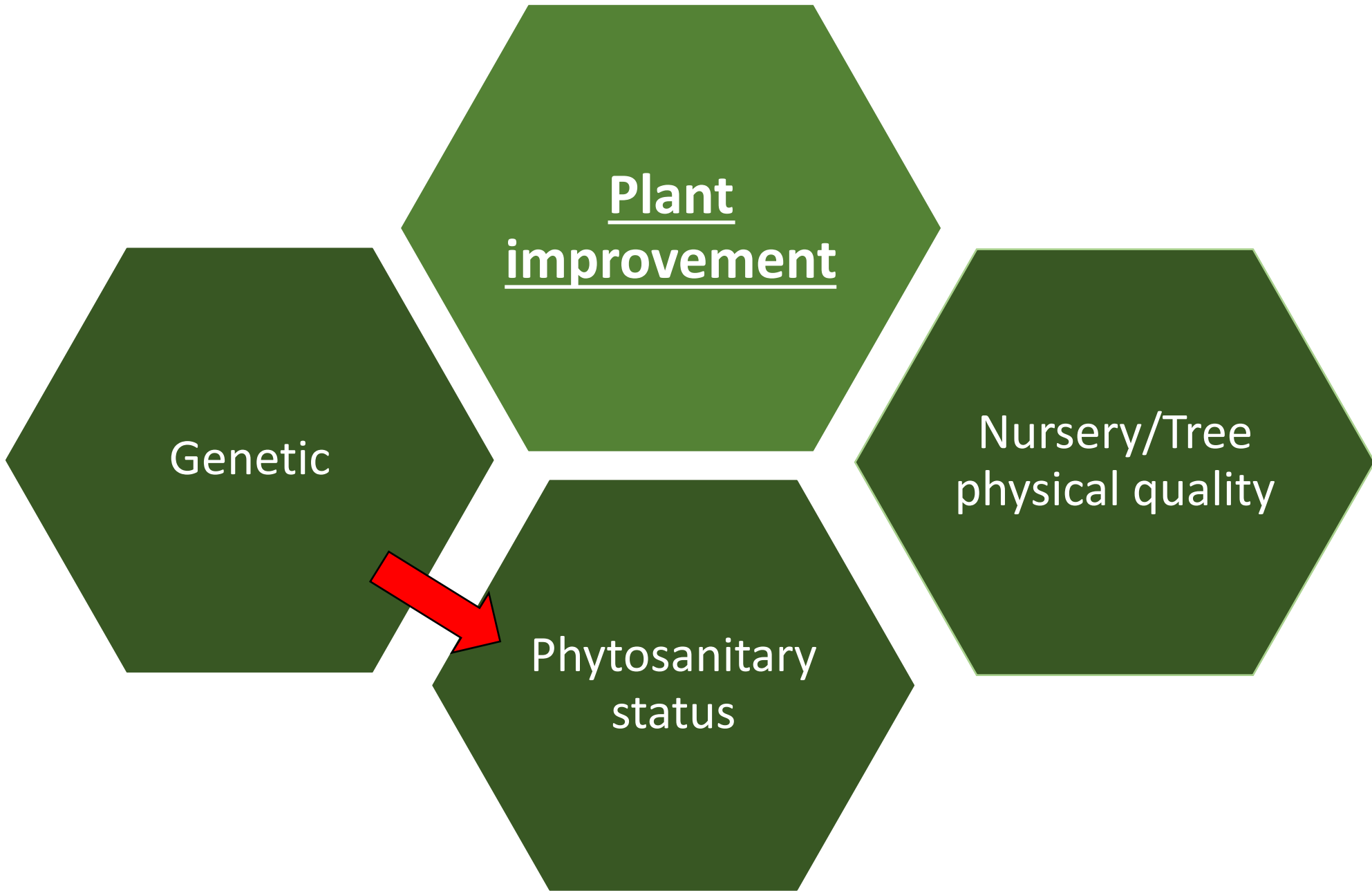
Total number of evaluations, cultivars and selections according to the source of samples for the 2020, 2021 & 2022 seasons' independent evaluation services							
	Evaluations	Cultivars	Advanced Cultivars*	% of Total advanced cultivars*	Culled Cultivars	% of Total culled cultivars	Evaluation Plots
Apple	674	233	21	3,1	212	91,0	28
Pear	353	189	32	9,1	157	83,1	18
Nectarine	571	294	25	4,4	269	91,5	12
Plums	633	274	49	7,7	225	82,1	10
Peaches	256	157	11	4,3	146	93,0	11
Apricots	80	38	6	7,5	32	84,2	5
Total	2567	1185	144	5,6	1041	87,8	84

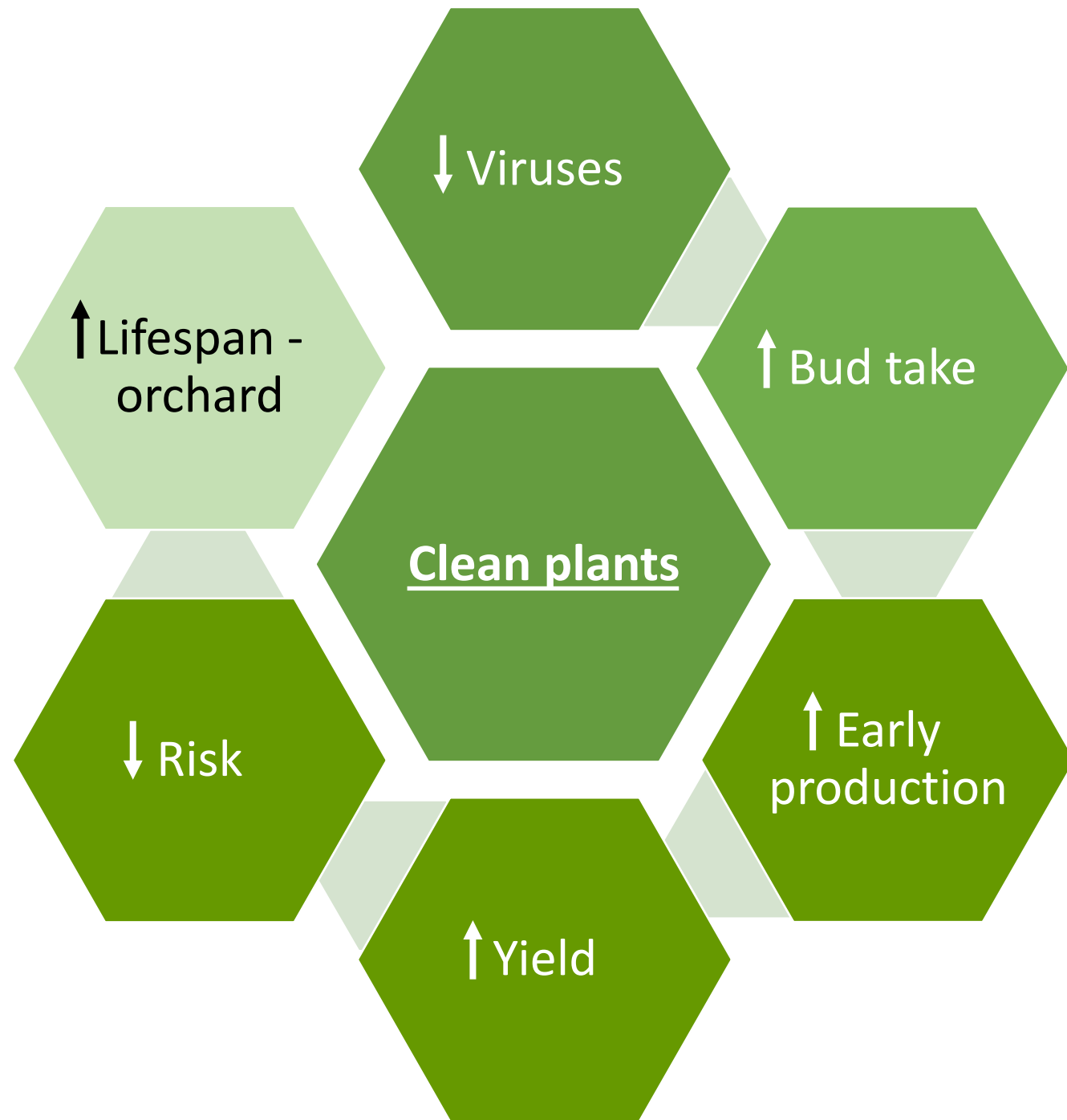
* Ready for Full Trial / semi-commercial evaluation

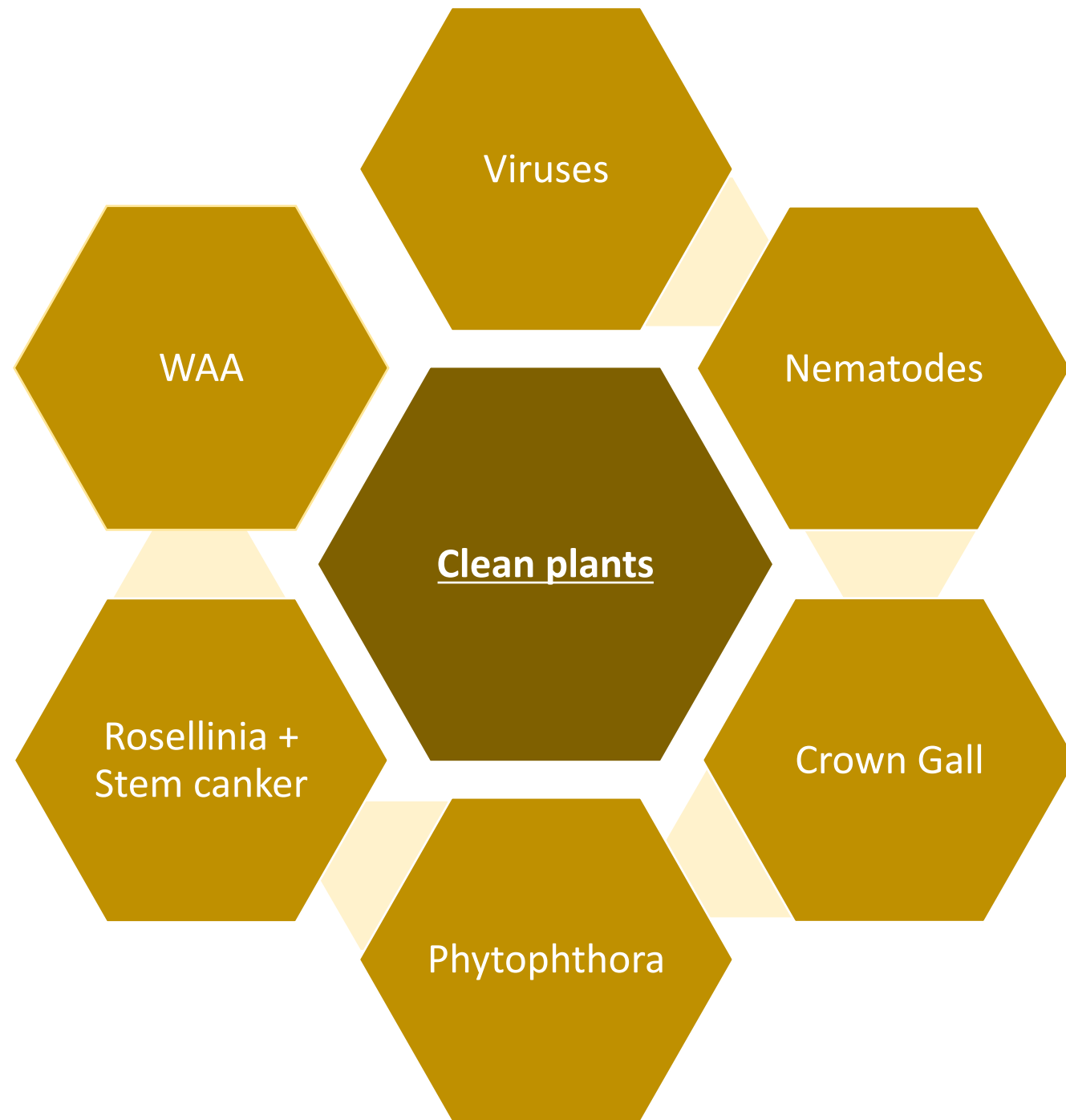


**What is the value of
'clean' planting
material?**





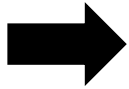




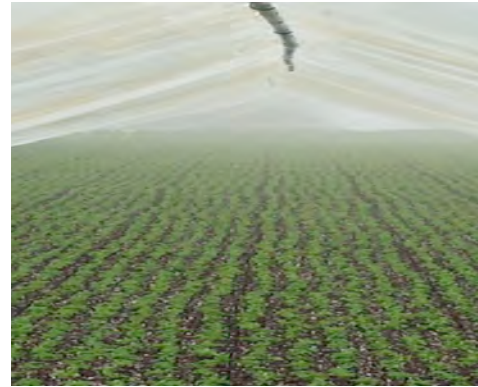
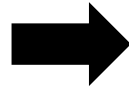
Tissue Culture + Pots



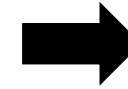
Virus tested nucleus



Tissue culture multiplication



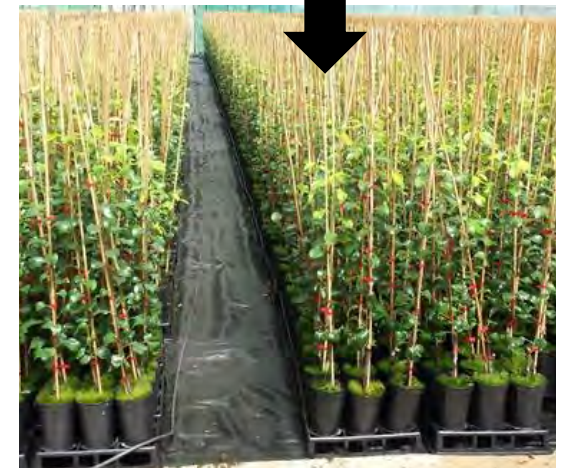
TC growth beds



Micro graft



Root / tree balance



Potted tree

Clean material

Quarantine pest / diseases

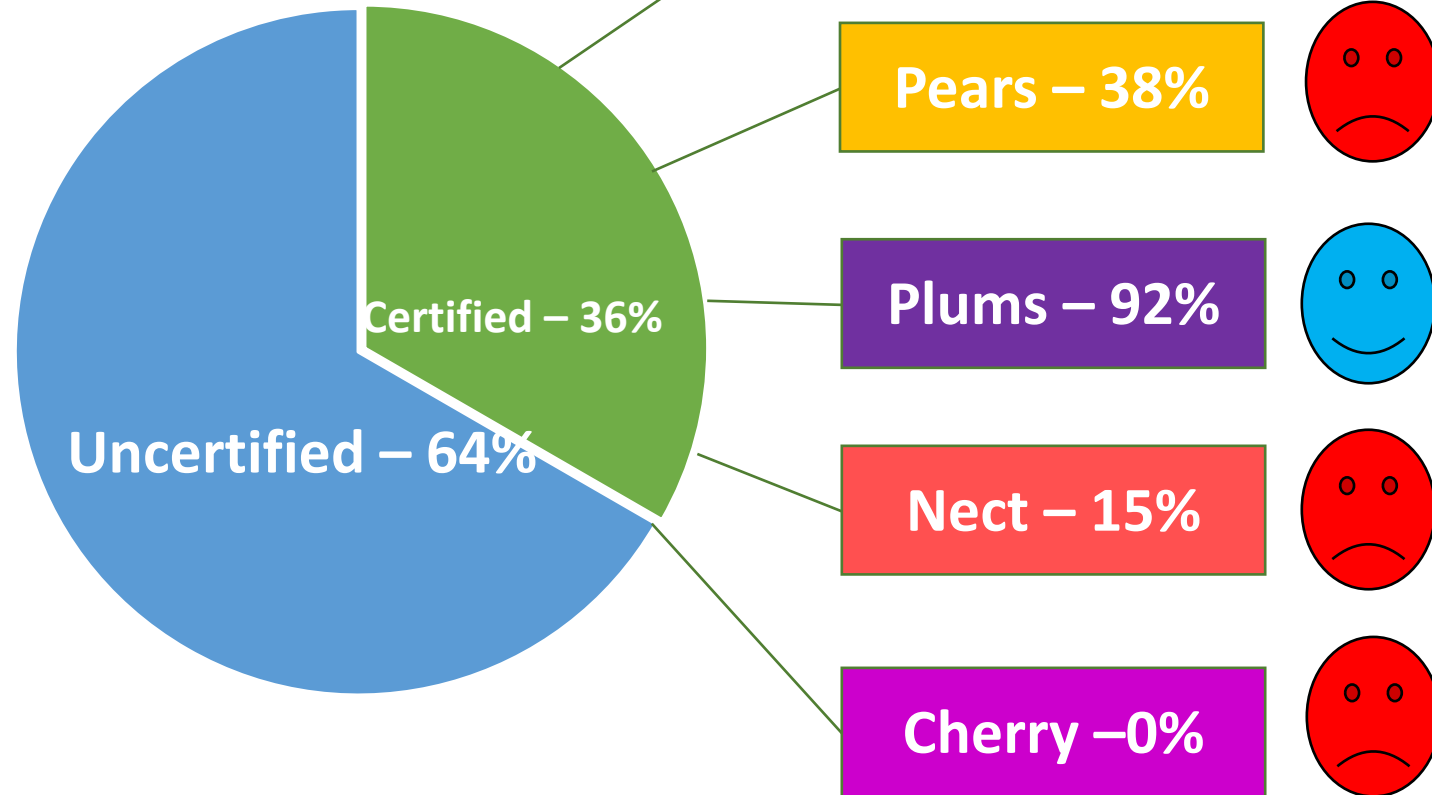
Scheme pest & diseases



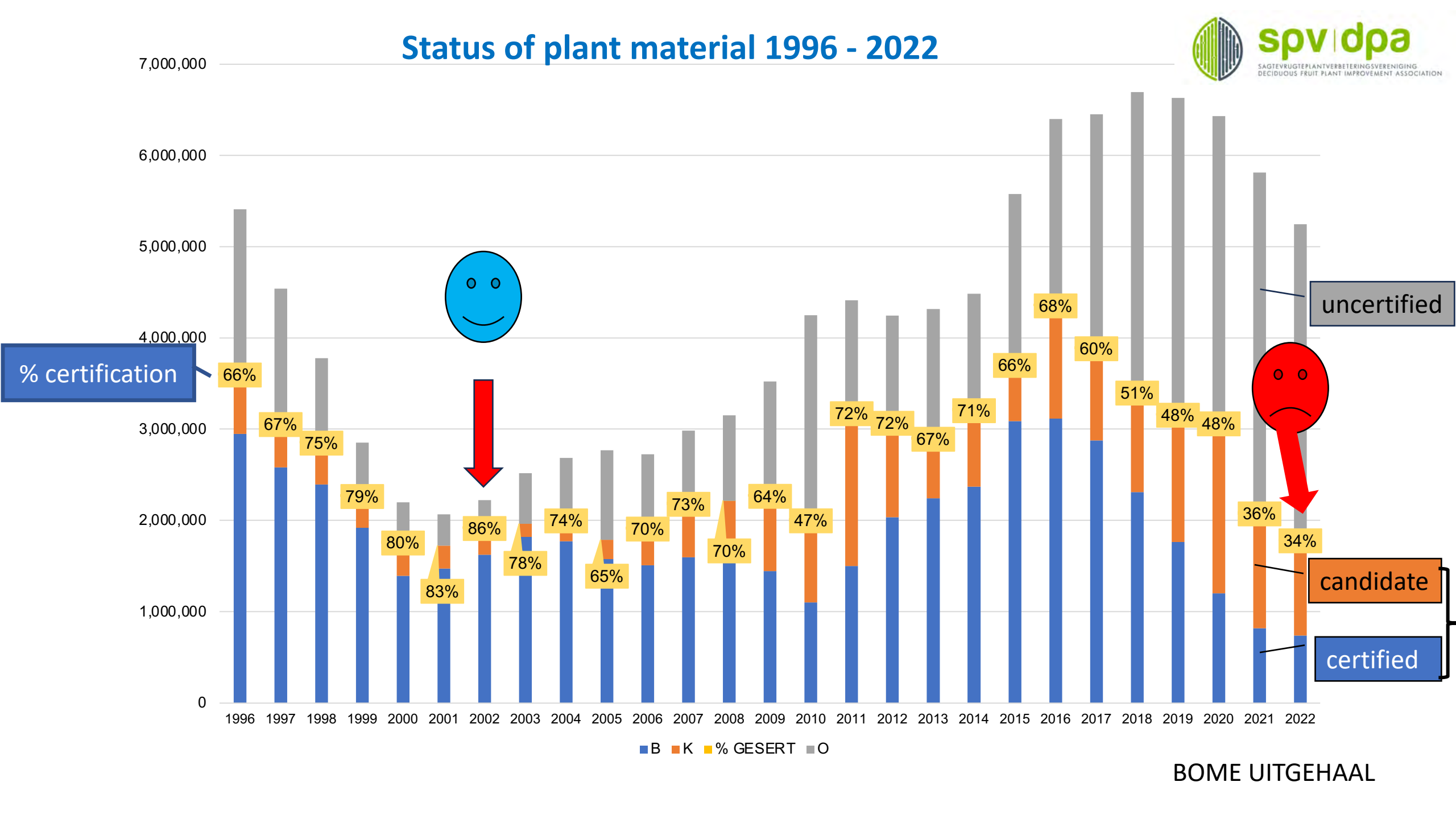
The Plant Improvement Act, 1976 (Act 53 of 1976)



Plant certification in SA - 2023



Status of plant material 1996 - 2022



How can clean
planting material
be achieved?



Plant certification schemes

1. International benchmarking

2. Implementation plan

3. Business plan ISP 1-3

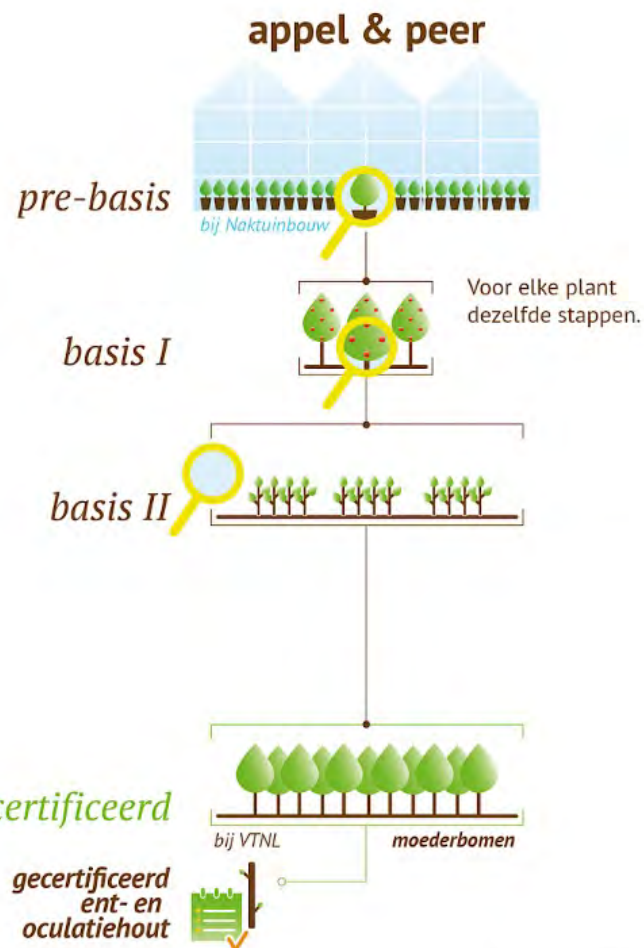




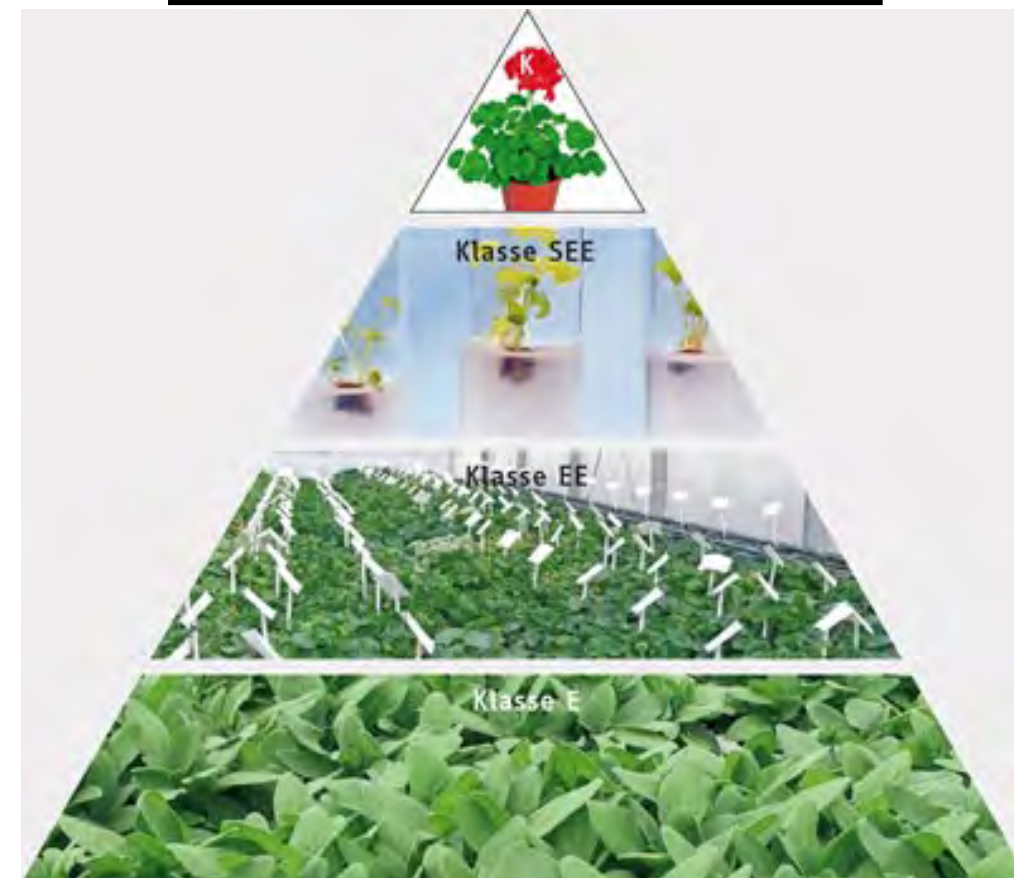
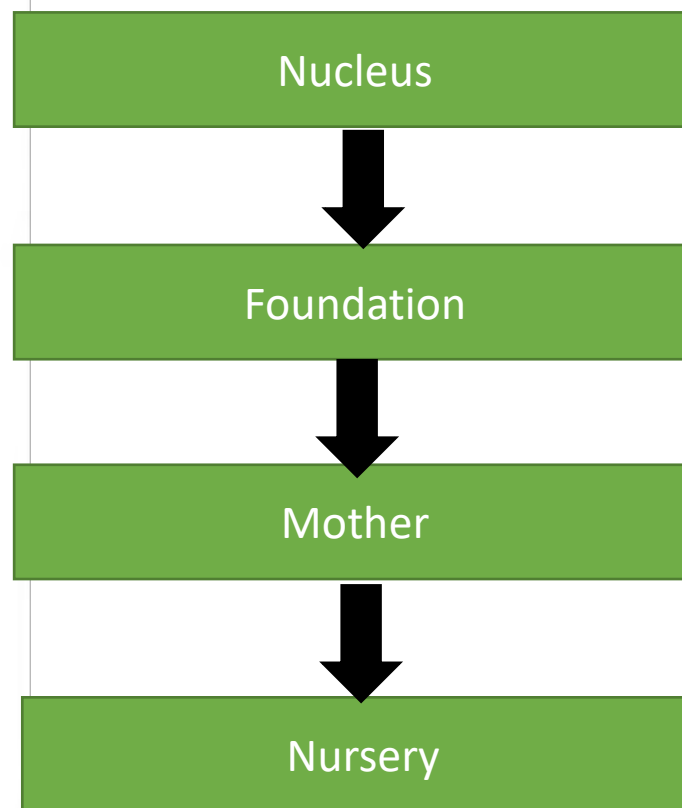
**What are the main
features of the
Dutch/EU system?**

Classic route

Start clean



© vermeerderingstuinen nederland



Source: CAV

End clean

Services: fruit
trees, seed,
vegetables, flowers



Independent service
provider under the
ministry

Inspection:

- Delegated authority
- 90 inspectors
- Cover CAC & Elite

Services:

- Certification
- Inspection
- Diagnostic & testing
- Thermotherapy
- Biological indexing
- quarantine
- Variety testing
- Maintenance – nucleus material

Certification:

- Minimum EU – CAC
 - (Plant passport)
- Elite Certification
 - Voluntary (70%)

Elite-uitvoering			
	Botanische naam:	Malus domestica 'Cripps Pink'	
	Handelsnaam:	Prima Pink	
	Tuinstam:	'Golden delicious Reinders'	
	Onderstam:	'M 9'	
1234567	Reg.nr:	12345	Categorie: Gecertificeerd
	Partijnr:	2017.1	Aantal: 216 certificaten
			Dat: 2017

Laboratory:

- Diagnostics
- R&D
- Virus cleaning

Monitoring and surveillance





Independent service
provider under the
ministry



Indexing:

- Indicator plants
 - Glasshouse
 - Orchard (hardwood indexing)

Services:

- Certification
- Inspection
- Diagnostic & testing
- Thermotherapy
- Biological indexing
- quarantine
- Variety testing
- Maintenance – nucleus material

Quarantine:

Import inspections



Variety testing:

Variety testing DUS



DNA fingerprinting

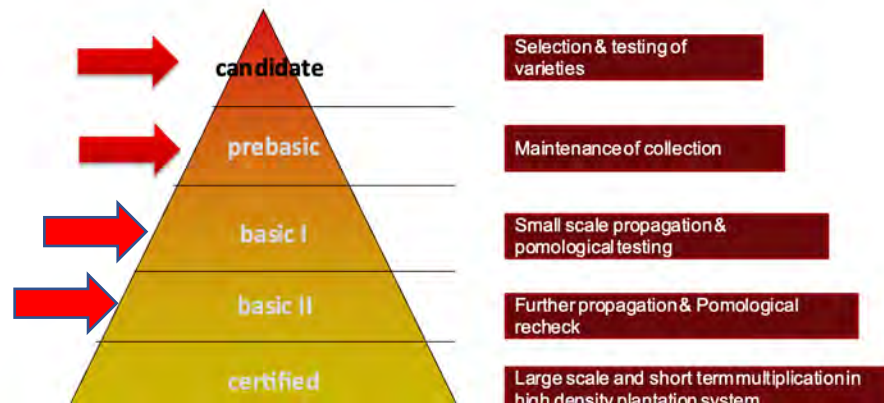




Independent service
provider under the
ministry

Services:

EU/EPPO Certification "pyramid"



• Maintenance –
nucleus material





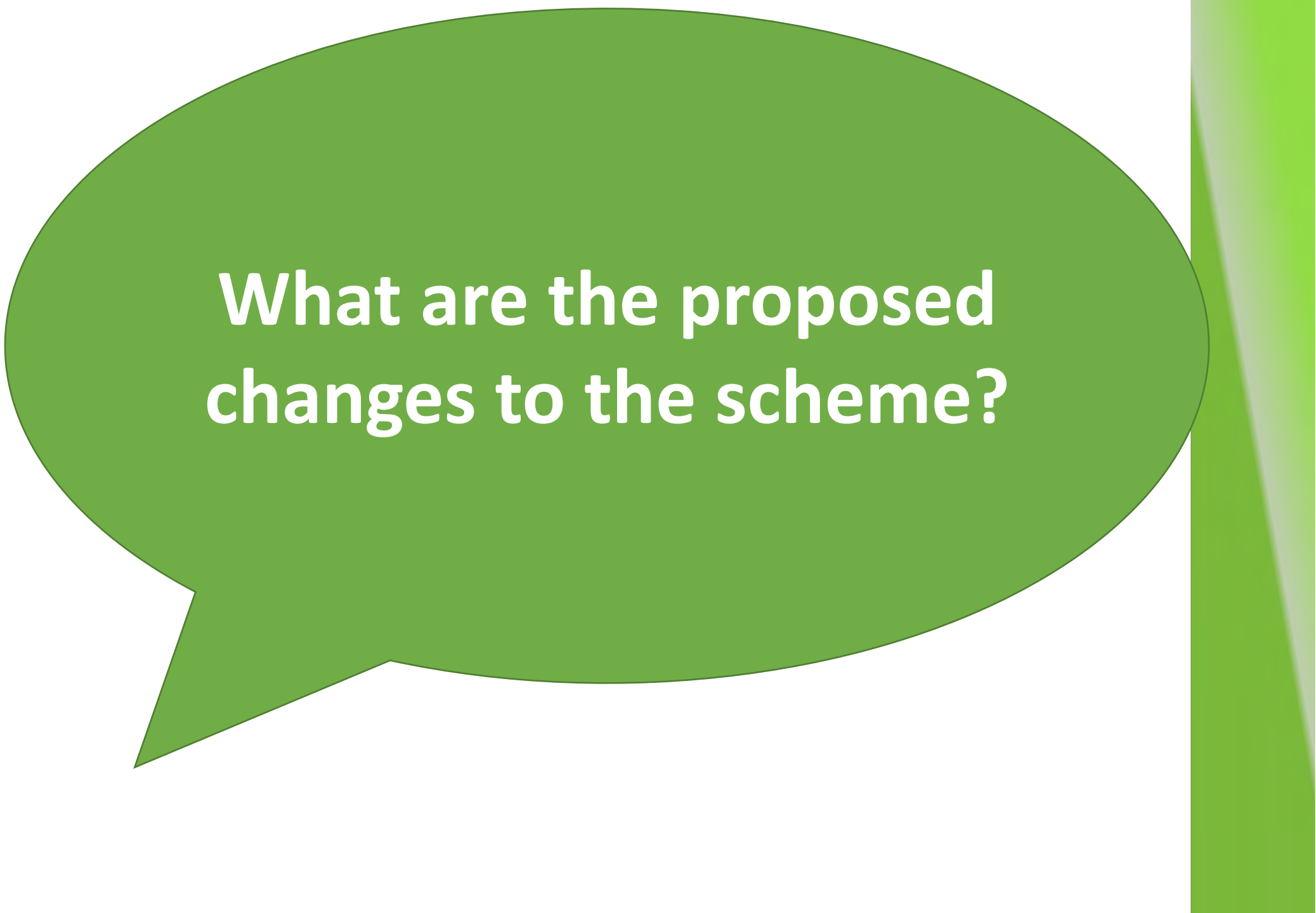
*vermeerderingstuinen
nederland*

Independent provider
of bud/graft –
scions/rootstocks

Bud park:

- Illegal to cut budwood in orchards
- Focus – bud quality
- All certified budwood supply to nurseries
- Replace budwood trees every 5 seasons – maintain quality
- Restart with clean nucleus material





**What are the proposed
changes to the scheme?**

PIPs objectives

1. ↑ quality of clean plant material
2. ↑ efficiency and ↓ timeline
3. ↑ level of certification

Proposed changes



1. Scheme regulations = best practice
 - a) Implementation – **restart**
2. ISP1-3 – **Independent lab** (quarantine + scheme) & nucleus
 - a) Refocusing SAPO
3. Focus on “**start clean – end clean**”
 - a) Test free vs visually free (NGS) – review tests (phytosanitary committee)
4. Mother blocks – **budwood parks**
 - a) No budwood cut in commercial orchards
5. **Inspection** – PlantSA
 - a) Include ‘uncertified material’
6. **User-pay** principle



**What is the take-home
message?**

Take home
message

```
graph TD; A([Take home message]) --> B["START WITH THE RIGHT GENETICS"]; A --> C["START CLEAN"]; A --> D["START -RIGHT NURSERY TREE"]; B --> E["END WITH THE SAME GENETICS"]; C --> F["END CLEAN"]; D --> G["END WELL"];
```

**START WITH THE
RIGHT GENETICS**

**END WITH THE SAME
GENETICS**

START CLEAN

END CLEAN

**START -RIGHT
NURSERY TREE**

END WELL

FRESH QUARTERLY

FOR THE DECIDUOUS FRUIT GROWER

ISSUE ELEVEN
Dec 2020

HORTGRO
Growing Fruit IQ

The plant
material
issue

FRESH QUARTERLY

FOR THE DECIDUOUS FRUIT GROWER

ISSUE TWENTY
Mar 2023

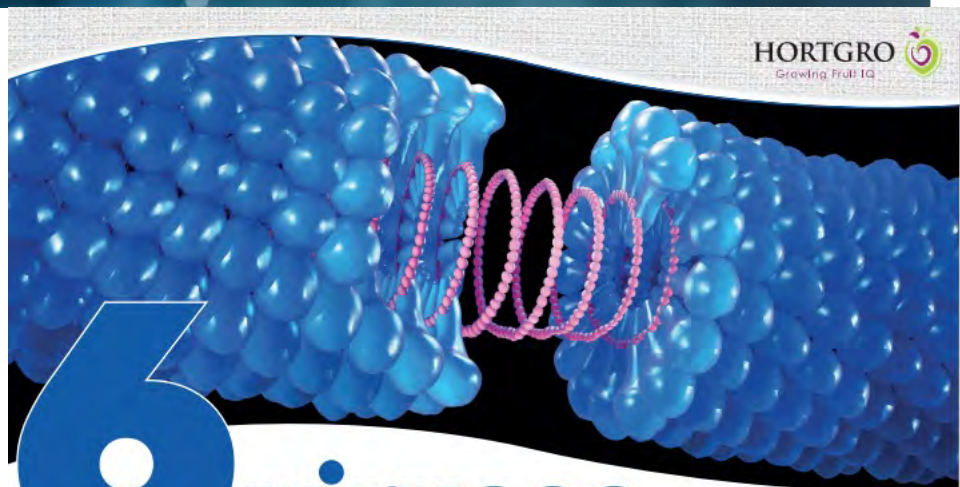
HORTGRO
Growing Fruit IQ



How do we achieve
Nursery-Tree Quality?

WHAT IS A VIRUS?

HORTGRO
Growing Fruit IQ



6 viruses and a viroid

The essentials explained for pome- and stone-fruit growers seeking to prevent losses.

A graphic representation of a virus similar to apple chlorotic leaf spot virus. The blue structure is its protein coat, and the pink structure is its genetic material.

Bacteria and fungi are other examples of pathogens. Bacterial cells are roughly 10 to 100 times bigger than viral particles, and

https://www.hortgro-science.co.za/wp-content/uploads/docs/dlm_uploads/2024/03/virus-english-.pdf

HORTGRO
Growing Fruit IQ

VIRAL

economics



The financial repercussions of diseases go further than you might think.

The cost of disease is easy to see when infection equals death or disability. But viruses and viroids of fruit trees seldom kill their hosts and may cause few obvious signs of disease. So why are they so bad for the bottom line? There are five main reasons.

1. Direct losses

Viral infections can result in direct losses when trees die, or fruit is affected. For example, apple chlorotic leaf spot virus, apple stem grooving virus, apple stem pitting virus, prune dwarf virus, and Prunus necrotic ringspot virus can all cause graft union failure in susceptible cultivars.

Prunus necrotic ringspot and prune dwarf viruses can also decrease bud take after grafting. Infection of either scion or rootstock with prune dwarf virus has been reported to reduce bud take by up to 50% in almonds. A German study found that viral infections could reduce bud take in apple nurseries by as much as two-thirds.

Pear stony pit caused by apple stem pitting virus is an example of fruit damage related to viral infection. Affected pears are deformed and gritty. Up to 94% of the fruit on an infected tree can be damaged in a bad year.

In SA, plum viroid 1 causes sporadic losses in certain plum cultivars due to marbling. Infected trees look fine but abnormal appearance and quality render some fruit unmarketable. The occurrence of marbling seems to be influenced by environmental stress – a pattern also seen with many viral infections.

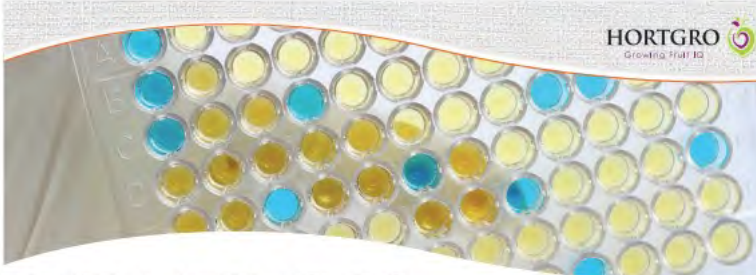
2. Reduced growth and yields

Failure to thrive is arguably a more significant – and underrated – outcome of viral infections in deciduous fruit trees than direct losses. One reason is that poor tree performance due to infection can be hard to disentangle from other causes such as drought or replant disease. Another is that the consequences of infection are cultivar dependent.

For example, researchers reported yield reductions of 40 - 50% in Golden Delicious and Red Delicious infected with apple mosaic virus, while yield reductions in McIntosh were less than 10%.

Infections with multiple viruses further muddy the waters. Whereas peach trees infected with Prunus necrotic ringspot virus had yield reductions of 18%, those infected with both Prunus necrotic ringspot

HORTGRO
Growing Fruit IQ



TEST METHODS demystified

Positive and negative results in the ELISA test are indicated by a colour change.

Do you think ELISA is the girl next door and RT-PCR is a new stone-fruit rootstock? Then you need to read this article.

ability of the test to detect very low levels of the target pathogen. Specificity is the ability of the test to differentiate its target from similar pathogens. The perfect test would be 100% sensitive and 100% specific – but there are no perfect tests in the real world.

The trade-off between sensitivity and specificity is shown in figure 1. As a rule of thumb, the greater the sensitivity of a test, the greater the risk of a false positive, and the greater the specificity, the greater the risk of a false negative.

3. Pathogens can change

Pathogens such as viruses mutate over time and new strains replace older ones. A test that worked for an older strain will not always perform as well on a new strain. Like the antivirus software on your computer, tests for plant pathogens need regular updating.

FIGURE 1: The trade-off between sensitivity and specificity

Two tests – A and B – can identify a hypothetical blue organism by detecting its colour. Test A is 100% specific. It is very strict about what counts as blue and will never call a green organism blue. But it also throws out the 16% of blue organisms that are turquoise. Test B is 100% sensitive. It detects any degree of blueness, so it never misses a blue organism. However, it will classify about 16% of green organisms as blue because they are turquoise.

The figures for real tests and real organisms will depend on the technology and how much the organisms overlap, but the fundamental trade-off still applies.

