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SESVanderHave Root-knot nematode resistant sugar beet varieties – an innovative breeding solution to help growers sustaining their rotation

Plant-parasitic nematodes are economically important pests associated with nearly all agricultural crops. Cyst nematodes (*Heterodera* and *Globodera* spp.), root-knot nematodes (Meloidogyne spp.) and lesion nematodes (*Pratylenchus* spp.) rank at the top of list of most important species. Root-knot nematodes are widely spread. Under the most important species *M. incognita*, *M. javanica*, *M. hapla*, *M. fallax* and *M. chitwoodi* can be found. Root-knot nematodes can cause severe damage in arable crops such as potatoes. Management is often difficult due to their wide host range, low damage threshold and fast multiplication. Growing resistant crops is a good way to manage this pest.

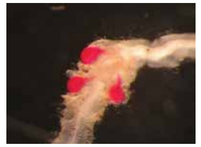


Figure 1: J2 juvenile (infectious stage) /
Figure 2: Adult female in the root (colored with Fuchsine acid) (Wesemael, ILVO)

Pest symptoms root-knot nematodes and economic damage

WHAT HAPPENS?

Root-knot nematodes penetrate the root at J2 stage and form feeding sites	
Above ground symptoms	Below ground symptoms
Often absent	Gall / knot formation on roots and tubers
Wilting, stunting and chlorosis	Reduced absorbtion of water and nutriens
Damage depends on species, initial population density, crop and crop cultivar, temperature and growing season length	

WHAT DOES DAMAGE LOOK LIKE?

Figure 3: Root-knot nematode galls on potatoes and carrots. Presence of egg mass just under the potato tuber skin. (Wesemael, ILVO)

HOW DO THEY SPREAD?

Egg containing soil	Infected plant material
Best control measure is therefore avoidance of introduction	

IMPACT OF THE CROP IN THE ROTATION?

Root-knot nematodes have a large host range. Crops in the rotation respond differently to the development of the nematode population.

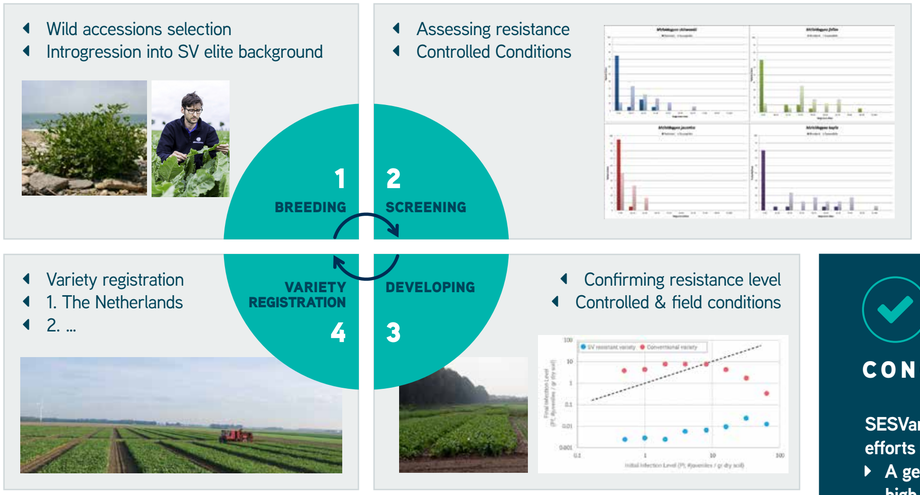
POPULATION		
Reduces	**Remains stable**	**Builds up**
Strawberry, chicory, lily, alfalfa, spinach, tulip	Pea, perennial ryegrass, beetroot, lettuce, onion, spring barley	Potato, carrot, salsify, tomato

Figure 4: Example of the evolution of the root-knot nematode M. chitwoodi population in function of the cultivated crops

ECONOMIC IMPACT?

- Yield loss due to reduced plant stand, decreased photosynthesis and malfunctioning roots
- **'Quality damage'** affecting processing industry or consumer acceptance.
- EPPO A2 listing (EU) as **quarantine organisms affects market entry.**

SESVanderHave breeding efforts in the development of root-knot nematodes resistant varieties



1. BREEDING

- Identification of a root-knot nematodes (RKN) resistance source in a wild accession in the standard wild accessions' selection workflow
- Development of sugar beet lines with high level of RKN resistance
- Introgression into SESVanderHave elite background

2. SCREENING

- Resistance tests in controlled conditions demonstrating a high level of resistance to M. chitwoodi
- Confirming high level of resistance to other Meloidogyne species (M. fallax, M. hapla, and M. javanica)

3. DEVELOPING

- Confirming very strong resistance with very low multiplication of M. chitwoodi under greenhouse and farmer field conditions (collaboration Wageningen University Research - SESVanderHave)
- Further research to estimate the impact on a sensitive crop in the same rotation ongoing

4. VARIETY REGISTRATION

Official variety trials started in 2020 in the Netherlands with a combined root knot nematode and beet cyst nematode sugar beet variety

CONCLUSIONS

SESVanderHave breeding efforts have resulted in:

- **A genetic solution with high resistance level to multiple species of root knot nematodes**
- **Competitive sugar beet varieties being brought to the market to meet the future requirements**
- **New perspectives for growers of sensitive crops who will be able to grow resistant sugar beet as a 'break crop' to greatly reduce the risk of loss of quality, yield, and potential regulatory issues.**

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