Advances and challenges in Breeding Disease-Resistant Vegetables

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Applied Genomics – KWS Vegetables

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SEEDING
THE FUTURE
SINCE 1856

KWS

KWS has a very young vegetables breeding program

Sugarbeet

New start in **Einbeck**

Vegetables

1856 → 1920 → 1945 → 1955 → 2019 → today

Cereals

Corn

Leading international player in plant breeding operating in over 70 countries

Breeders develop plants with future challenges in mind

Resistance

To diseases and pests

Yield stability

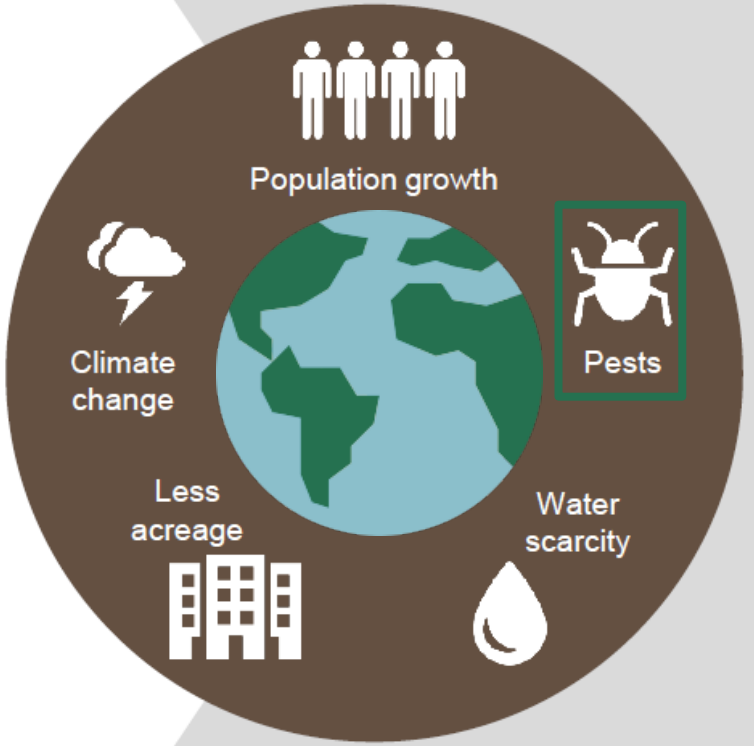
Improvement in spite of climate change as well as adaptation to regional conditions

Nutrient efficiency

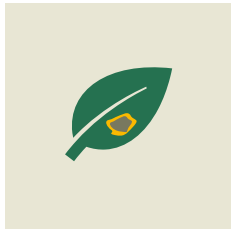
Efficient use of resources such as fertilizer

Stress tolerance

For example, scarcity of water



Challenges for Disease-Resistance Breeding



Known Diseases	Emerging Diseases	Applicability in Breeding
▪ Mixed infections (e.g. tomato: ToBRVF/PepMV) ▪ Diseases without existing tolerances or resistances (e.g. cucumber: Forc, watermelon: Fon2) ▪ Diseases with strong effects on breeding process (e.g. cucumber: CGMMV) ▪ Quality of some phytopathology assays is limiting the research	▪ New diseases can spread quickly and globally (e.g ToBRVF) and creating resistant varieties takes time (years!) ▪ Some pathogens undergo very fast evolution and resistant-breaking strains develop in 2-5 years (e.g. downy mildew in spinach, powdery mildew in cucurbits). ▪ Arms race: In spinach breeding is very focused on resistances	▪ Limitations of introducing new resistances (e.g. crossability with wild germplasm, multiple QTLs, patent landscape) ▪ Pleiotropic effects of introduced genes (effects on fruit quality and yield, incompatibility of specific genes, heat stability) ▪ Translation genomics to functions can be limited by missing mechanistical insights

The development of Resistances needs extensive gene discovery research

We need to understand the biology behind the resistance trait:

- We need to know the relevant target gene(s) and their biological function
- The regulation of the target sequence is of importance if optimal mutation site needs to be identified

Requires exchange of knowledge and development by:

- Attending Scientific Conferences and Symposia
- Stakeholder Dialogues
- Collaborative Research Projects with university and institutes (pre-competitive)
- In house Applied Research


Thank you for your attention.
Any questions?