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Ökologische Saaten
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Liveseeding Webinar „Hot Water Treatments for Vegetable Seeds“

Dr. Jelena Baćanović-Šišić
Seed diagnostic| Phytopathology
Bingenheimer Saatgut AG
Organic. Fair. Dynamic.

LiveSeeding

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Ökologisch.
Partnerschaftlich.
Lebendig.

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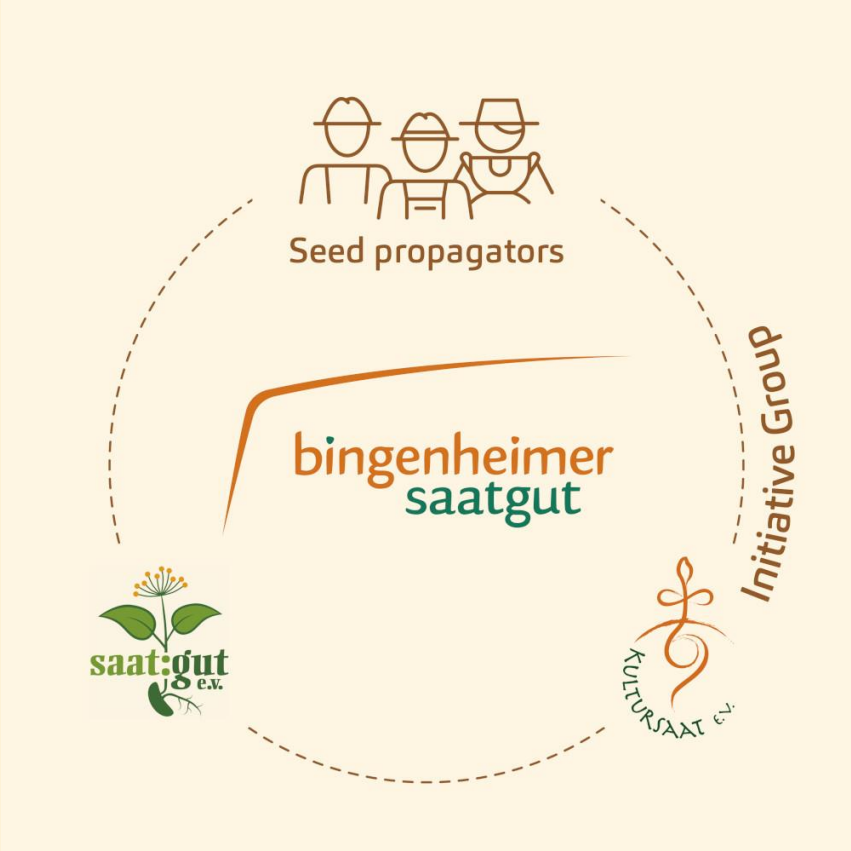
Part of a vibrant network



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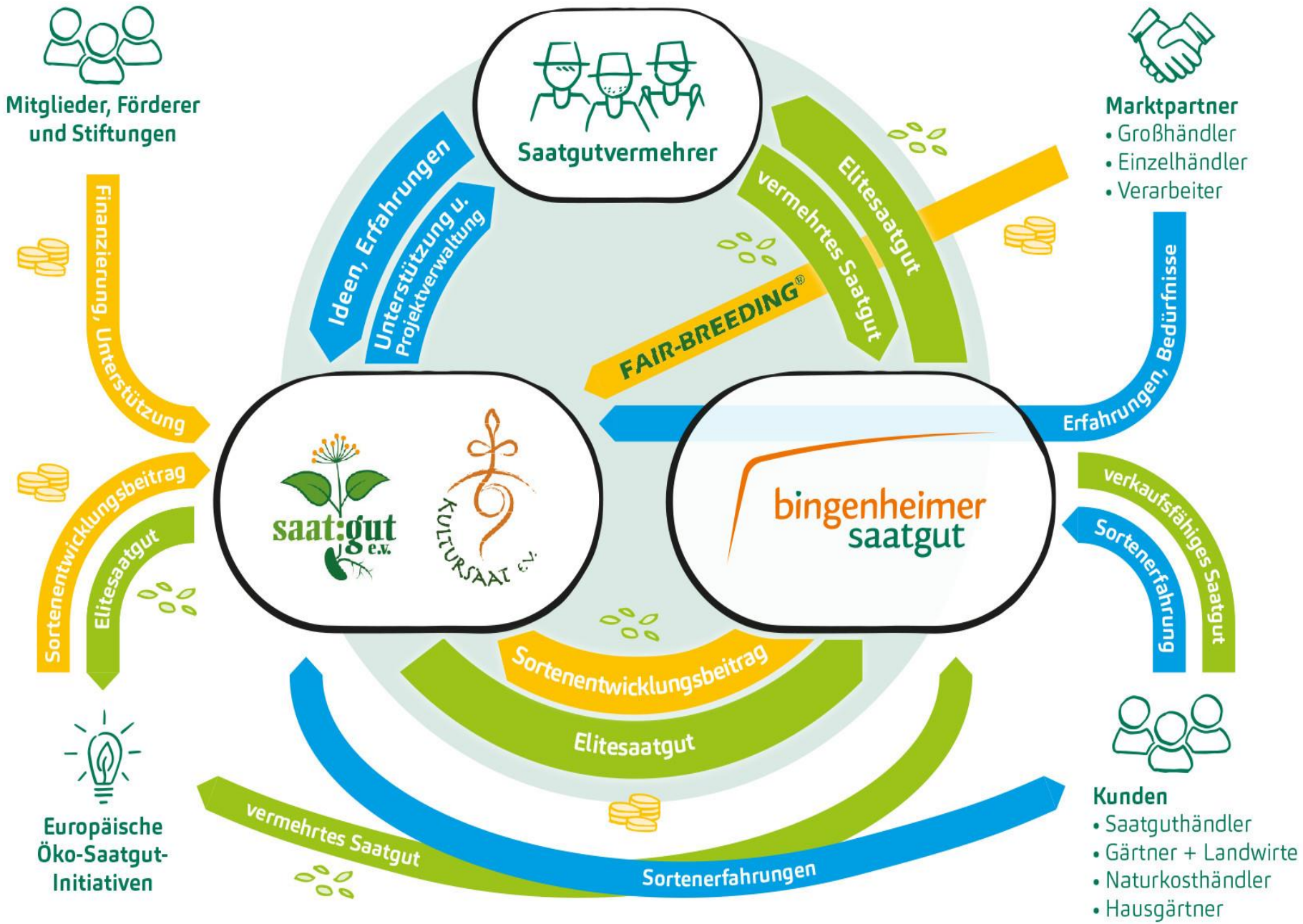
Mitglieder, Förderer und Stiftungen
Saatgutvermehrer
Marktpartner
• Großhändler
• Einzelhändler
• Verarbeiter
Ideen, Erfahrungen
Unterstützung u. Projektverwaltung
Elitesaatgut
vermehrtes Saatgut
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Finanzierung, Unterstützung
Erfahrungen, Bedürfnisse
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Sortenentwicklungsbeitrag
Elitesaatgut
verkaufsfähiges Saatgut
Sortenerfahrung
Sortenentwicklungsbeitrag
Elitesaatgut
vermehrtes Saatgut
Sortenerfahrungen
Europäische Öko-Saatgut-Initiativen
Kunden
• Saatguthändler
• Gärtner + Landwirte
• Naturkosthändler
• Hausgärtner

Bingenheimer Saatgut AG

1975: idea of committed gardeners => foundation "Initiative Group for Vegetable Seeds from Biodynamic and Organic Breeding" - *group can be understood as a network of the multipliers/ propagators and breeders based on partnership*

1985: Founding Allerleirauh GmbH: Sales, processing and packaging

1994: the Kultursaat Association was founded to promote the development of new vegetables varieties for the professional organic farmers

2001: Foundation of Bingenheimer Seed AG

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Bingenheimer Saatgut AG

> than 100 permanent employees, plus seasonal workers

– 12 departments

> 500 open pollinating varieties of vegetables, herbs, flower seeds and green manure

> 90 varieties from the Kultursaat

- 1 ha outdoor and 110m^2 greenhouses

> 115,000 customers

- As of 2017 we deliver to 50 countries worldwide

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https://www.bingenheimersaatgut.de/en/

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Hobby gardener | Professional grower | Specialised Resellers

Shipping region: Germany (DE) | Language

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Our new varieties

Discover all the novelties
of the 2024 season
in our online shop.
All new varieties

Welcome to our online shop!

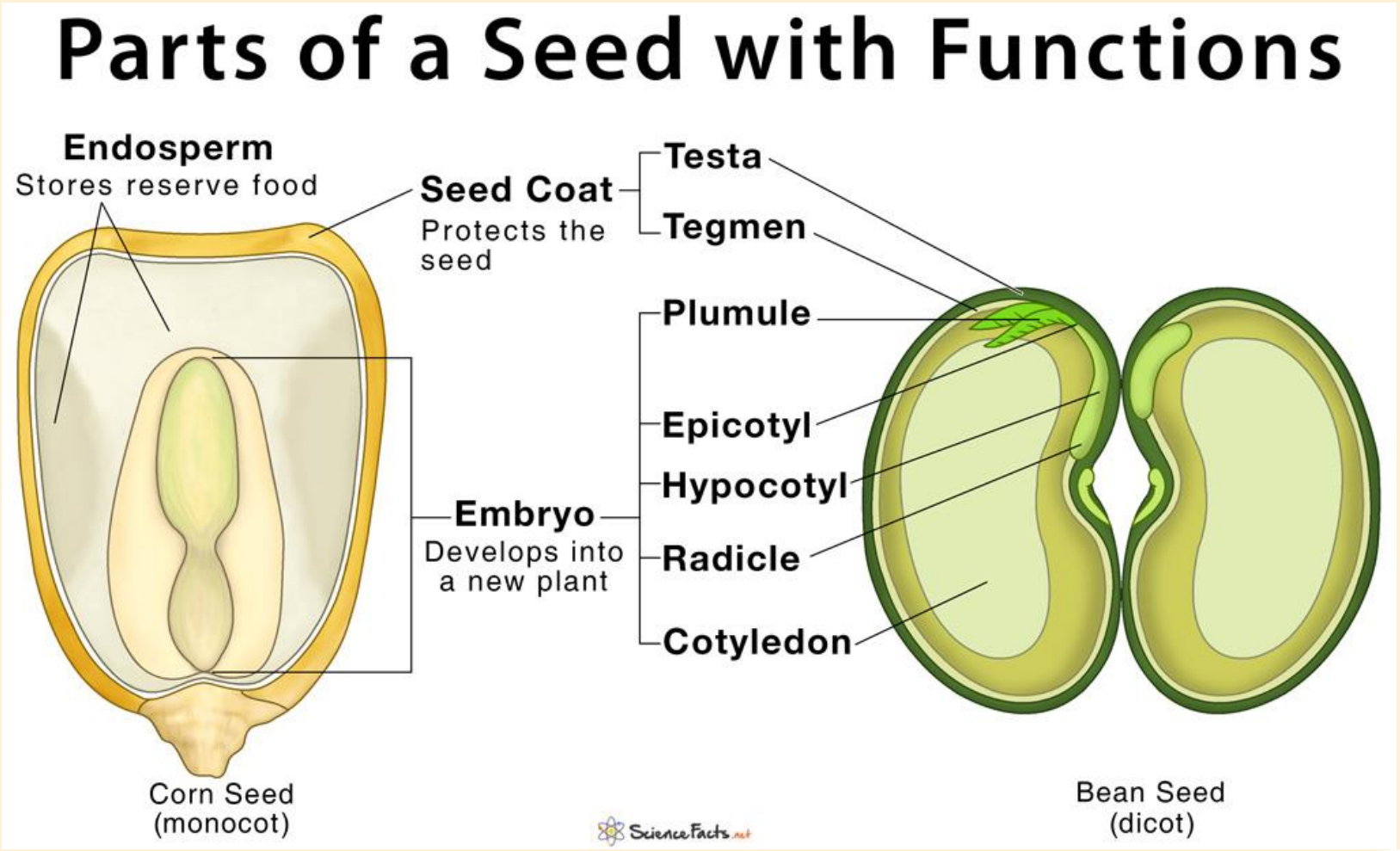
Our concept: Organic seeds – seed-resistant varieties of the highest quality

Are you looking for organic seeds for the field, greenhouse, garden or balcony box? Then you've come to the right place! We only sell organically certified seeds. And here is what matters to us:

- **Reproducible, seed-resistant varieties.** No hybrid varieties, no patents, no genetic engineering or biotechnology.
- **Promotion of biodynamic / organic breeding** - organic right from the start.

Seeds
Where it all begins and ends

Parts of a Seed with Functions



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Seedborne vs Seedtransmitted

- Seedborne pathogens – carried by seeds (externally or internally) that may or may not be transmitted to plants grown out of those seeds causing disease

- Seedtransmitted pathogens – transmitted directly to plant growing out of infected seed, causing the disease

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Contamination vs Infecton

- Contamination – presence of pathogen on the seed surface

- Infection – pathogen is inside the seed, endosperm or embryo

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Significance of seedborne diseases

1) Loss of germination and vigor
2) Yield reduction
3) Reduction of marketable yield
4) Reduction in shelf life, etc.

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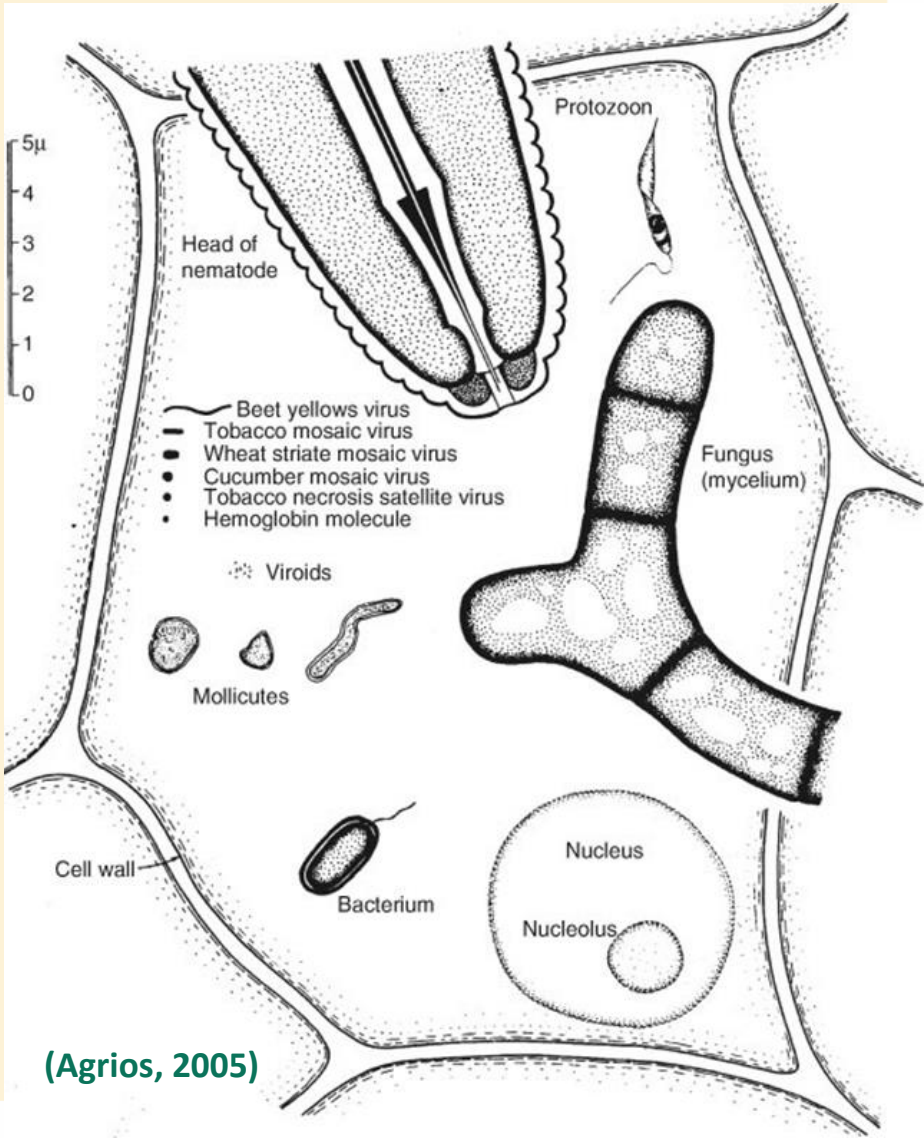
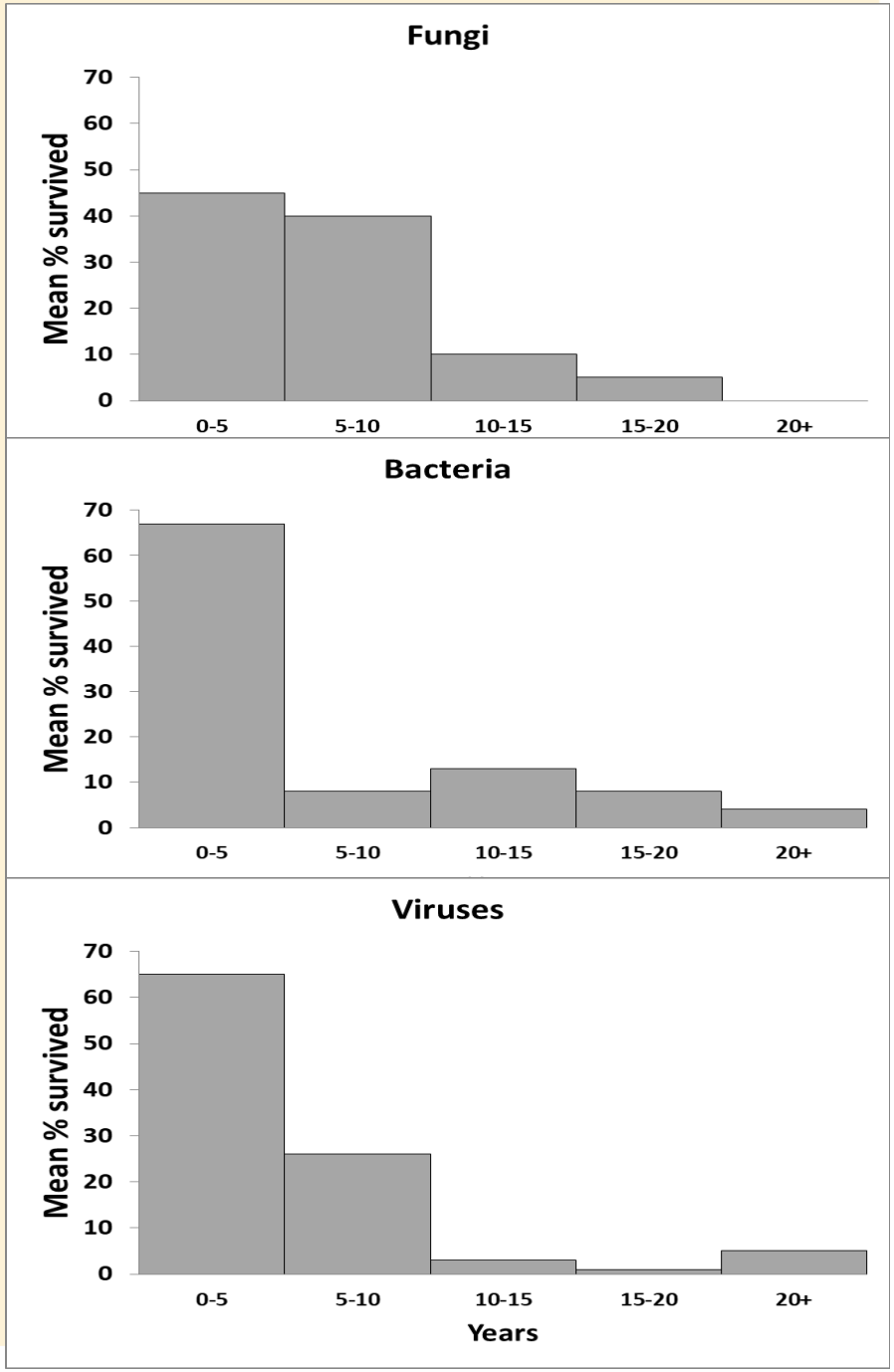
- **Pathogen –** living organism that causes disease in plants
- **Type of plant pathogens:**
  - Viroides
  - Viruses
  - Phytoplasma
  - Bacteria
  - Oomycota
  - Fungi
  - Nematodes



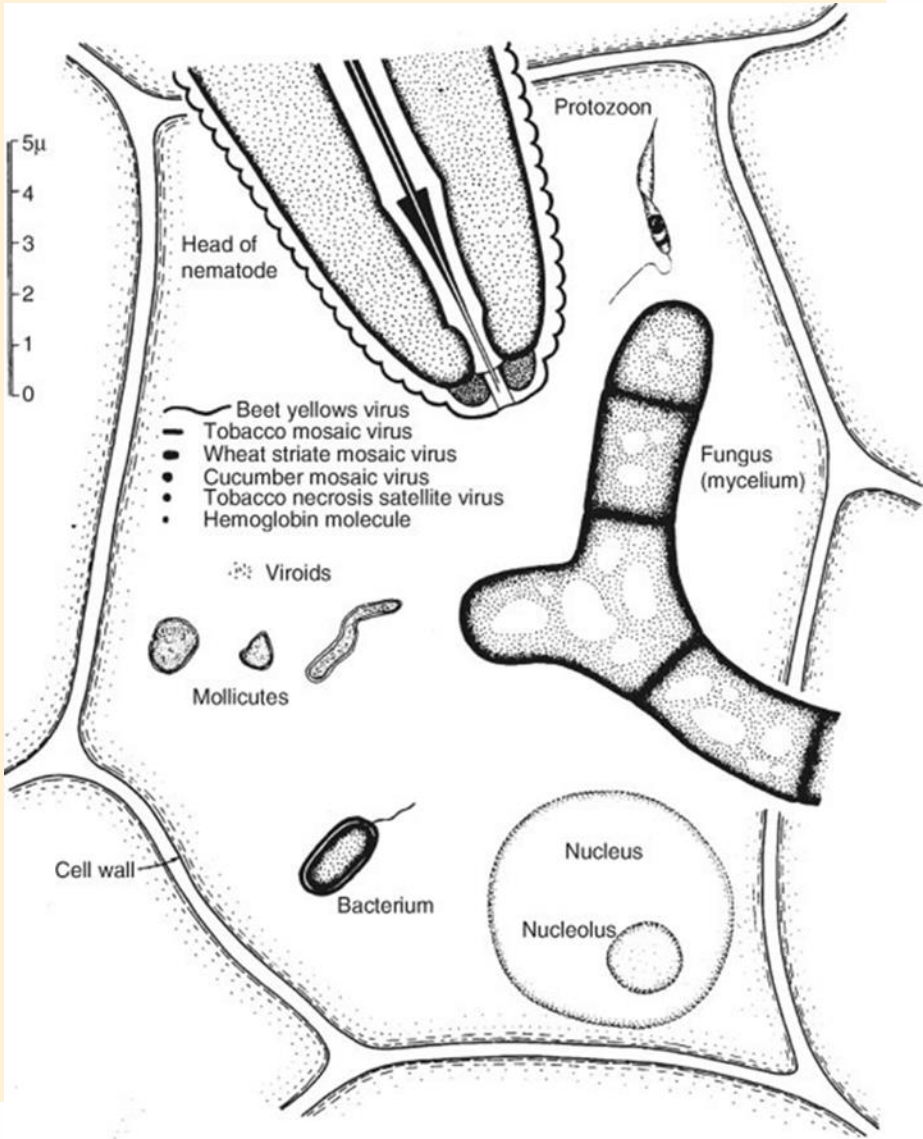
(Agrios, 2005)

How long can pathogen remain in seed?



Where they come from?

- Parent plant
- Soil
- Crop residues
- Irrigation water
- Other crops
- Weeds
- Insects



Mechanism of seed infection

- Pathogens can infect seeds **at all stages** of seed development!

1) **Anthesis** – flower development, pollen shed, pollination – smuts, ergots, viruses
2) **Seed development** – fertilization to maturity
3) **Seed maturity** – physiology maturity to harvest, during drying

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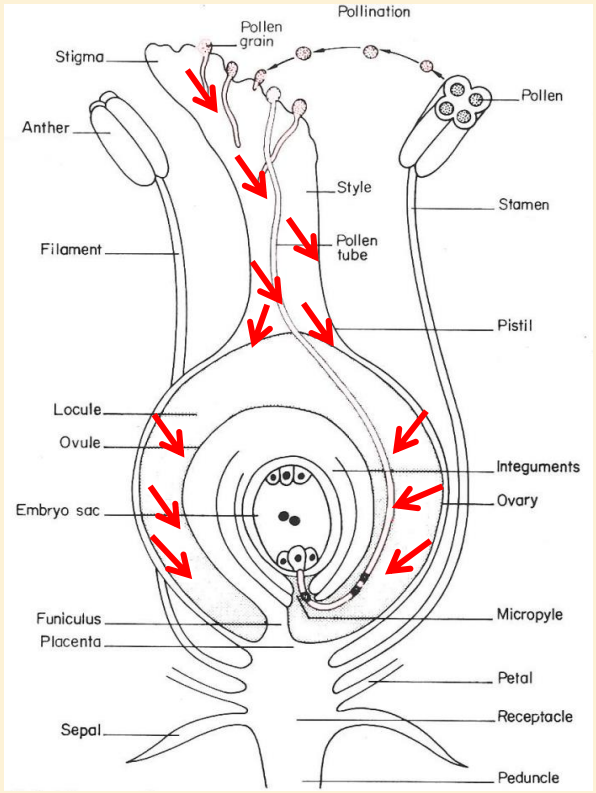
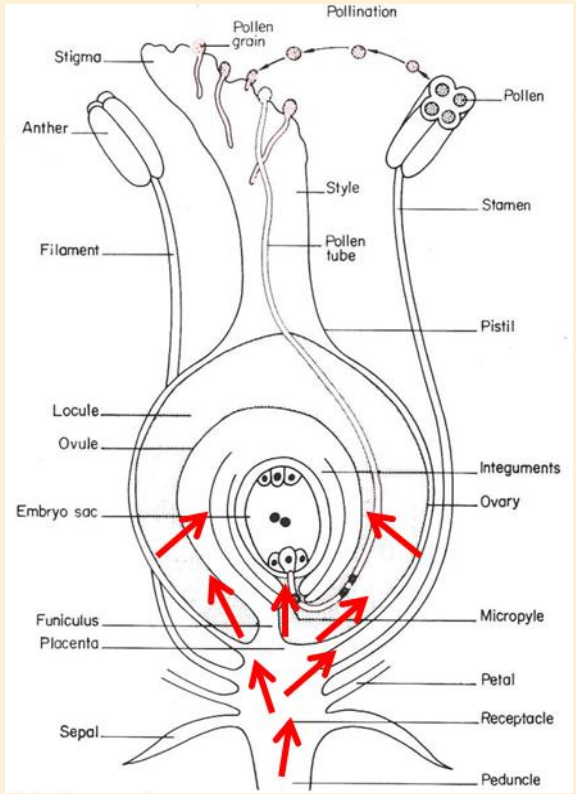
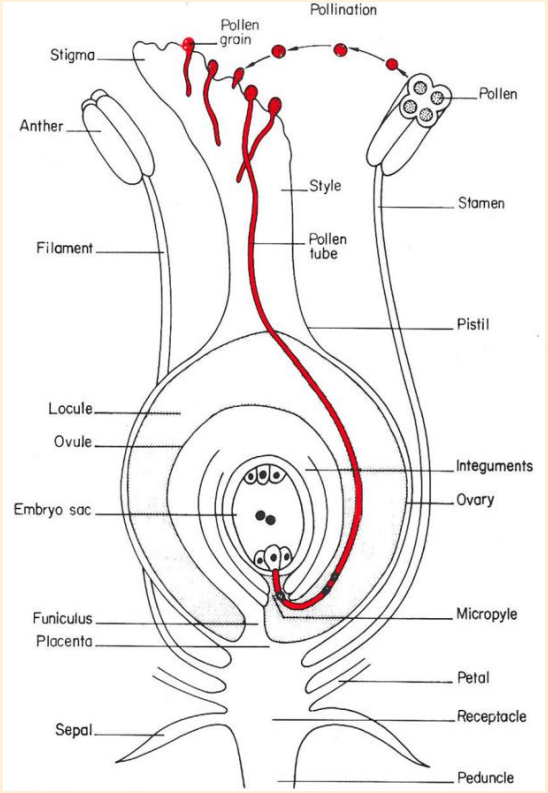


Infection through stigma, style and ovary
(ergots, loos smuts, *Fusarium* spp., *Botrytis*, *Cladosporium variabile*, *Cucumber mosaic virus*)

(Maude, 1996)



Systemic infection through the mother plant
(embryo-borne viruses, bacterial diseases, *Fusarium* spp., vascular wilt fungi)



Infected pollen
(some viruses)

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Location of pathogens in seed

- Biotrophs
  - Obligate parasite, do not kill the host, have narrow host range, can not be cultured; viruses some fungi; typically in embryo

- Necrotrophs
  - Kill host cells, feed on dead tissue, wide host range, can be cultures; fungi and some bacteria; typically seed coat and/or endosperm

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Pathogens on the seed coat

- *Xanthomonas campestris pv. campestris* - black rot in crucifers
- *Pseudomonas syringae pv. tomato* - bacterial speck in tomatoes
- *Alternaria spp.*- causes blights
- *Cladosporium spp.* - causing leaf mold
- *Botrytis cinerea* - causes gray mold
- Tobacco mosaic virus (TMV)

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Pathogens within seed coat

- *Fusarium* spp. – causing willt and root rot
- *Verticillium* spp. – Verticilium willt
- *Colletotrichum* spp. - causing anthracnose
- Tomato Brown Rugose Fruit Virus (ToBRFV)

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Pathogens in the edosperm

- *Fusarium* spp. – causing willt and root rot
- *Aspergillus spp.*
- *Penicillium* spp.

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Pathogens in the embryo

- *Fusarium* spp.
- *Colletotrichum* spp.
- *Pseudomonas syringae* pv. *phaseolicola* - causes halo blight in beans
- *Xanthomonas campestris* pv. *vesicatoria* - causes bacterial spot in peppers and tomatoes
- Tomato Mosaic Virus (ToMV)
- Tobacco Mosaic Virus (TMV)

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Seed borne inoculum trasholds

- *Lettuce mosaic virus (LMV)*
  - zero tolerance in USA and Australia
  - 0,1% in Europe
- *Xanthomonas campestris* pv. *campestris* in brassicas
  - 1 in 30 000 seeds
- *Phoma lingam* in brassicas
  - 1 in 10 000 seeds
- *Ascochyta fabae* in broad beans
  - 1 in 600 seeds
- *Cylindrocladium parasiticum* in peanuts
  - 1 in 400 seeds

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Seed health testing

- **Sensitive** – able to detect pathogen at low concentration
- **Specific** – able to detect targeted pathogen in the presence of non-targets
- **Speed** – rapid turnaround
- **Reliable** – unaffected by slight variation in test conditions
- **Repeatable** – consistent performance
- **Reproducible** – transferable, consistent performance across different laboratories
- **Cost-effective**

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Methods of detection of seed borne pathogens

Test type	Fungi	Bacteria	Virus	Nematodes
Visual examination	√	x	x	x
Grow-out	x	√	√	x
Bioassay	x	x	√	x
Wash or Soak - microscope exam	√	x	x	√
Blotter test	√	x	x	x
Agar media test	√	√	x	x
ELISA	x	√	√	x
PCR	√	√	√	√

Source: The American Phytopathological Society (APS)

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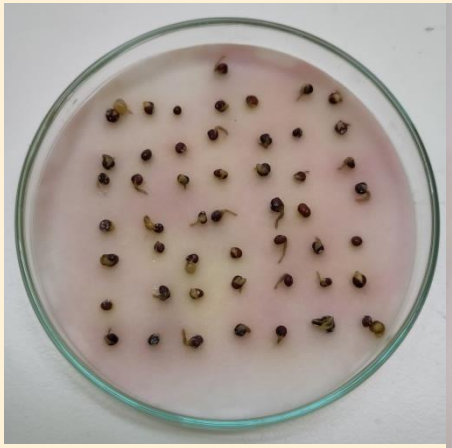
Blotter Tests

- For fungal pathogens
- Advantages - inexpensive, versatile, direct observation of viable pathogen
- Limitation – small numbers of seeds is tested, expertise needed

ISTA

Seed Health Methods 2023 (Desktop Version)

Price	Free
Associate Member-Price	Free

- 7 001a Detection of Alternaria dauci in Daucus carota (carrot) seed by blotter method — Download
- 7 001b Detection of Alternaria dauci in Daucus carota (carrot) seed by malt agar method — Download
- 7 002a Detection of Alternaria radicina in Daucus carota (carrot) seed by blotter method — Download
- 7 002b Detection of Alternaria radicina in Daucus carota (carrot) seed by malt agar method — Download
- 7 003 Detection of Botrytis cinerea in Helianthus annuus (sunflower) seed — Download
- 7 004 Detection of Leptosphaeria maculans and Plenodomus biglobosus in Brassica spp seed — Download
- 7 005 Detection of Ascochyta pisi on Pisum sativum (pea) seed — Download
- 7 006 Detection of Colletotrichum lindemuthianum in Phaseolus vulgaris (bean) seed — Download
- 7 007 Detection of Alternaria linicola Botrytis cinerea and Colletotrichum lini in Linum usitatissimum (flax linseed) seed — Download
- 7 008 Detection of Caloscypha fulgens in Picea engelmannii and P glauca (spruce) seed — Download
- 7 009 Detection of Fusarium circinatum in Pinus spp (pine) and Pseudotsuga menziesii (Douglas fir) seed — Download

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Seed treatments in Organic agriculture

1) Hot water treatment
2) Hot steam treatment
3) Botanicals/Plant extracts
4) Biological control agents
5) Essential oils

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Hot water treatment (HWT)

- Commonly used
- Effective against fungal and bacterial pathogens
- **Directly kills pathogen** – denaturation of proteins and enzymes; disruption of cell membrane
- Systemic acquired resistance **(SAR)** in plants
- Enhancement of seed vigor – **Priming effect**

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Considerations and Limitations

- Correct temperature and duration are crucial
- Too high or too long – seeds can be quickly damaged, reducing the germination rate
- Effective HWT – conditions differ not only among species but among cultivars and even seed lots
- Years of experience
- Trial and error

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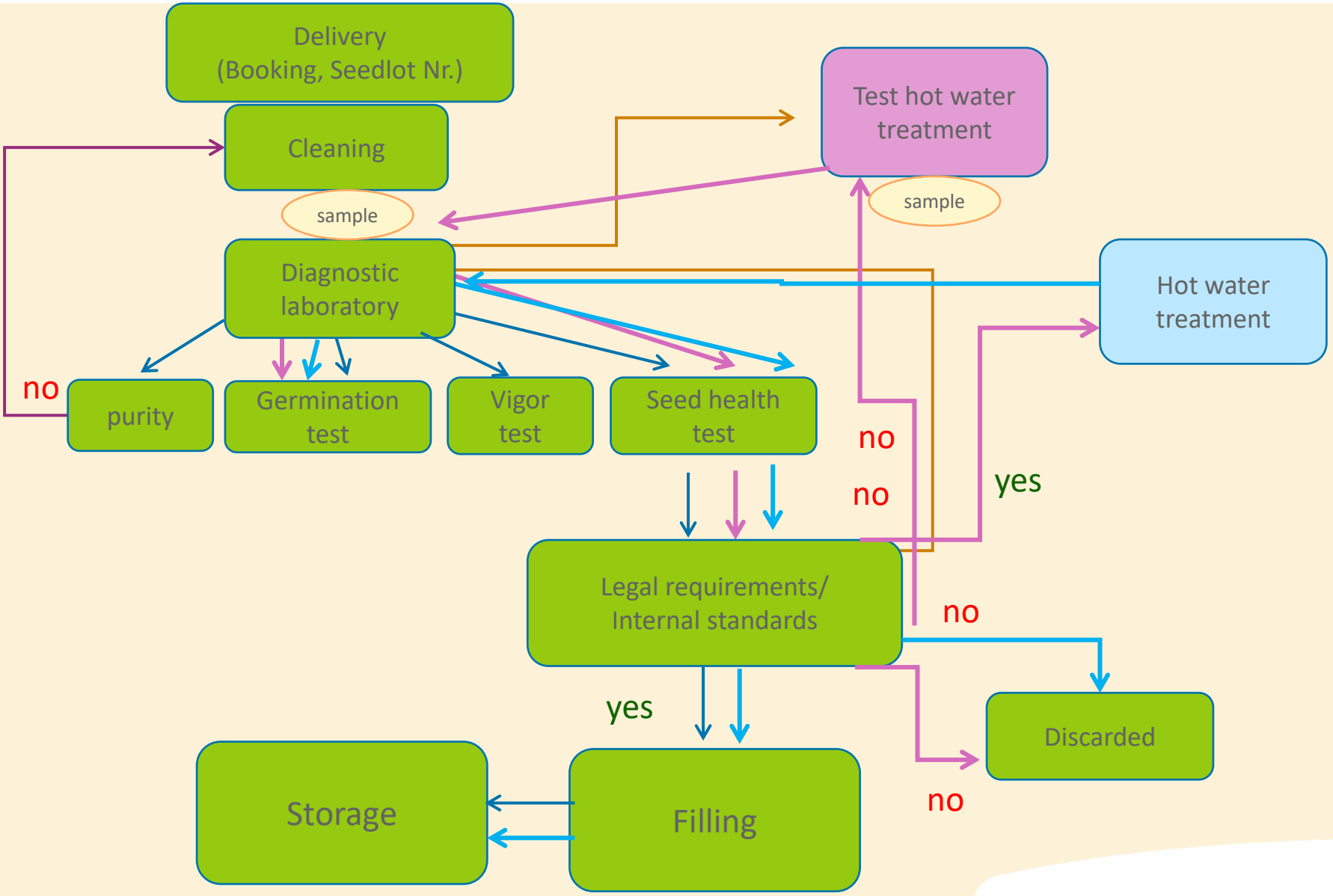
HWT at BSAG



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Species that are treated

Asia Salat	Savoy cabbage	Swiss chard	Celery
Pak Choi	Kale	Beetroot	Miner's lettuce
Lamb’s Lettuce	Kohlrabi	Carrots	Onions
Cabbage	Turnip	Parsly	Dill
Cauliflower	Oxheart cabbage	Radish	
Red cabbage	Fennel	Endive	
Broccoli	Pumpkins	Lettuce	

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Booking after delivery

Claytonia perfoliata - **Miner's lettuce**

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Cleaning

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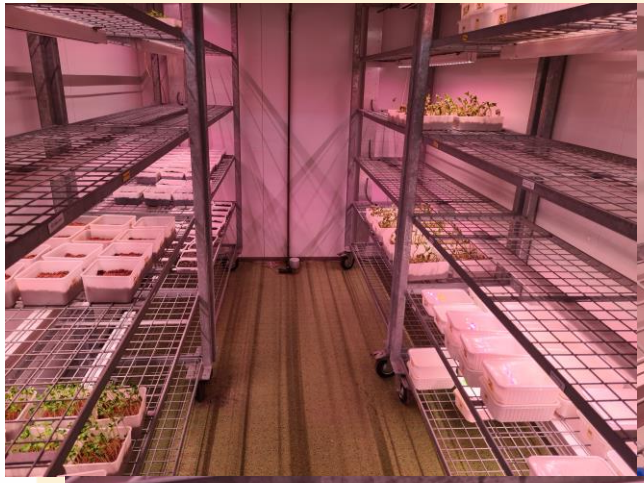
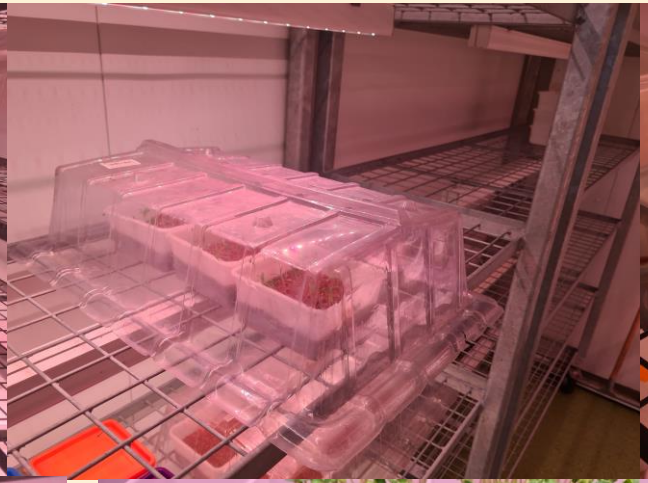
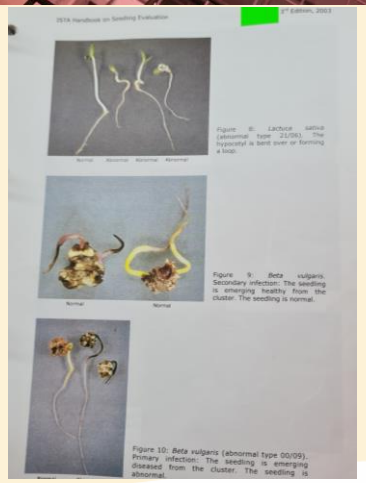
Diagnostic laboratory







Germination and vigor tests

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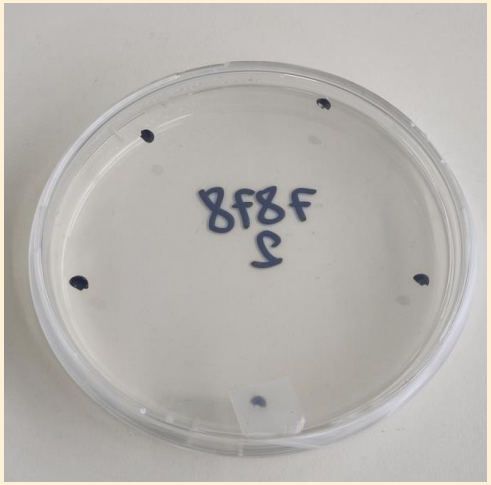
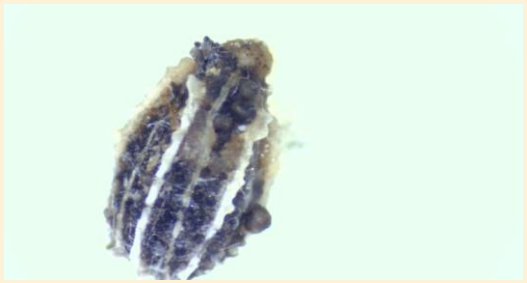
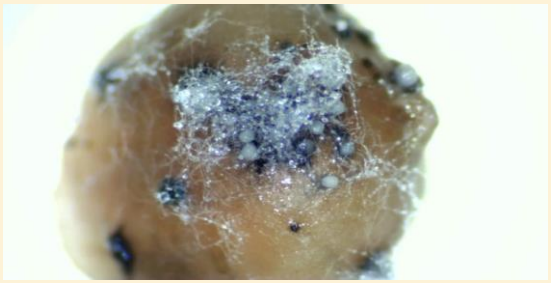
Diagnostic laboratory







Seed health testing

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Diagnostic laboratory

Test hot water treatment

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Test hot water treatment

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HWT

Equipment and Material List

- 500 liter water tank with automatic control and hot water heating
- 500 liter cold water tank
- Cargo lift with grid basket
- Centrifuge
- Circulation pump
- Treatment bag made of nylon fabric
- Scales
- Wire and wire drill unit
- Bag labels with wire
- Waterproof Sharpie (edding)
- Laboratory alarm clock-
- Drying racks, clean, free of foreign seeds, not defective, if necessary paper sheets to place underneath
- Dehumidifier
- Drying boxes with blower, clean and free of foreign seeds, with fleece inlay if necessary
- Seed humidity meter
- New bags
- New paper bags for reserve samples
- New labels for sacks and paper bags

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Max 6L volume in bags

Maximal weight of one bag

	Carrot	Pumpkin	Beetroot	Lamb lettuce	Parsley	Cabbage	Beans
Maximal weight [kg]	2,5	3,2	2,2	1,75	3,0	1,5	5,0
Maximal allowed humidity [%]	9,0	8,0	12,0	8,5	8,0	7,0	< 14,0

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10

Max 15 bags/treatment

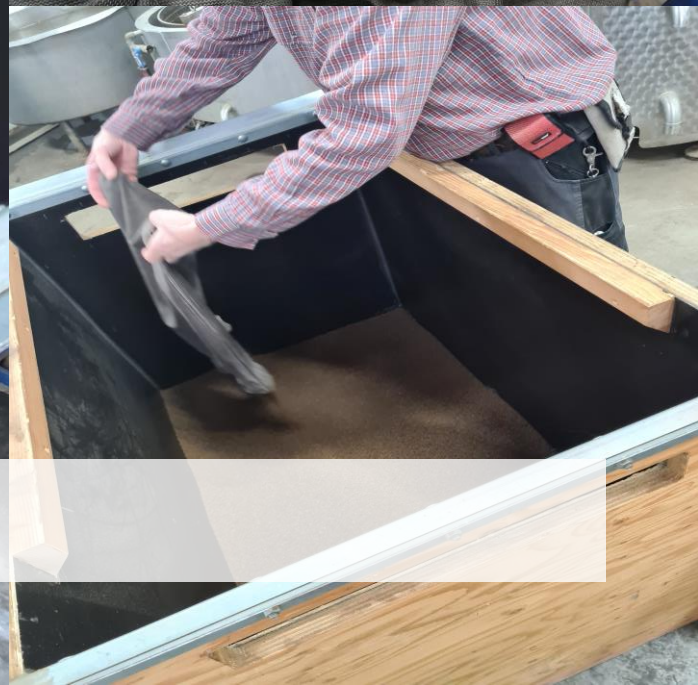
Preheating at 32°C

Main treatment

Cooling in cold water
Max 5 minutes

Centrifuge

Drying



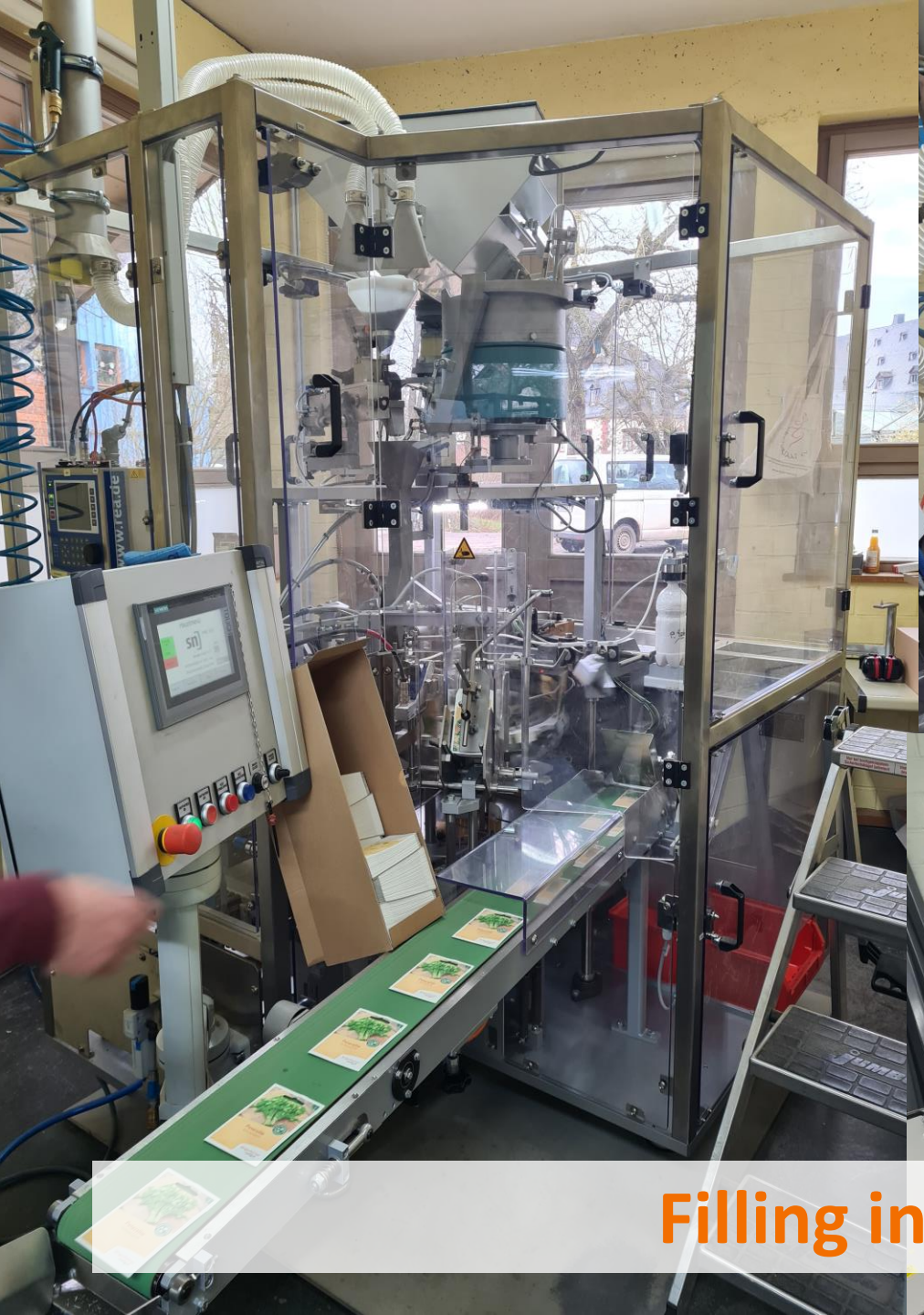
Drying

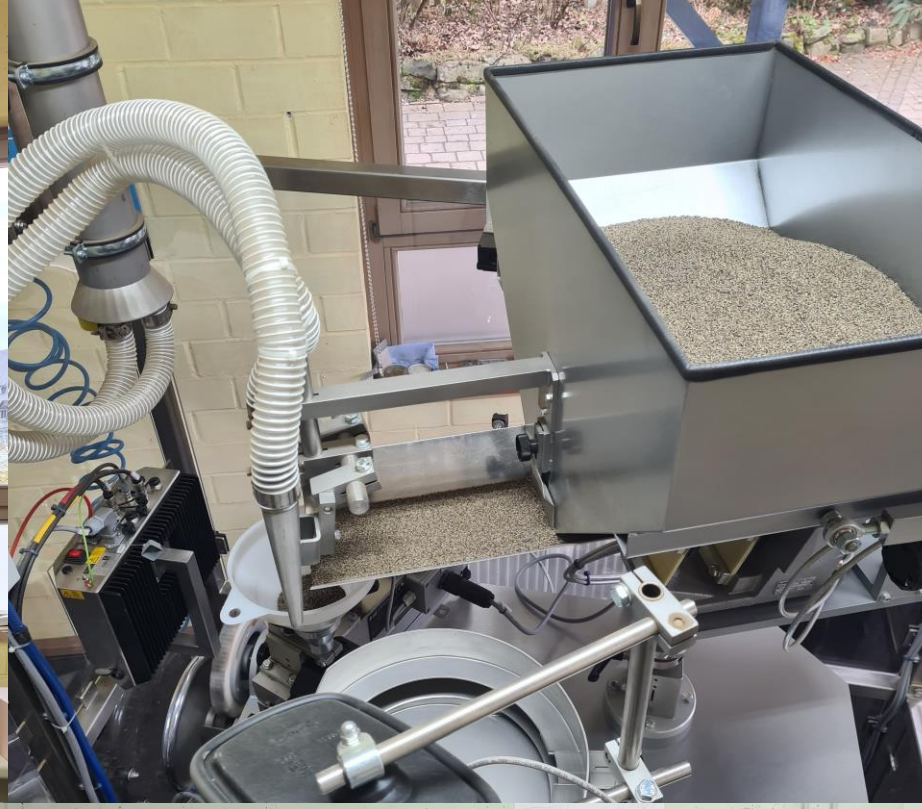
Drying


G795
20963
53/10
MOG-SG-104 (AS)
Möhre
EU-Standard
GenehmigungsNr: MOG300/23-81
2021
SRD
04.01.2024
DE-007-Öko-Kontrollstelle

Labeling

Filling in bags





Filling in bags

Storage

Robila

Carrot • Gulerod • Wortel

Persika

Outdoor Cucumber • Frilandsagurk • Augurk

Azur Star

Kohl Rabi • Glaskål • Koolrabi

Red Kuri

Pumpkin • Græskar • Pompoen

Neckarriesen

Lettuce • Hovedsalat • Kropsla

Aromata

Parsnip • Pastinak • Pastinaak

Pantos

Pepper • Peber • Paprika

Avano

Leek • Porre • Prei

Rodelika

Carrot • Gulerod • Wortel

Zuckertraube

Tomato • Tomat • Tomaat

Rainbow Chard

colorful swiss chard • Flerfarvet sølvbede
Kleurrijke snijbiet

bioverita

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Golden Bantam

Sweet corn • Sukkermais • Suikermais

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Wunder von Kelvedon

Pea • Markærte • Doperwt

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Ocimum basilicum

Basil large leaves • Basilikum storbladet
grootbladige basilicum

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Melissa officinalis

Lemon balm • Citronmelisse
Citroenmelisse

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Thank you for your attention

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