

# InNoBaHort

## Innovative sustainable Nordic- Baltic horticulture

Ulvi Moor

Nordic-Estonian Research Day

Tartu 2025

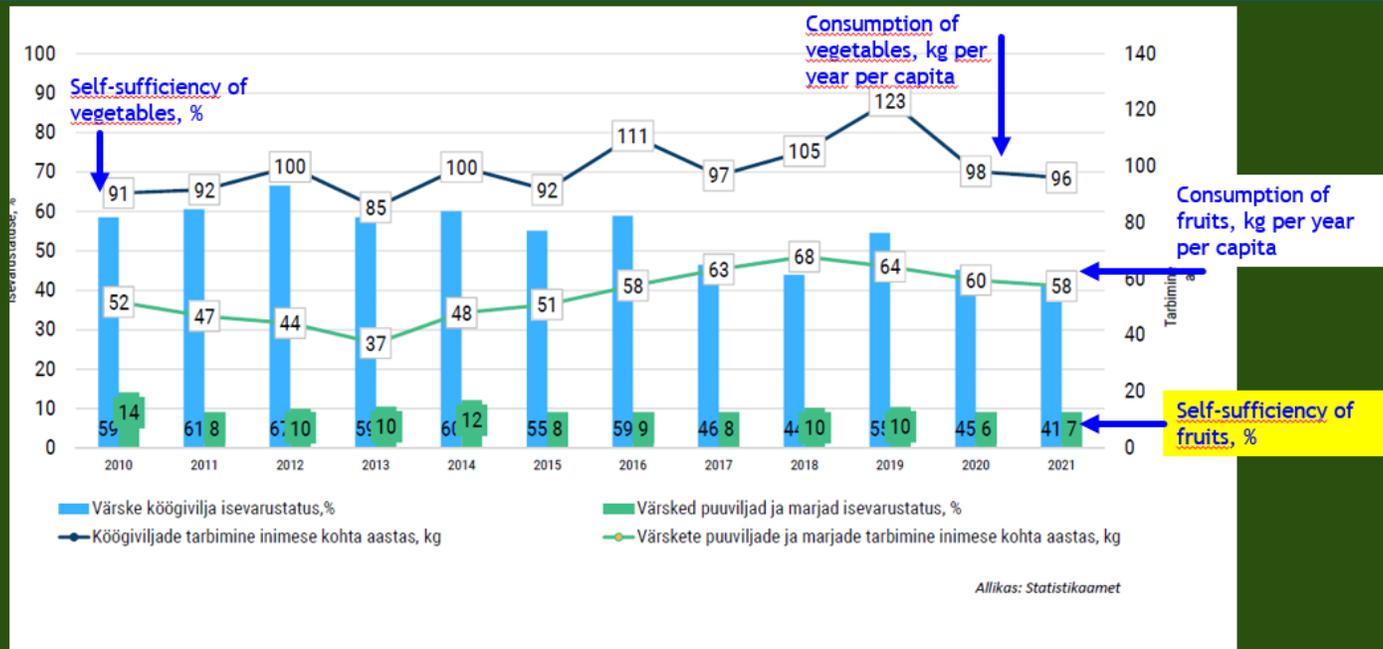


# Background

- Self-sufficiency of fruits and berries in Nordic and Baltic countries is very low.
- New pests and diseases are emerging every year.
- EU aims to decrease the use of mineral fertilizers and synthetic pesticides – **will we loose our local fruit production?**



Anthracnose (*Colletotrichum acutatum* in strawberry fruits). Photo: U.Moor



European canker (*Neonectria ditissima*) in apple tree. Photo: U.Moor

# Project aims



to decrease the environmental burden of horticultural production **without compromising the yield:**

- to reduce the amount of mineral fertilizers (rapid leaf analysis methods, fertilization according to plant needs);
- to reduce the use of synthetic pesticides (biological alternatives, plant disease forecasting models);
- selecting cultivars with a high level of resistance to challenging diseases.



Priit Põldma

WP1: fertilization based on leaf analyses  
EMU, Luke, SLF



WP2: plant protection based on disease forecasting NIBIO, SLU, EMU, LAMMC



Arne Stensvand

WP3: sustainable alternatives to chemical pesticides  
LAMMC, EMU



WP4: disease resistant cultivars for sustainable apple production  
SLU, NIBIO, Luke, EMU



Larisa Gustavsson

WP5: dissemination, project admin.



Ulvi Moor



Neringa Rasiukevičiūtė



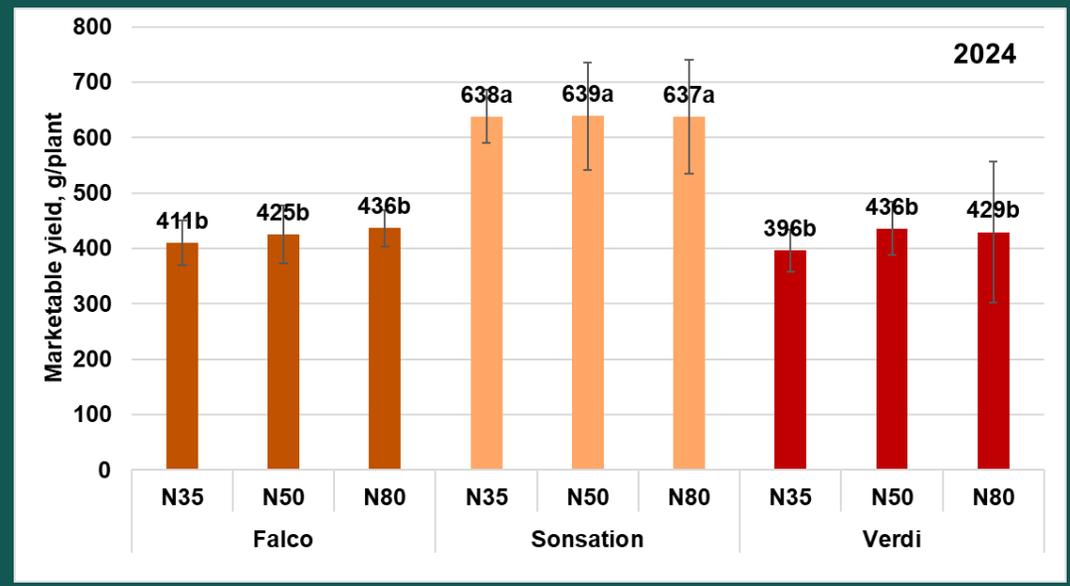
# SOME RESULTS

**WPI: no macronutrient deficiencies and no yield decrease due to 30% decreased nitrogen fertilization**

Leaf analyses were taken 4 times:

- ▶ 19. May,
- ▶ 02. June,
- ▶ 15. June,
- ▶ 08. July

Photos: U. Moor



	N%	P%	K%	Ca%	Mg%	Zn mg/kg	Fe mg/kg	Mn mg/kg	Cu mg/kg
Falco 80	2.877	0.32	1.72	0.83	0.30	17.0	99.3	67.03	6.22
Verdi 80	2.970	0.26	1.85	0.93	0.33	11.1	100.3	64.65	5.62
Sonsation	2.803	0.29	1.72	0.80	0.30	22.10	97.08	58.73	6.52
Falco 50	2.903	0.31	1.68	0.85	0.34	16.6	93.1	61.44	6.14
Verdi 50	2.550	0.28	1.68	0.75	0.32	12.5	106.8	66.22	6.20
Sonsation	2.707	0.29	1.67	0.87	0.37	10.7	75.7	40.35	6.12
Falco 35	2.903	0.31	1.56	0.88	0.38	15.4	101.0	63.02	6.07
Verdi 35	2.750	0.26	1.68	0.83	0.37	11.4	102.2	68.95	6.16
Sonsation	2.700	0.28	1.59	0.82	0.31	14.0	90.6	56.00	6.30
RECOMMEN	2.5-3.2	0.25-0.40	1.5-2.5	0.8-1.5	0.30-0.60	20-40	50-100	30-100	5...10

Green -optimal  
 Yellow-below optimal  
 Pink-above optimal

Date		N - Total ppm	P - ppm	K - ppm	Ca - ppm	Mg - ppm	Zn - ppm	Fe - ppm	Mn - ppm	Cu ppm
19.05.24.	Producer	737	589	4258	487	474	3.91	0.23	6.54	0.28
19.05.24.	EMU	846	769	4309	470	460	1.89	0.34	4.52	0.36
01.06.24.	Producer	931	576	5162	789	721	1.43	0.42	6.18	0.10
01.06.24.	EMU	825	595	4769	572	641	0.92	0.39	4.76	0.12
15.06.24.	Producer	976	523	4111	758	693	0.91	1.38	5.77	0.20
15.06.24.	EMU	888	630	4465	858	770	1.08	0.64	4.83	0.17
08.07.24.	Producer									
08.07.24.	EMU	515	535	4115	1078	724	1.06	0.69	4.3	
	OPTIMUM	1160-2320	500-1000	4000-5750	600-1500	750-1000	1.55-2.95	0.95-2.4	10.0	



Date		N - Total %	P - %	K - %	Ca - %	Mg - %	Zn - ppm	Fe - ppm	Mn - ppm	
19.05.24.	Producer	2.99	0.32	1.54	0.53	0.31	49.2	69	65	6.1
19.05.24.	EMU	3.37	0.36	1.70	0.63	0.30	43.0	99	74	6.7
01.06.24.	Producer	2.58	0.24	1.70	0.75	0.30	11.9	85	104	6.0
01.06.24.	EMU	2.80	0.29	1.69	0.84	0.34	14.5	96	61	6.1
15.06.24.	Producer	2.64	0.26	1.46	0.92	0.37	8.9	105	67	6.6
15.06.24.	EMU	2.57	0.25	1.40	1.03	0.37	10.9	86	58	6.2
08.07.24.	Producer	2.71	0.22	1.91	1.11	0.32	13.4	122	91	6.9
08.07.24.	EMU	1.97	0.21	1.35	0.92	0.31	2.5	64	36	6.0
	OPTIMUM	2.5-3.2	0.2-0.4	1.5-2.5	0.8-1.5	0.3-0.6	20-50	60-115	45-120	5.0-10

<b>Low</b>
<b>Optimum</b>
<b>High</b>

# WP2: plant protection based on disease forecasting



Arne  
Stensvand,  
NIBIO



Mature fruiting bodies of *N. ditissima*

Photo: A. Podavkova



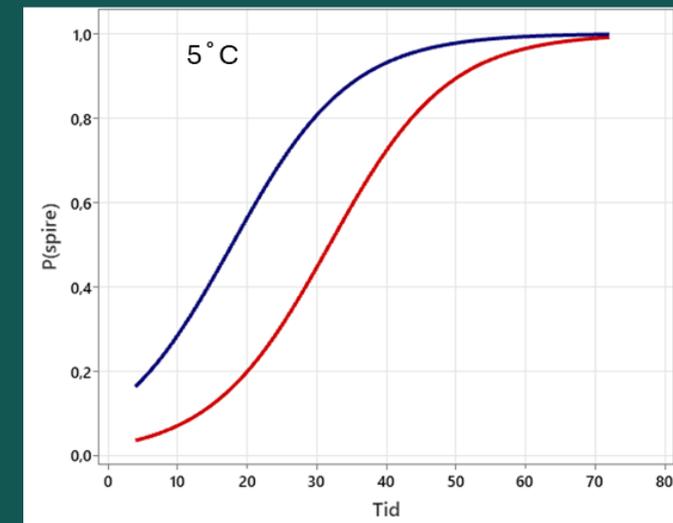
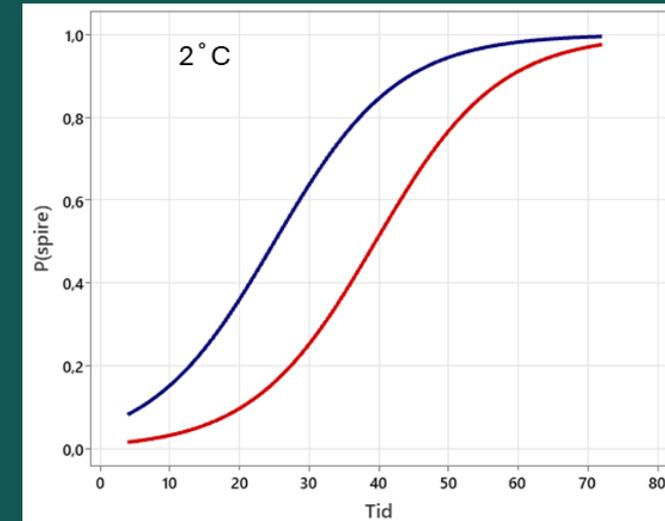
Trapping of ascospores  
and conidia from apple  
cankers

- Modelling of existing and new data on spore dissemination for the fungi causing European canker (collaboration Norway – Finland) and *Mycosphaerella* leaf spot.

# European canker (*Neonectria ditissima*)



Sources of inoculum are wind spread ascospores from perithecia (left) and rainsplash spread conidia from sporodochia (right)



Example of models: Germination of ascospores (red) and conidia (blue) over time (hours) for 2 and 5 °C

# WP3: alternatives to chemical pesticides



Neringa Rasiukevičiūtė  
,LAMMC

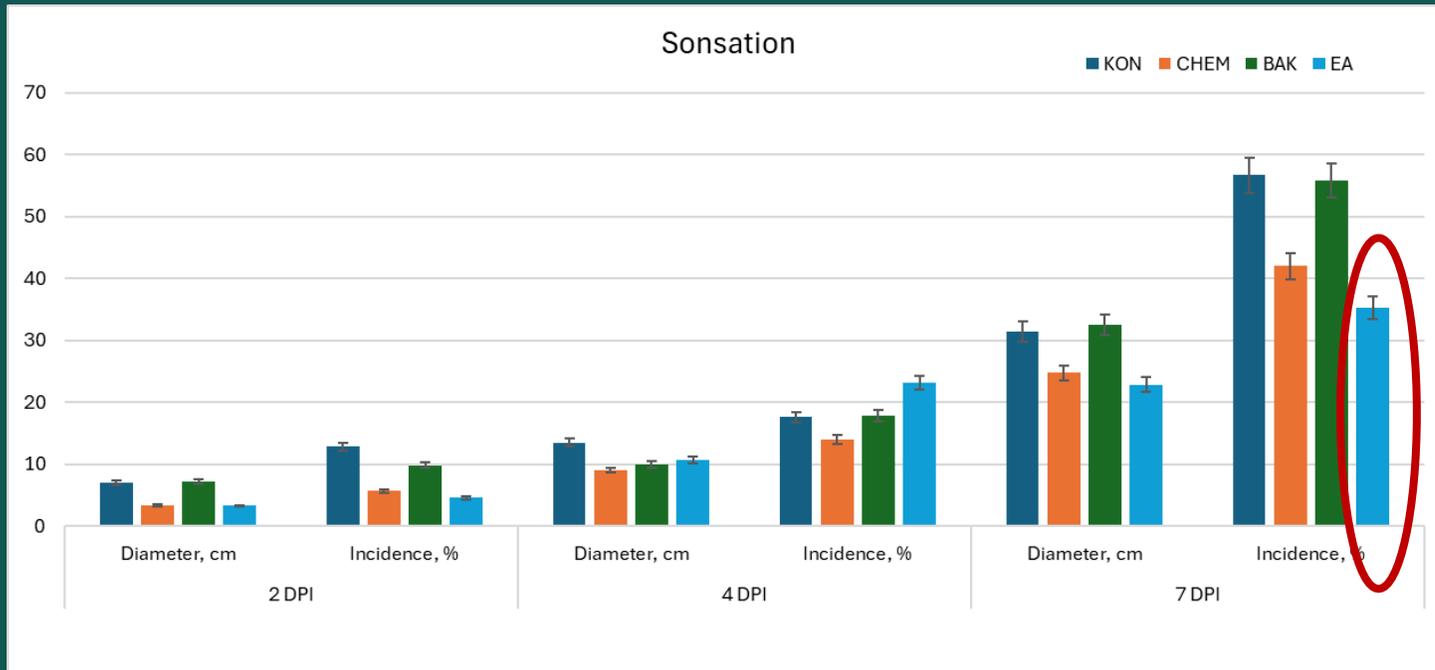
## Treatments:

- 1) KON - control treatment – no plant protection used,
- 2) CHEM - chemical treatment,
- 3) BAK - biological products based on bacteria,
- 4) EA - plant extract treatments



'Sonsation'

'Elsanta'



Average yield of strawberries (g) according to Duncan's test ( $P < 0.05$ ); the same letter indicates no significant differences between treatments.

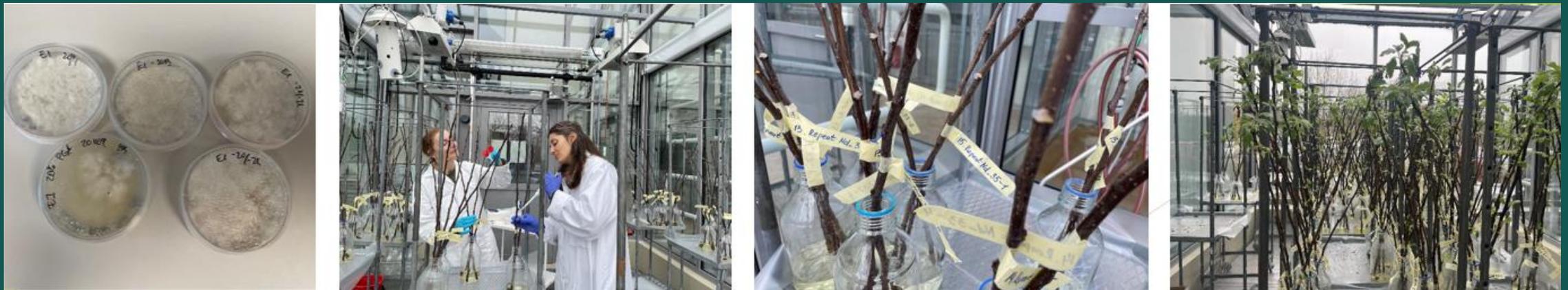
# WP4: disease resistant cultivars for sustainable apple production



Larisa Gustavsson, SLU

Variation in virulence among *Neonectria ditissima* isolates has been studied

- Detached shoot assay on the highly susceptible cultivar 'Katja' (eng. 'Katy'), under controlled climate conditions (12-16 °C, 70% RH)



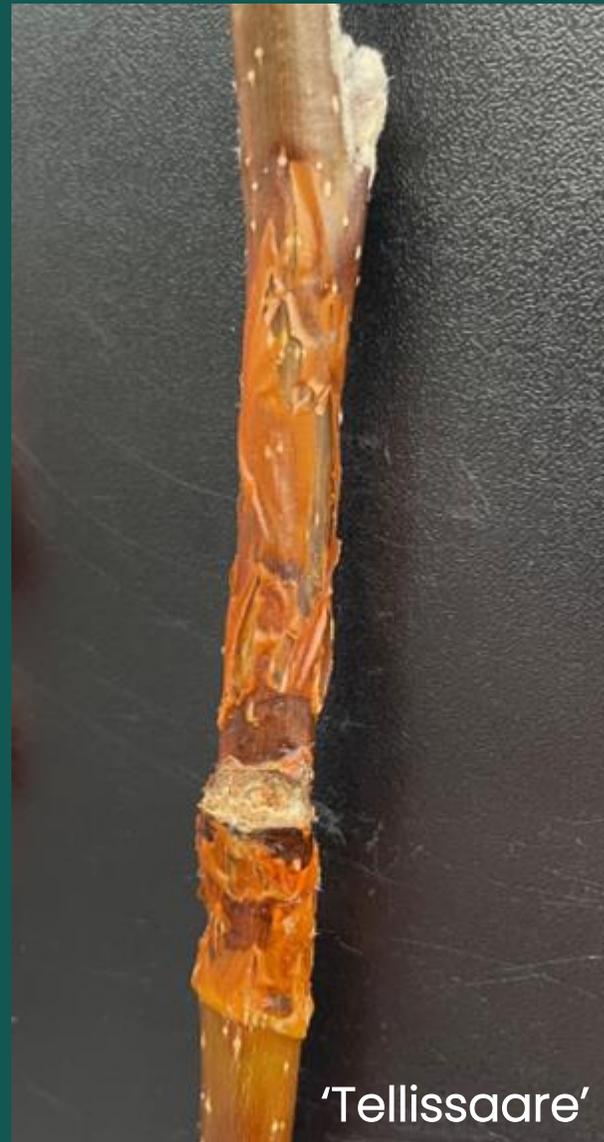
Photos: L. Gustavsson

## To be continued...

No complete genetically determined resistance to *N. ditissima* has so far been found in apples, but the degree of damage vary among different apple genotypes.

19 Swedish and 19 Estonian cultivars were evaluated in SLU.

**Some Estonian cultivars demonstrated the level of resistance similar to that of 'Aroma' and 'Santana' and thus have potential to be used as parents in future breeding efforts.**



# PhD student mobility

Matis Moks has been working in Larisa Gustavsson's lab three times:

14.08–17.08 2023 (supported by InNoBaHort)

12.12–15.12 2023 (supported by InNoBaHort)

18.03–17.04 2024 (supported by Erasmus+ scholarship)

NOVA PhD course in Norwegian University of Life Sciences „Current and future plant disease management“ (28.04.24 – 03.05.24), partly supported by InNoBaHort



Photo: Ulvi Moor



# Why Nordic-Baltic research cooperation is good

- The same species and partly the same cultivars,
- similar climate,
- mostly the same pests and diseases,
- similar production practices,
- small group –less administration, more research work,
- similar mindset – we understand each other 😊



Photo: Priit Põldma

# Thank You!

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Mid-term meeting in Saaremaa, Aug.24