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Agronomic performances of tomato and winter vegetables in the Danish trial

Presented by Ivan Paponov

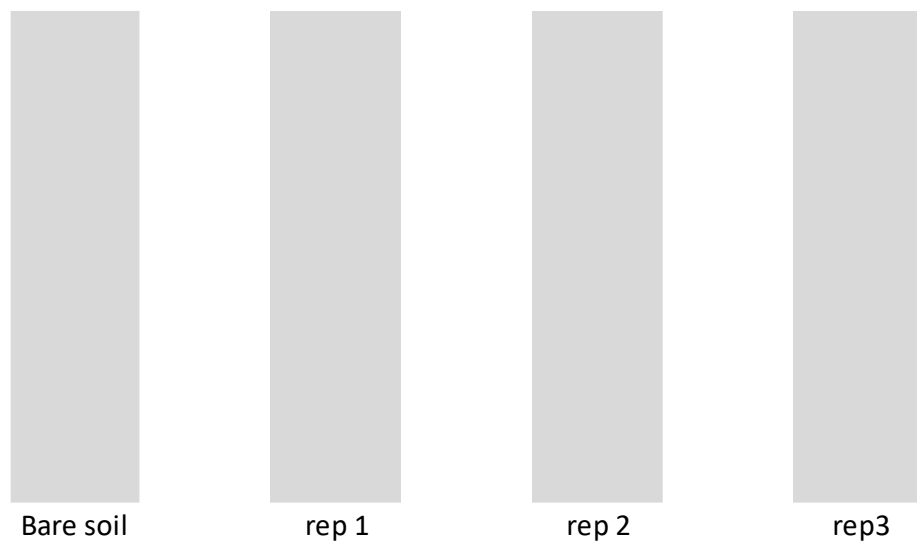
Final project Meeting

Rome, 21/09/2021



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Experimental site Denmark - BAU



Fodder radish

Sown 09-09-2018

Harvest 20-12-2018



Bare soil

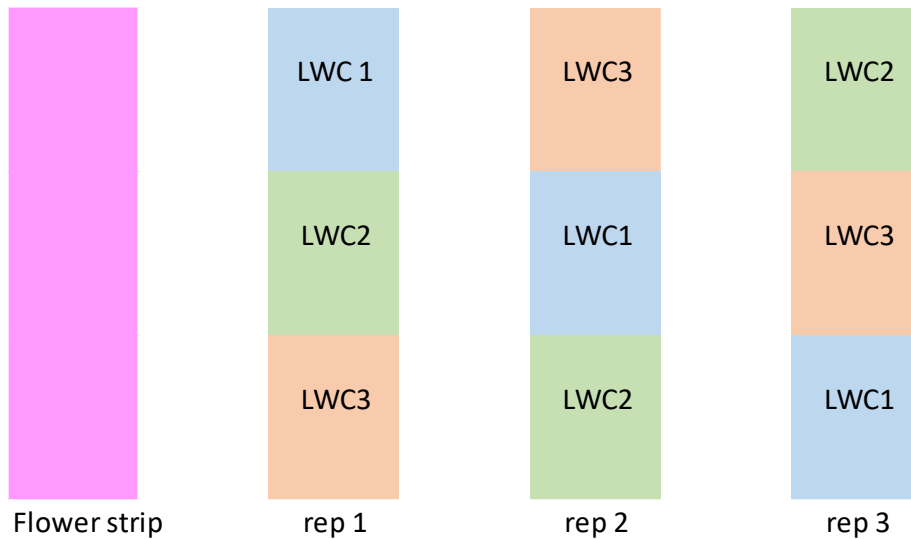
20-12-2018 until

22-03-2019

Tomato

Planted 22-03-2019

Experimental site Denmark - INN



Fodder radish

Sown 09-09-2018

Harvest 07-11-2018



WLC

Sown 16-11-2018

Harvest 12-03-2019



Lettuce

Sown 01-02-2019

Planted 22-02-2019

Harvest 24-04-2019

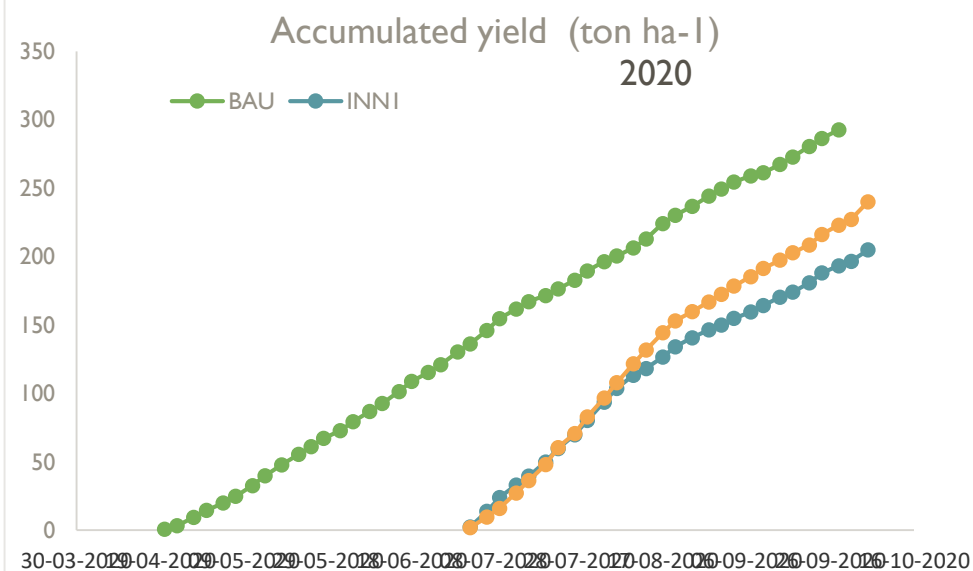
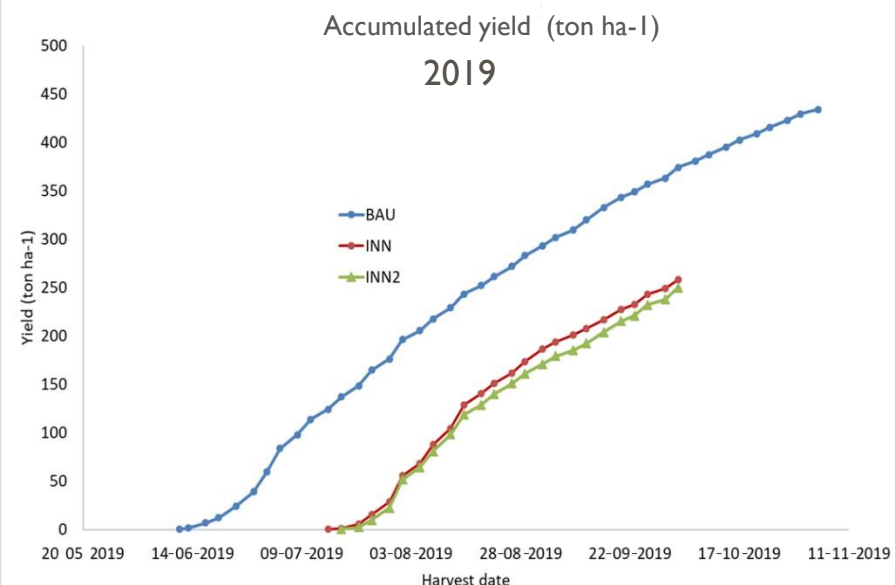


Tomato/snap pea

Planted 01-05-2019

Sown 22-05-2019

Tomato 2019/2020 – Yield and energy for heating



System	Harvest period	Total yield (kg m ⁻²)	Energy use (kWh m ⁻²)	Harvest period	Yield (kg m ⁻²)	Energy use (kWh m ⁻²)
2019						
BAU	11 Jun – 04 Nov	41.96	301	20 Ap – 28 Sep	29.3	498
INN	18 July – 03 Oct	25.82	0	02 July – 05 Oct	20.5	0
INN2	15 July – 03 Oct	24.99	0	02 July – 05 Oct	24.0	0

INN2 from ClimateVeg project



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Yields - Denmark

System	Crop	(Saleable) yield (ton ha ⁻¹)*	Head size (g)
INN	Fodder radish	17.02±0.78	
	Winter purslane	1.87±0.52	
	Lettuce	21.05±134	198.1±13.6
BAU	Fodder radish	22.87±2.66	

* Netto production area 2/3 of total area

WLC's evaluation

Mizuna – did not germinate, soil temperature too low in November? The ones that germinated developed well in spring

Mangold – only few plantlets survived, too small for over-wintering

Winter purslane – Only one harvest, could have taken more and postponed the crop of lettuce

In 2019/2020 – Earlier sowing/planting if possible or planting of bigger plantlets.
Other crops (spinach sown late autumn)

THREE ORGANIC GREENHOUSE SYSTEMS ARE COMPARED

- Business as usual (BAU) – heating according to traditional tomato crop
- Innovative system 1 (INN) – heating below 4 °C and venting at 20 °C
- Innovative system 2 (INN2) - heating below 8 °C and venting at 20 °C

Winter 2019/2020

- BAU – one long tomato crop, no winter leafy crop (WLC)
- INN – summer crop of tomato + two short WLCs (Greenresilient)
- INN2 – summer crop of tomato + one long WLC crop (ClimateVeg)

INN – Brown mustard followed by pointed cabbage



Sown: 10 October
Harvested: 17 February
Terminated: 05 March
Yield: Between 0.5 and 5 tons per ha
Cultivar: Moutarde rouge metis
Comment: Germination very uneven - sow earlier or plant out; not so suitable for multiple harvests



Sown: 07 February
Planted: 05 March
Harvested: 28 April
Yield: 254 g per head without trimming
Cultivar: Eersteling
Comment: Too small - planting early February necessary

INN – Lettuce followed by celtuce



Sown: 19 September
Planted: 10 October
Harvested: 18 December
Yield:
Cultivar: Olmetie
Comment: Looked very well until early December. Very few saleable heads at harvest due to grey mould



Sown: 03 January
Planted: 31 January
Harvested: 16 April
Yield: 137 g per plant without trimmings
Cultivar:
Comment: Grew very well, but needs long days for proper stem elongation (flowering)

INN – spinach followed by lettuce



Sown: 10 October 2019
Planted:
Harvested: 12 March 2020
Yield: 4.4 ton per ha
Cultivar: 30177
Comment: Did not germinate very well. Better to plant out. Cultivar with bigger leaves such as 'Nores'.



Sown: ?
Planted: 12 March 2020
Harvested: 28 April
Yield: 95 g per head
Cultivar: Lollo rosso
Comment: Very small. Grey mould.

CONCLUSIONS

- It is a bit of a compromise to start WLCs early enough for a good establishment and harvesting the last tomatoes. Our tomato crop was terminated 03 October and WLCs sown or planted 10 October.
- Most crops were better sown in plugs and planted out as conditions in autumn were inappropriate for good germination and seedling establishment. A few crops like Mizuna, brown mustard and winter purslane can be sown if a good seedbed is prepared.
- Under Danish conditions light is the limiting factor and plants are hardly growing from end-November until mid-February. The winter 2019/2020 was mild with only few hours of sun. Alternative: supplemental LED!
- Promising alternative WLCs to Asian greens/winter purslane/lettuce are peas, spinach (if a large leaved cultivar is chosen), celtuce (if night interruption is introduced) + pointed cabbage.
- The difference in tomato yields between INN2 and BAU decreased in the second year due to diseases for plants in the BAU system