



**ØkologiRådgivning**  
Danmark ApS

**Cover crops and green manure in organic vegetable production**  
**Mads Juul, organic advisor**

Passion • Innovation • Nærvær

# Agenda

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- Introduction
- Different use of cover crops in vegetable cultures
- Species suitable for cover cropping
- Green manure/clover grass
- Estimated effect on carbon level



# Who are we

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- Organic advising company – both plant and cattle
- Covering about 86.000 ha (1/3 of the total organic production)
- 18 employees
- Customers in all parts of Denmark but primarily in southern and central part of Jutland



# Project: Cover crops in organic vegetables

- Was a project under "Innovationscenter for økologisk landbrug" called "Øget kulstofopbygning i økologiske grøntsager"
- External consultants from HortiAdvice – Richard de Visser and ØkologiRådgivning Danmark – Mads Juul
- NOT scientific - based on field tests and experience
- Intended as inspiration for growers



# Why look at it

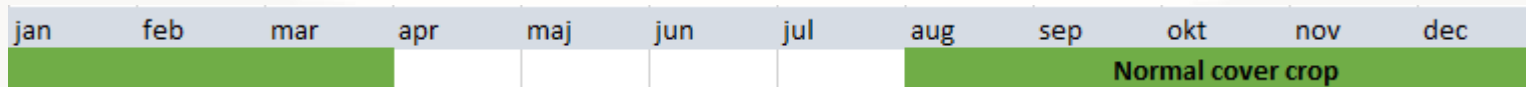
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- Vegetable production is very intense, lots of tillage and bare soil and the crops leaves next to no residue
- Often the crop requires a lot of N but also leaves a lot in the ground
- Change in weather pattern to more extreme – requires a more resilient soil
- Cover cropping is a challenge in traditional vegetable production
  - Often late harvest and intensive land use
- But the production opens up to some “unconventional” solutions
- Danish organic law requires 50% of C-binding and 20% nitrogen fixing crops/cover crops
  - Easy on cattle farms. Tricky on arable farms. Difficult in vegetables



# How can it be done

- Cover crops are traditionally sown just after harvest or undersown into a crop
- Grows through the winter and is incorporated before sowing in march/april
- Vegetable rotation limits the choice of cover crop type – often Brassica like oil raddish
- Cover crops could grow for a longer time in the spring than in traditionally farming



# What we looked at

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- Seeding after harvest
- Seeding in spring before a late planted culture
- Use of heandlands and irrigation tracks
- Undersowing in standing culture



# Sowing after harvest

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- Easy establishment – especially if there is no residue
- If it can be done in first half of August, everything will work! (In Denmark)
- If seeded later a lot of growth will be lost (in Denmark august 20th is last call in regulations)



Phacelia, buckwheat, linseed, berseem clover, red clover, mustard





# Species for sowing after harvest

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## Early sowing

Oilseed radish and mustard (if rotation allows)

Grains (rye, oat, barley and spring wheat)

Phacelia

Buckwheat

Wetches

Berseem and crimson clover

(Mallow, *Malva sylvestris*: looks promising)

## Late sowing (Until early september)

Mustard

Grains

## Late september into october

Rye and vetch

Works well if it can grow until may with potential for a biomass harvest for feed/biogas





# Seeding in spring before a late planted culture

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- Sowing of rapid growing species in spring ideal with a high part of legumes
- Incorporated before planting of culture
- Could be peas, beans, buckwheat, phacelia, berseemclover
- Regarded to be too expensive compared to the effect. Could drain the soil for available water
- Not fieldtested

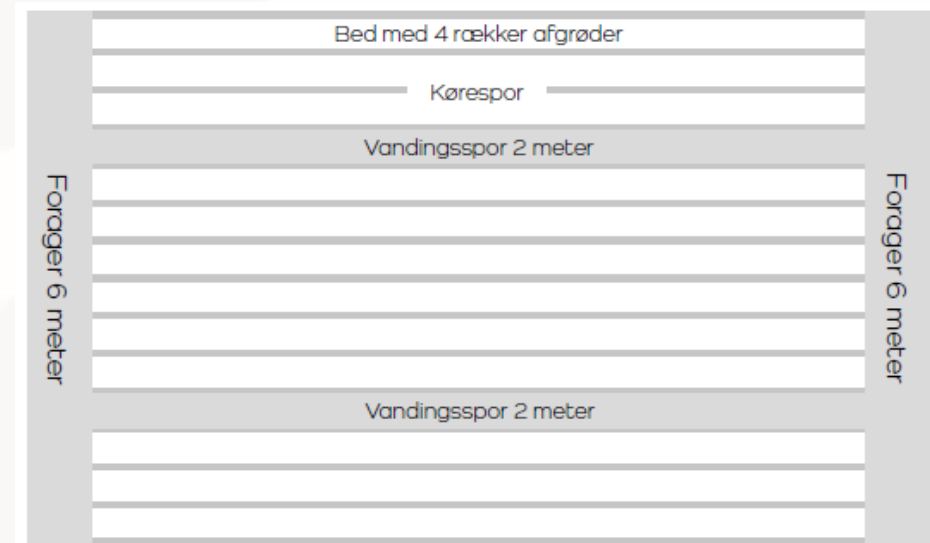
jan	feb	mar	apr	maj	jun	jul	aug	sep	okt	nov	dec



# Use of headlands and irrigation tracks

- Large parts of a vegetable field is not used for crops
- Headlands and tracks has a large potential to increase the areal for cover crop
- Example of a 1 ha field

	Areal med afgrøde	Arealer uden bevoksning			
	Bede	Vandingsspor	Forager	Kørespor	Mellemrækkerne
<b>Bredde</b>	2 meter	2 meter	6 meter	0,3 meter	0,15 meter
<b>Længde</b>	250 meter	250 meter	42 meter	250 meter	250 meter
<b>Antal</b>	12	2	2	15	36
<b>kvadratmeter</b>	6.000 m <sup>2</sup>	1.000 m <sup>2</sup>	504 m <sup>2</sup>	1.125 m <sup>2</sup>	1.350 m <sup>2</sup>
<b>Andel uden bevoksning på marken</b>	46% af arealet kan potentielt anvendes til efterafgrøder i dyrkningssæsonen				



# Use of headlands and irrigation tracks

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- Could be used for green manure (clovergrass)
- Lot of traffic on the headlands!
- Needs to be durable grasses (fescues)
- Sown when the worst traffic is done



Grass on headland and track in carrotfield  
Photo: Richard de Visser



# Undersowing in standing culture

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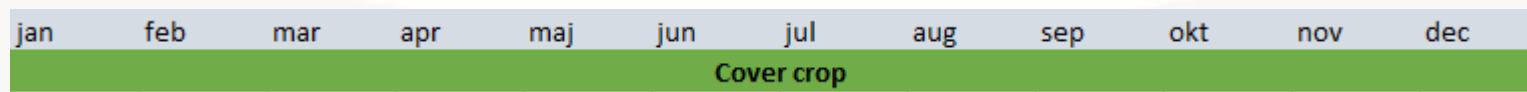
- Not common in vegetable production
- Known method from grain, works well in most situations
- Often cost effective
- Competition between crop and cover crop is essential
- Potential for a longer growing season for the cover crop



# Undersowing in standing culture

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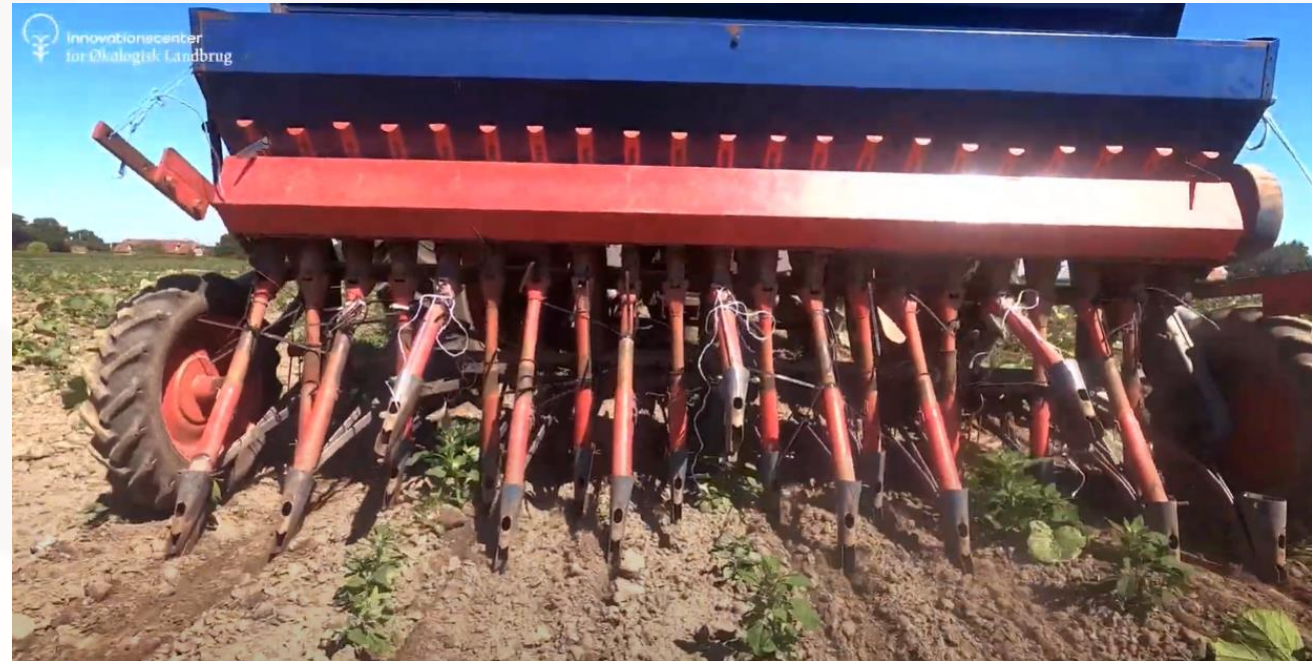
- Did work in field test
- Harvest method is important – hand picking or gentle mechanical harvest
- Good result in pumpkin, celeriac and corn
- Can be done in some cabbage cultures as well



# How is it done

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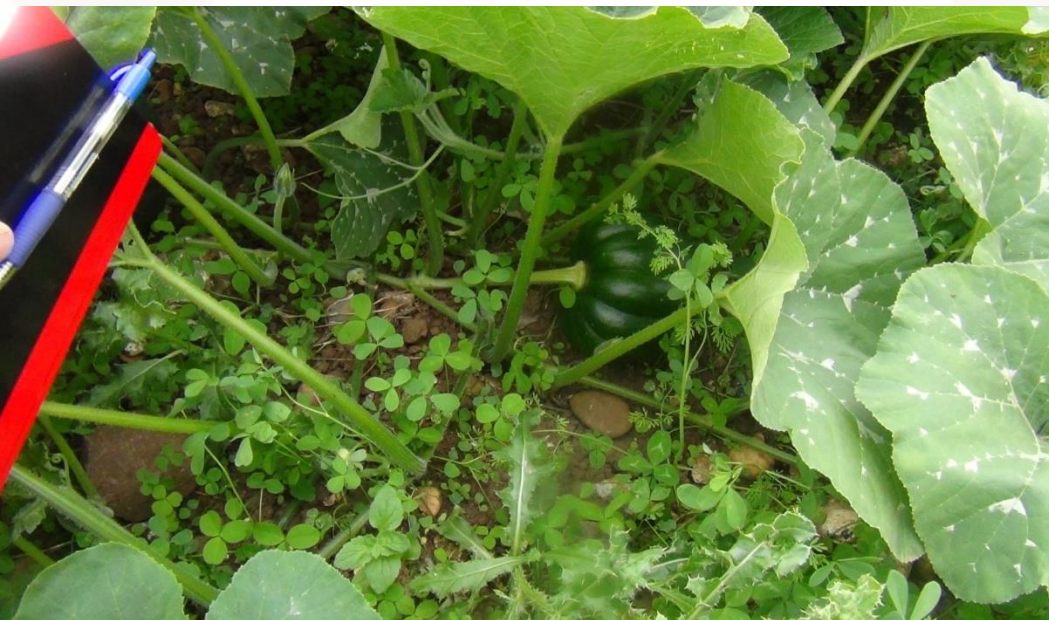
- Custom build machine or the old drill from the shed
- See a video about undersowing in pumpkin  
[https://www.youtube.com/watch?v=VPrJ7\\_qcKRM&t=38s](https://www.youtube.com/watch?v=VPrJ7_qcKRM&t=38s)





# The outcome

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Photos: Richard de Visser

# Worst case

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- If the cover crop is too aggressive it can lead to high yield loss and a complicated harvest
- Seeding date has to be adjusted to the culture
- After sowing weeding is limited/impossible
- Consider carefully if it is worth taking the chance



# Species for undersowing

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- Clover (red and white)
- Phacelia
- Slow growing grasses (red fescue and turf grasses)
- Vetch
- Chicory
- Plantain
- **Always consider the cover crops growth pattern next to the main crop**



# Effect on C level in soil

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- Carbon levels have been measured in Denmark between 1986-2009
- Changes in carbon stocks of Danish agricultural mineral soils between 1986 and 2009. / Taghizadeh-Toosi, Arezoo; Olesen, Jørgen E; Kristensen, Kristian et al.
- In average soils contain 63 tons of C in 0-25 cm
- Highest C content in regions with cattle and grassfields
- Cover crops adds 0,12 ton of C per annum in 0-25 cm
- Grassfields adds 0,95 tons per annum



# Effect of cover crops

Dyrkningssystem	Efterafgrøde	Grøngødning	Ændring i C-pulje (ton C/ha)
1	-	-	-0,9
2	+	-	-0,3
3	-	+	0,23
4	+	+	0,71



# Wholeyear green manure

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- Another word for clovergrass
- Grass, clover and ideally herbs
- Different root profil
- Best way to add carbon
- Add lots of nitrogen
- Effective weed control
- Doesnt't provide profit!
- Or perhaps?



# Use of clover grass

- As a forage crop for cattle
- Biomass production for biogas
- Example from 2023 (2 cuts) (1 DKK → 1,56 SEK)

		Price	
Yield	11 tons DM	1.000 kr.	11.000 kr.
Machinery and transportation		-	4.500 kr.
Profit			<u>6.500 kr.</u>



# Economy

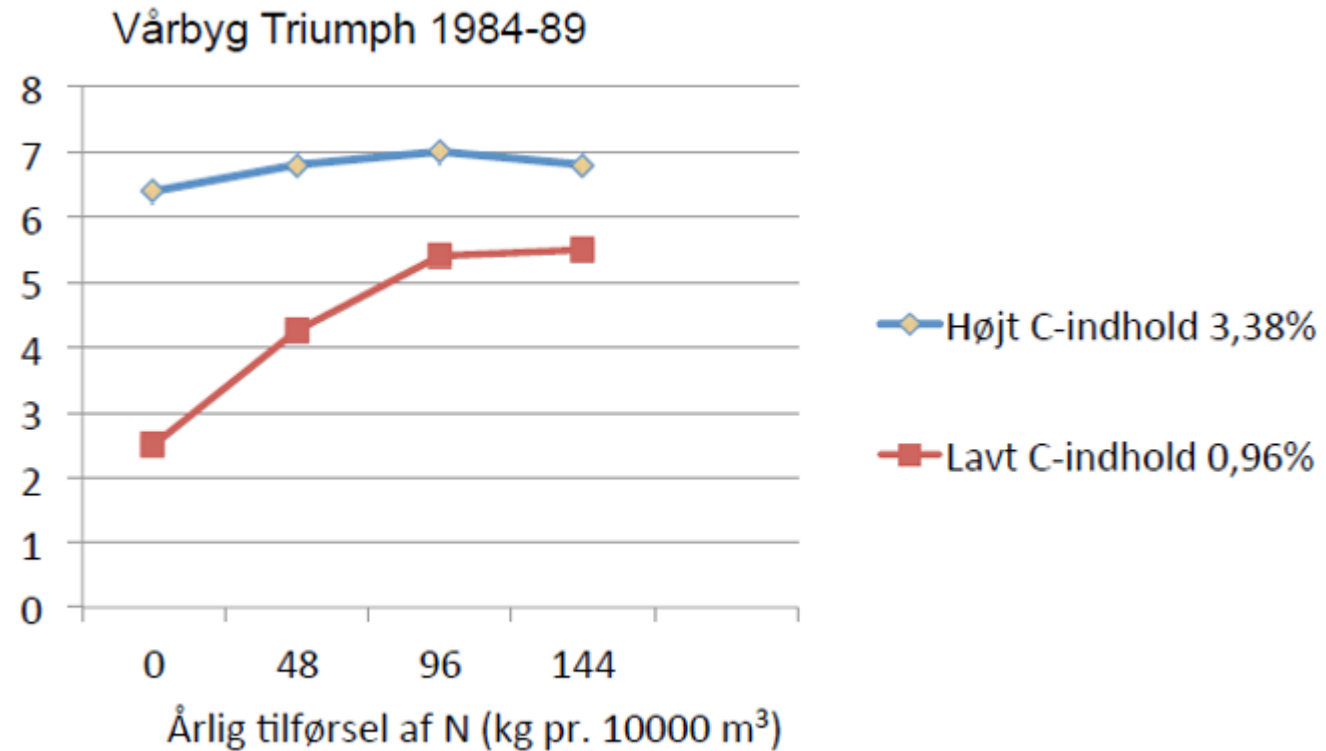
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- Seed cost can vary a lot – try to keep it at about 500 dkr./ha
- Machinery cost and capacity has a large influence
- If investment in new machinery is necessary it can become very expensive
- Seeding could be included in weed management
- What is the value of a more resilient soil?





# Carbon does matter



(Christensen, B.T. og Johnston, A.E. fig. 18.11 s. 461 1997)



# Conclusion

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- It is possible to add more cover crops and green manure into a vegetable system
- The easiest way is to seed after harvest of early cultures
- Undersowing is possible and with good potential but is risky
- Limited effect on carbon level in soil with cover crops but increase with clovergrass



# For more information

- Find the inspiration catalog on [icoel.dk](https://icoel.dk)
- Search for "Øget kulstofbinding i økologiske grønsager"



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