

# Climate gas emission in carrot production

Appendix for demonstration day on 28.02.2024

ESG and sustainability plans on farm level

## ESG

### E - Environment

- Biggest issue in Denmark
- Environment, including climate change, pollution, water and ocean resources, biodiversity, as well as resource use and circular economy.

### S - Social issues

- Important but generally we are doing good in DK/Northern Europe
- Including the company's impact on its own workforce, workers in the value chain, affected communities, as well as consumers and end-users.

### G – Governance

- Generally something we are good at in Denmark due to a strong national system controlling companies in Denmark/Northern Europe
- Corporate governance, including corporate behavior.
- Companies complies with rules, pay tax etc.

## CLIMATE FOOTPRINT

### Level of climate footprint

Global calculations:

- Product level – What is the climate footprint of the product (1 kg plastic bag with carrots) from farm to fork?
- LCA (Life cycle analysis)
  - o Different methods, land use are sometimes included.
- Possible to be very detailed with different carrot types: early, autumn and winter carrot.
- Include input from transport, production of fertilizer, pesticides ...

- This numbers gives a climate footprint of the carrot in a global perspective.

#### National calculations:

- Farm level – What is the climate footprint of the farm? Or the climate footprint of 1 kg product from the farm?
- National goal and regulation
  - o 70 % CO<sub>2</sub>e reduction in Denmark by 2030
    - Only emissions made nationally on the farm.
      - Use of fertilizer, diesel, gas, electricity
    - Not emissions of production of NPK-fertilizer/pesticides made outside DK nor transport outside of DK.
    - That means imports are "free", i.e. fertilizer from abroad is free in the national CO<sub>2</sub>-bookkeeping.

#### How bad is the carrot compared to other food

Product:	Kg CO <sub>2</sub> / kg	Product:	Kg CO <sub>2</sub> / kg
Beef	36,5	Pasta	1,7
Bacon	12,5	Rye bread	1,5
Shrimp	12	Milk	1,2
Cheese	12	Beer (per litre)	1,2
Chocolate	11	Roll cheese	1
Pig	8,1	Grapes	0,8
Coffee	7,9	Banana	0,7
Liver pâté	7,4	Oatmeal w. milk	0,6
Plant fars	4,4	Orange	0,5
Tea	4,3	Foreign apples	0,5
Egg	4	Potatoes	0,5
Hen	4	Oat drink	0,5
Hummus	3,6	Local apples	0,4
Cod	3	Foreign tomatoes	0,4
Wine (per litre)	3	Foreign peppers	0,4
Sweets	3	Foreign cucumbers	0,4
Chickpeas	2,7	<del>Pointed cabbage</del>	<del>0,4</del>
Rice	2,9	Carrots	0,3

## Where is the most CO<sub>2</sub>-equivalents to be saved in carrots?

0,4 kg CO<sub>2</sub>e /kg carrot - CarbonCloud [link](#) og Concito [Den store klimadatabase](#)

- 29 % from field
- 10 % from transport
- 5 % from processing
- 56 % from packaging

*“Over 60% of the carbon footprint is due to the resources used in processing and packaging.”*

The field emissions (UK numbers):

- 41 % farm machinery
- 22 % farming on drained wetlands – not an issue at all farms
- 18 % N<sub>2</sub>O emissions from the field bacteria in the soil (dependent on the N-fertilizer)
- 13 % fertilizer production
- 5 % limestone and urea production
- 2 % pesticide production

No numbers for deforestation, irrigation, use of plastic and fleece cover, straw covering?

## Danish agricultural climate tax

Field emission: 29% of the total emission 0,4 kg CO<sub>2</sub>e per kg carrot equals 0,11 kg CO<sub>2</sub>e per kg carrot.

- Estimated yield: 50 ton /ha

$$50 \text{ ton carrot/ha} * 0,11 \frac{\text{kg CO}_2\text{e}}{\text{kg carrot}} = 5,5 \text{ ton} \frac{\text{CO}_2\text{e}}{\text{ha}}$$

Climate tax on agriculture – DKK pr ton CO <sub>2</sub> e	Calculation
<b>Model 1: 750,-</b>	$5,5 \text{ ton} \frac{\text{CO}_2\text{e}}{\text{ha}} * 750 \frac{\text{kr}}{\text{ton CO}_2\text{e}} = 4.125,00 \text{ kr per ha}$
<b>Model 2: 375,-</b>	$5,5 \text{ ton} \frac{\text{CO}_2\text{e}}{\text{ha}} * 375 \frac{\text{kr}}{\text{ton CO}_2\text{e}} = 2.062,50 \text{ kr per ha}$
<b>Model 3: 125,-</b>	$5,5 \text{ ton} \frac{\text{CO}_2\text{e}}{\text{ha}} * 125 \frac{\text{kr}}{\text{ton CO}_2\text{e}} = 687,50 \text{ kr per ha}$

## COMMENTS ON PRODUCTION IMPACT AND FARM PLANS FOR SUSTAINABILITY

Nitrous oxide ( $N_2O$ ) emission is a big part of the emissions in the field.

- However, carrots are fairly low in nitrogen input (110-125 N/ha) 43-78% of what other vegetables (cabbage, lettuce, onions (140-285 N/ha)) and e.g. spring wheat (159-181 kg N/ha) 69 % get.
- The emission might be based on standard CO<sub>2</sub>-equivalents.
- The calculation will probably be made from the amount of nitrogen used.

Energy consumption

- Plough – Is possible to not plough or doing it less?
- Stone burying – Is possible to not doing stone burying or doing it less?
- Bed former
- Mechanical weeding
- Spraying
- Top lifting
- Straw adding and removal
- Harvest by soil lifting

Early carrot

- Use of plastic and fleece

Storage – Straw covering vs storing facilities

- Straw covering uses about 60 tonnes of straw pr field, straw from about 15 ha of cereal fields per ha of carrot.
  - o Is it negative or positive to apply straw?
    - In this case the amount is possibly too extreme
    - If some of it were collected at harvest and either reused or delivered into a e.g. biogas station.
- Use of plastic
- Extra use of energy for machinery at covering and winter harvest
- Extra use of energy for driving when covering and if the straw should be reused.

Demonstration day 28. February 2024

