# 58.772,56

# 58.772,56 kg ha⁻¹

# DEFINING 'POTENTIAL YIELD'

# WHAT DEFINES POTENTIAL?

▶ Based on yield equation:

> › Tillers per metre square      ×
> › Spikelets per tiller      ×
> › Florets per spikelet      ×
> › Seeds per floret      ×
> › Thousand seed weight

▶ So then... 58.772,56 kg ha$^{-1}$?

# WHERE DO THE NUMBERS COME FROM

▶ During the pollination studies, detailed yield components were assessed

▶ 8 locations

  ▶ 3 per year for 2 years in Denmark

  ▶ 1 per year for 2 years in New Zealand

▶ For each assessment, all seed heads were graded into size categories: 5 in total
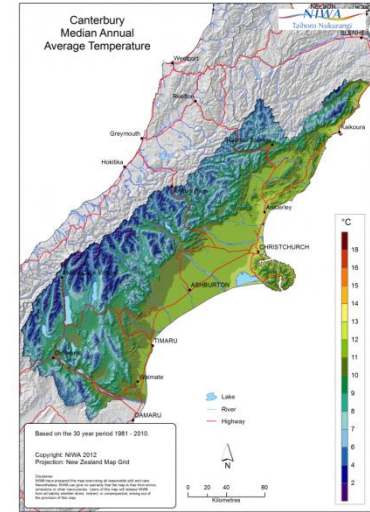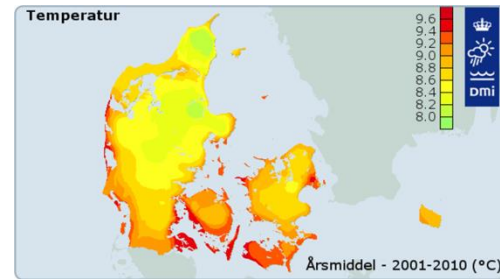
# USING REAL NUMBERS

▶ These numbers are real: based upon extensive yield assessments

▶ They are of course, the maximum value for each category

    ▶ 58.700kg seed ha$^{-1}$ is made up of:

        › **4100** tillers m$^{-2}$

        › **29** spikelets per tiller

        › **14** florets per spikelet

        › **100%** seed set

        › **3,5g** TSW

▶ And, clearly not realistic, so what is?
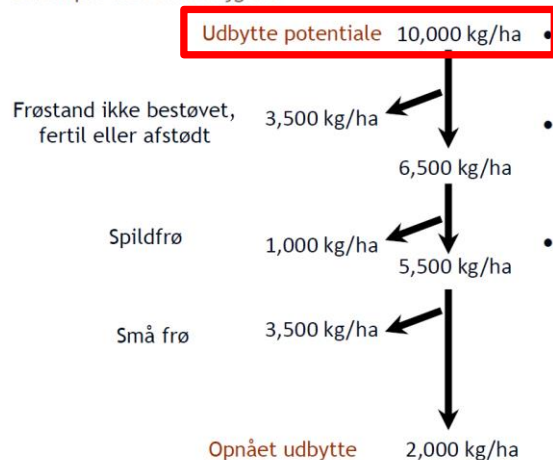
# HERE IS WHAT OUR FRIENDS SAY:

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# IS 10.000 KG SEED HA$^{-1}$ ANY BETTER?
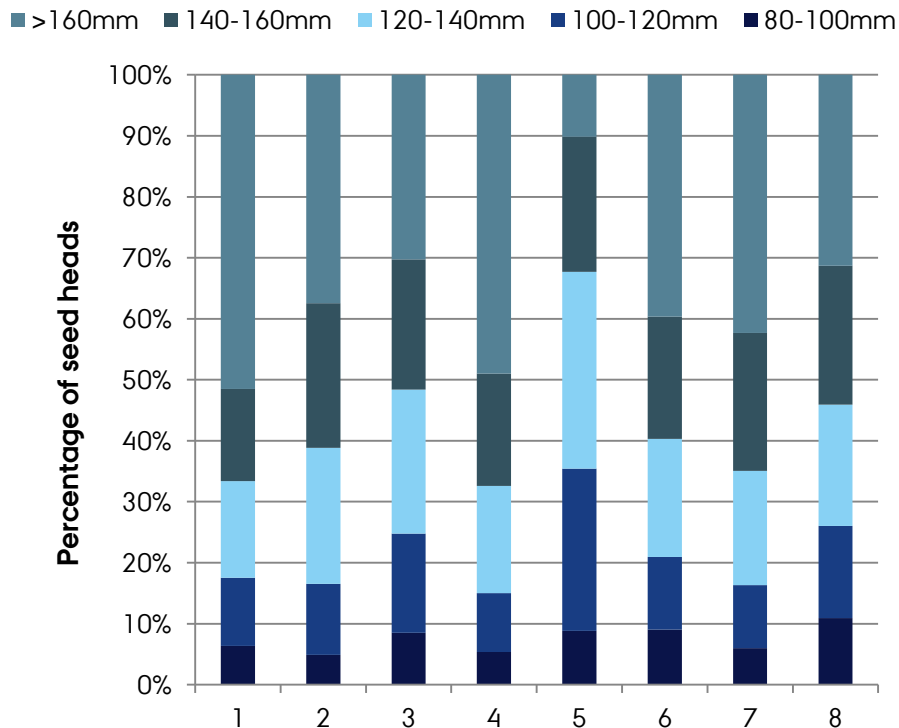


- What is it based on?

  - 2500 tillers
  - 20 spikelets
  - 10 florets
  - 100% seed set
  - 2,5 g TSW

- But who has defined these numbers? And why?

- We have something difference to say

# 6.700 KG HA$^{-1}$

- The **key difference** being that is includes seed head sizes

- We will see later the importance of seed head size to seed yield via yield assessment and path analysis

# SEED HEAD SIZE IS IMPORTANT

| Seed head size | 80-100mm | 100-120mm | 120-140mm | 140-160mm | >160mm |
|---|---|---|---|---|---|
| Harvested seeds/m² | 4641 | 16856 | 21989 | 21044 | 10687 |
| Harvested kg/ha | 97 | 354 | 462 | 442 | 224 |
| **% of Yield** | **6%** | **22%** | **29%** | **28%** | **14%** |

| Seed head size | 80-100mm | 100-120mm | 120-140mm | 140-160mm | >160mm |
|---|---|---|---|---|---|
| Harvested seeds/m² | 5177 | 7917 | 12765 | 18790 | 34210 |
| Harvested kg/ha | 109 | 166 | 268 | 395 | 718 |
| **% of Yield** | **7%** | **10%** | **16%** | **24%** | **43%** |

| Seed head size | 80-100mm | 100-120mm | 120-140mm | 140-160mm | >160mm |
|---|---|---|---|---|---|
| Harvested seeds/m² | 2083 | 4514 | 11537 | 13277 | 49979 |
| Harvested kg/ha | 44 | 95 | 242 | 279 | 1050 |
| **% of Yield** | **3%** | **6%** | **14%** | **16%** | **61%** |

# PATH ANALYSIS

▶ Path analysis is a statistical approach

▶ It tells us the most important yield components

▶ Key benefit is the **one way** 'causal admissible paths'

    ▶ That is, earlier set yield components cannot be changed by later forming factors

       i.e., floret number cannot change spikelet number

▶ But as we know, seed head sizes are not uniform throughout the crop

▶ Can we factor this into the equation to get a better prediction of "potential yield"?

# PATH ANALYSIS – CONTD.

- **"Direct"** effects measure the effect of that component on yield
  - i.e., influence of seed head size on yield

- **"Total"** effect measure the 'direct' effects plus the effect that the component has on later forming components
  - i.e., seed head size on yield plus seed head size on spikelet number and floret number
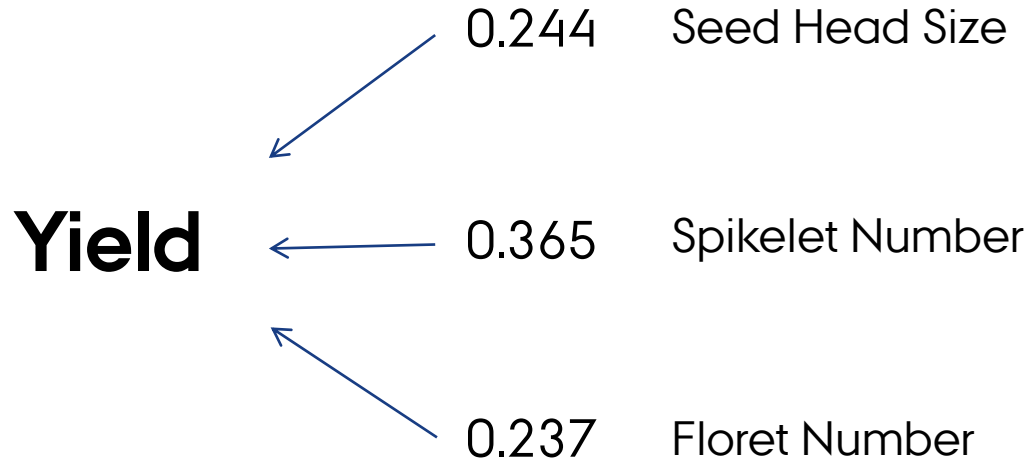  - n.b., we assume tiller number does not limit seed yield

# DIRECT EFFECTS
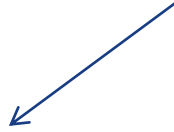
Seed Head Size

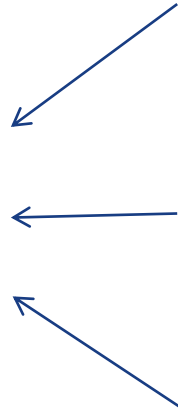**Yield**

Spikelet Number

Floret Number

# DIRECT EFFECTS

0.244    Seed Head Size

**Yield**    ←    0.365    Spikelet Number

0.237    Floret Number

▶ However, the "direct" effect does not consider the influence it has later

# TOTAL EFFECTS

# TOTAL EFFECTS

0.782    Seed Head Size

**Yield**

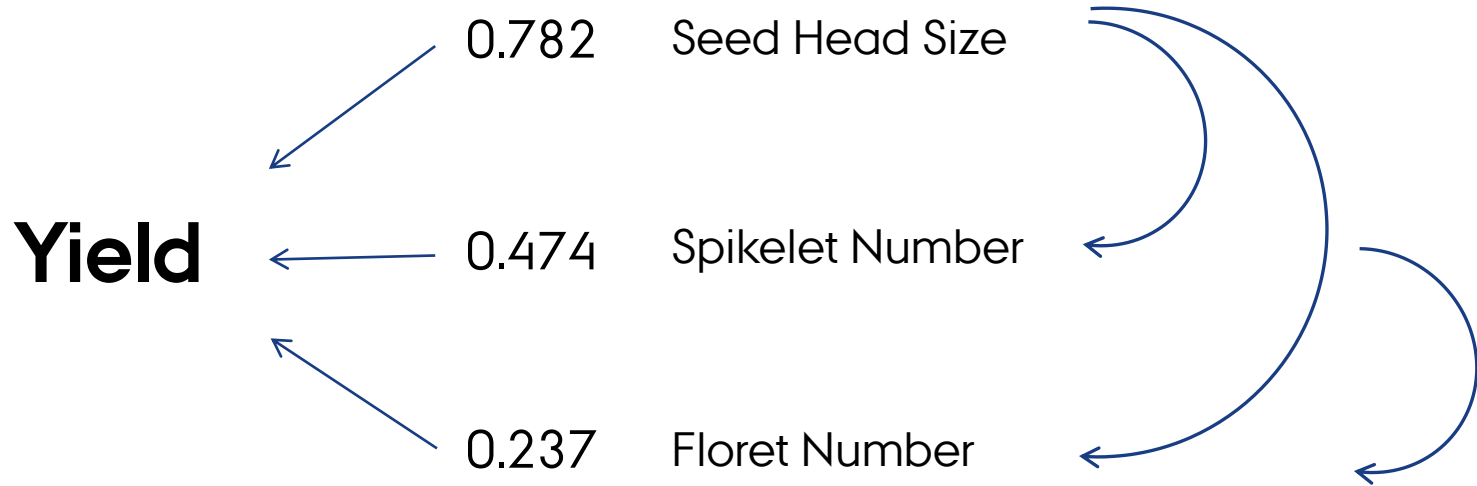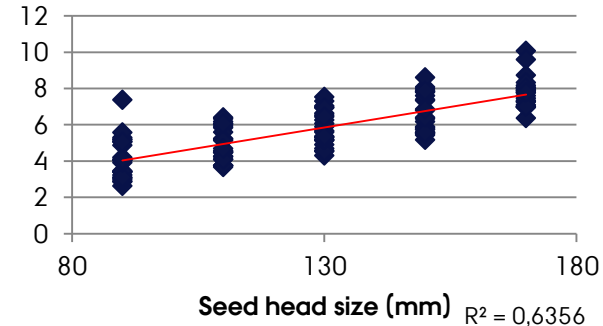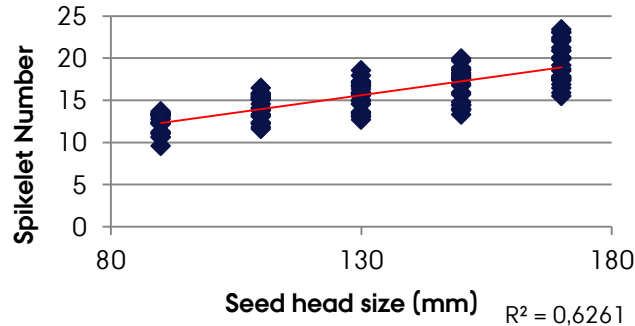0.474    Spikelet Number

0.237    Floret Number
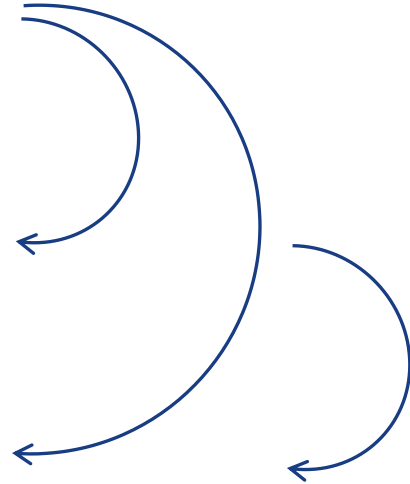
▶ Changes the importance, now seed head size is the most important yield component

# HOW DOES IT WORK?

▶ Seed head size has a low direct effect

▶ But coupled with the relationships below, it increases significantly



Spikelet Number vs Seed head size (mm), R² = 0,6261



Seed head size (mm), R² = 0,6356

▶ This is why, assuming seed head sizes are equal should be used with caution

▶ Promoting the need for a greater level of definition

# THE NEW 6.700KG

▶ If we assume 6.700kg ha$^{-1}$ to be the "potential"

▶ Our reproductive efficiency increases

▶ Reproductive efficiency is the:

"total number of seed positions"
"total number of harvested seeds"

| Harvested Yield (kg ha$^{-1}$) | Reproductive Efficiency (%) |
|---|---|
| 0 | 0 |
| 500 | 7 |
| 1000 | 15 |
| 1500 | 22 |
| 2000 | 30 |
| 2500 | 37 |
| 3000 | 45 |
| 3500 | 52 |

# WHAT DO THE YIELDS LOOK LIKE?



58.772 kg ha$^{-1}$

10.000 kg ha$^{-1}$

6.700 kg ha$^{-1}$

1.500 kg ha$^{-1}$

# RECAP

- ▶ We have a better estimate of potential seed yield when considering seed head size

- ▶ Based on the same yield equation

- ▶ Adding 'more pieces to the pie', makes for a delicious pie

  - ▶ Seed head size drives up yields by increasing spikelet and floret number

- ▶ Improves 'reproductive efficiency'... Literally overnight

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# WHERE TO NEXT...

- ▶ Pollination rate (seed set) %

- ▶ Thousand Seed Weights

  - ▶ Both will complete the "path"

- ▶ Information this study will provide will finally give our team and breeders some much needed information

- ▶ And the answer might not be as straight forward as you think....

**THANK YOU**

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