



# Digging Deeper: Identifying long-coleoptile wheat for dry seeding success

University of Manitoba

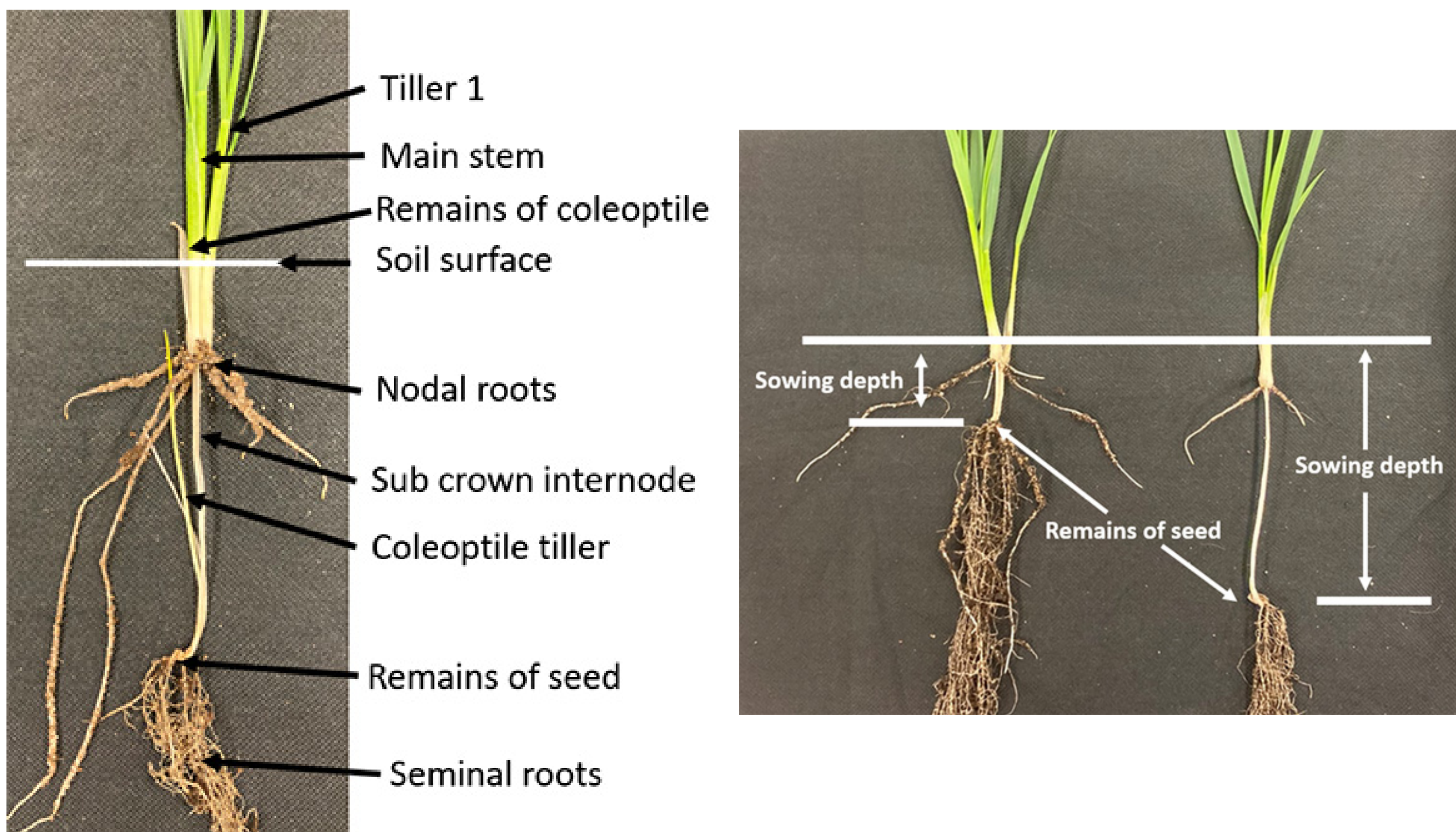
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## INTRODUCTION

- Seeding into moisture during dry conditions may require very deep seeding
- The coleoptile is the protective sheath that encloses the emerging shoot and first leaves, it needs to "punch" through the soil surface
- The longer the coleoptile, the greater the emergence potential
- The length of the coleoptile determines the depth of soil cover from which a seed can reliably emerge.
- Semi-dwarf wheat cultivars can result in a shorter coleoptile, hindering emergence when deep seeding

What is the coleoptile length of Canadian spring and wheat cultivars? Does plant height relate to the length of their coleoptile?



Wheat plant anatomy. Photo credit: CSIRO

The effect of sowing depth on wheat plant with short and long coleoptile relative to the surface. Photo Credit: CSIRO

## METHODS

We screened 34 spring wheat and 16 winter wheat cultivars for coleoptile length potential under controlled growing conditions

Seeds were sieved to maintain similar seed size and disinfected with a 1% bleach solution.

Twenty-five uniform seeds were placed germ side down in the middle of moist germination paper and placed fold-side down in a 50mm diameter plastic centrifuge tube and held upright in the holder

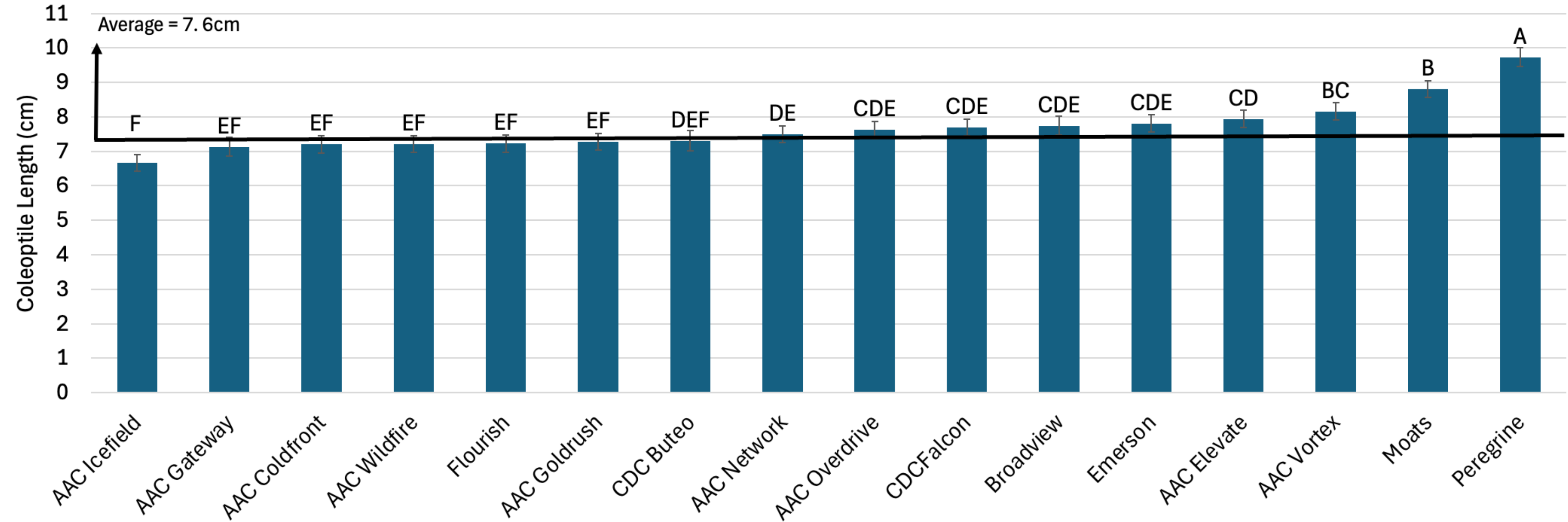
Tubes were placed in growth chambers set to 18C with 90% humidity in darkness. After 7 days, 10 seedlings were randomly selected to measure coleoptile length. The experiment had 3 replicates and repeated twice.

Plant heights were collected from a combination of Seed Manitoba Guides, Variety Descriptions, and 3 years of field data from the Winter Wheat Breeding program at the University of Manitoba

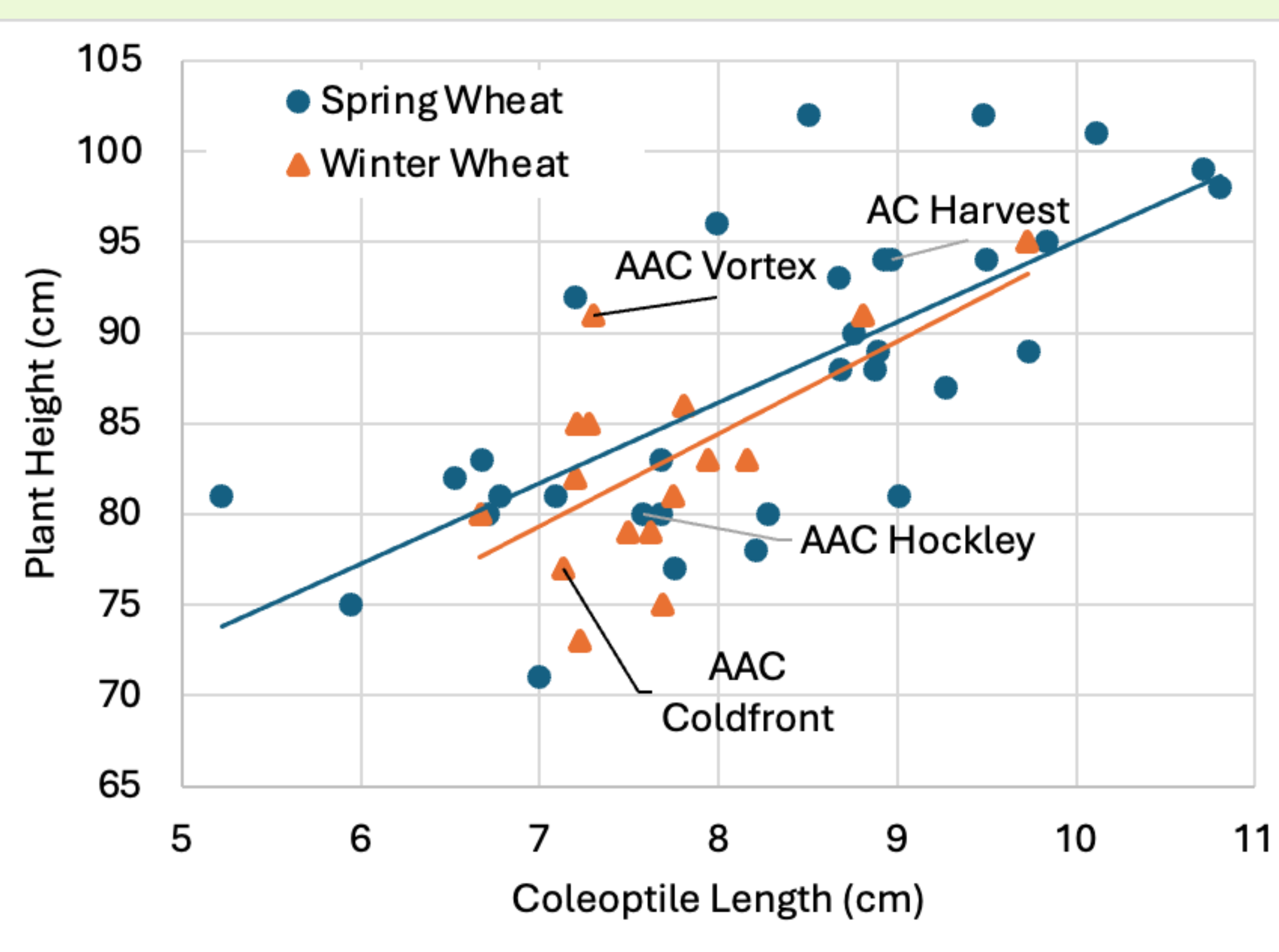
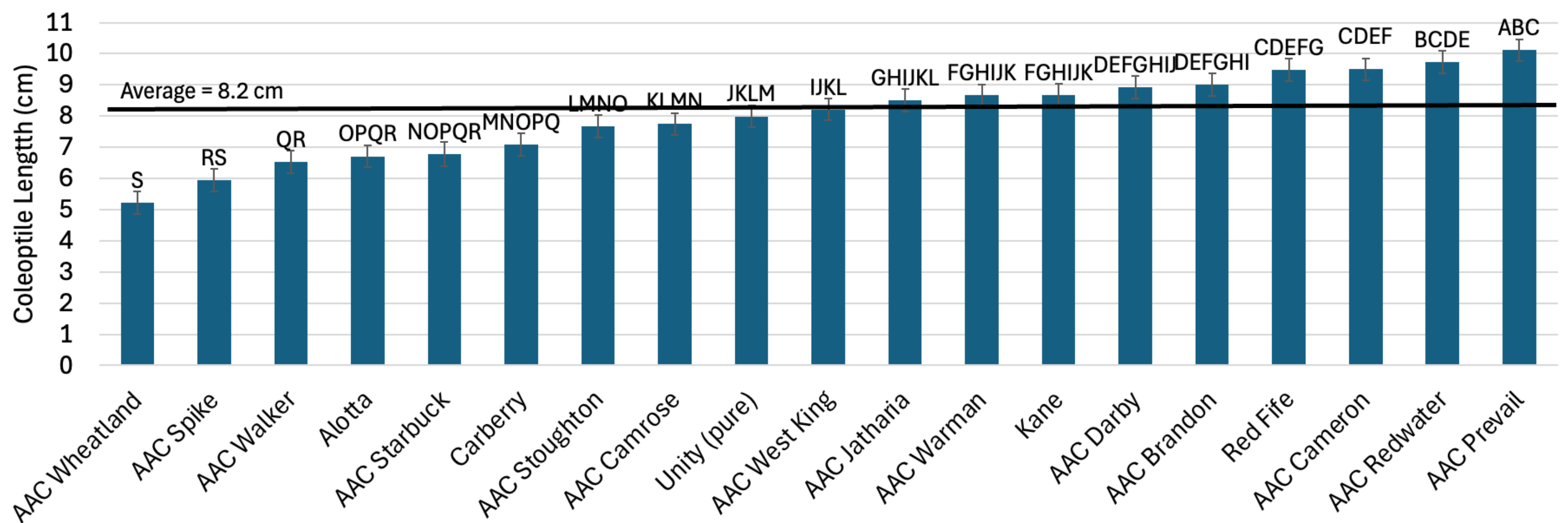


An example of coleoptile lengths after the 7-day incubation period.

## RESULTS and DISCUSSION



Above: Coleoptile Lengths of 16 winter wheat cultivars. Below: Coleoptile Lengths of 20 spring wheat cultivars. Exhaustive list found in publication, linked in the QR code at the bottom of this poster. Cultivars with the same letters are not significantly different from each other at P>0.05



Relationship between coleoptile length and plant height among 16 winter wheat and 33 spring wheat cultivars

**Quick conversion! 1 inch = 2.54 cm**  
Optimum seeding depth for cereals:  
1 - 2.5 inches = 3.75 - 5cm

- Winter wheat cultivars ranged from 6.7 to 9.7 cm
- Spring wheat cultivars ranged from 5.2 to 10.8 cm (McKenzie)
- There was a significant relationship among plant height and coleoptile length, but some exceptions exist
  - AAC Vortex and AAC Coldfront had similar coleoptile length, but varied in height by 20cm
  - AAC Brandon and AAC Starbuck are similar height, but AAC Brandon's coleoptile was 2.2cm longer
- Pushing strength, speed, tillage practices, soil texture, and temperature should also be considered in future research

## CONCLUSIONS and OTHER CONSIDERATIONS

Coleoptile length does vary by cultivar, so having this information may help if you/client are worried about dry soil conditions at seeding.

The majority of deep seeding research has been done in Australia and some considerations they report are:

- Good quality (protein), good germ, large seed size is beneficial
- Sandy light soils -> furrow in-fill can increase sowing depth by 30%
- Increasing seeding rate by 15-20% can help with emergence success
- Sowing deep also requires more power, slower speed, and possible greater press-pressure that could reduce emergence

Tons of information can be found at: <https://grdc.com.au/> and searching "coleoptile"



A seedling that did not make it to the surface.

Source: De Oliveira Silva, 2013: <https://osuwheat.com/2013/09/06/planting-wheat-in-hot-soils/>

Complete list of coleoptile lengths can be found here:

Carkner, et al. 2025. Can. J. Plant Sci. 105, 1-6. <https://doi.org/10.1139/cjps-2025-0075>

Check out the publication ->

