

The relationship between early root growth in canola and yield

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Introduction

- Why Roots?
- Root growth
- Relationship to seed yield
- Work in other crops



Root Growth

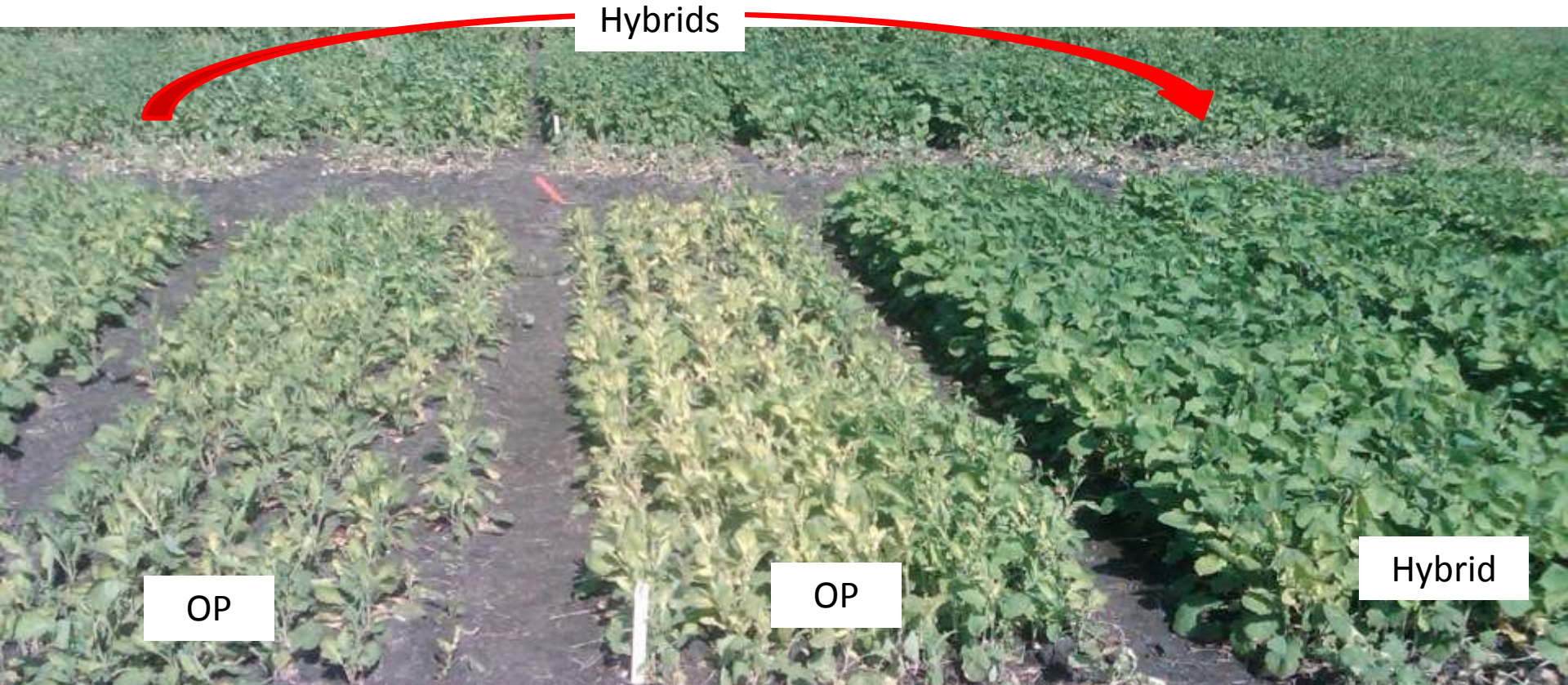


Hybrid

OP

175

Root Growth



Hybrids

OP

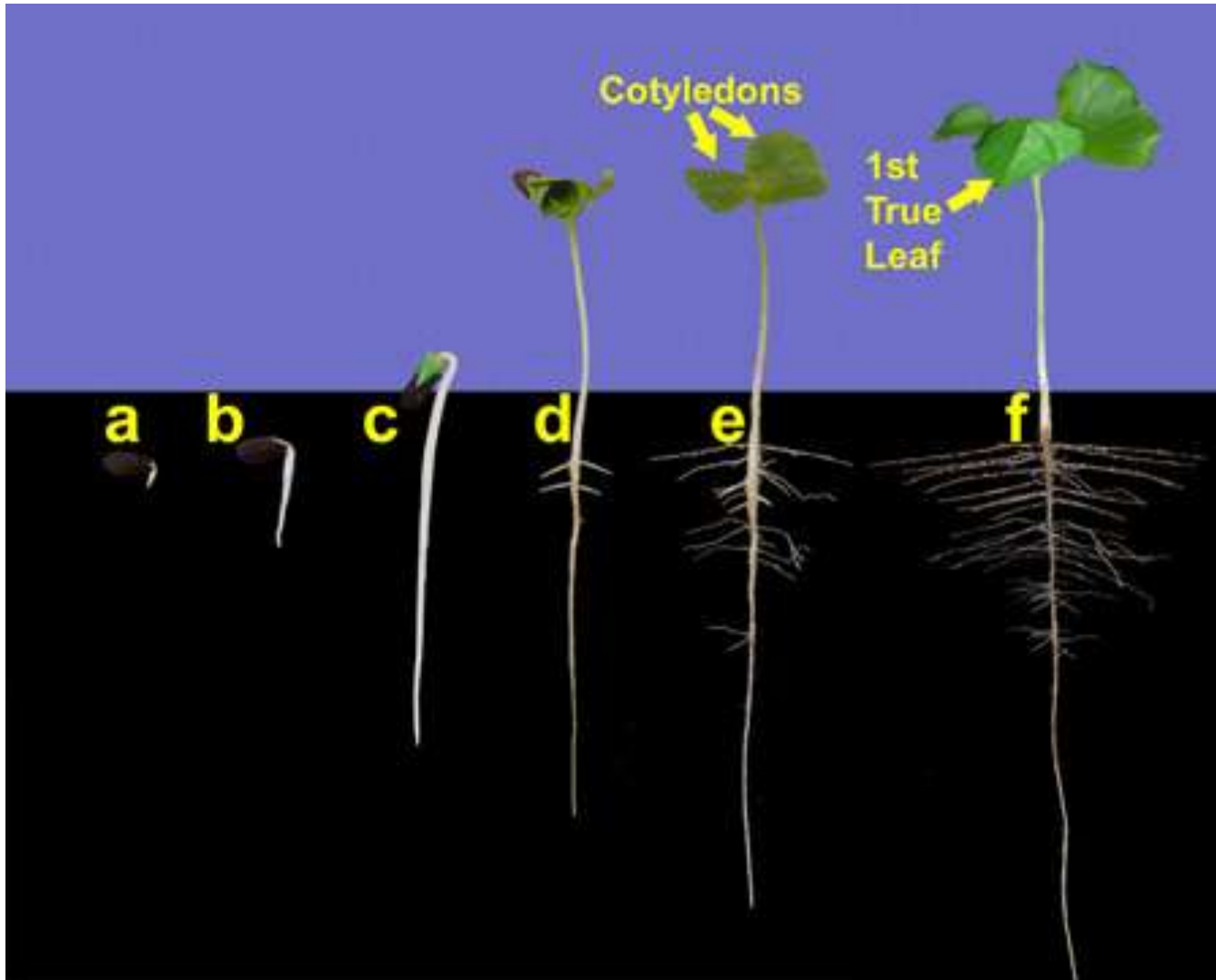
OP

Hybrid

Canola Root Growth

- >70% of a canola root is in the top 15cm of the soil profile
- 100-150cm in depth
- Water extraction recorded from a depth of 150cm, but 92-95% of the total comes from the top 105cm
- 85% of the root length is comprised of fine roots less than 0.4mm in diameter

Root Growth

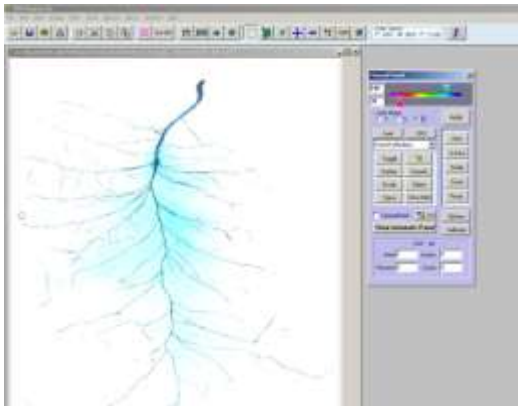


Source: <http://www.Allahdingroup.Com/cottonphysiology.Php>

Field Experiment



Field Experiment



Field Experiment

- Sample Stages

Cotyledon



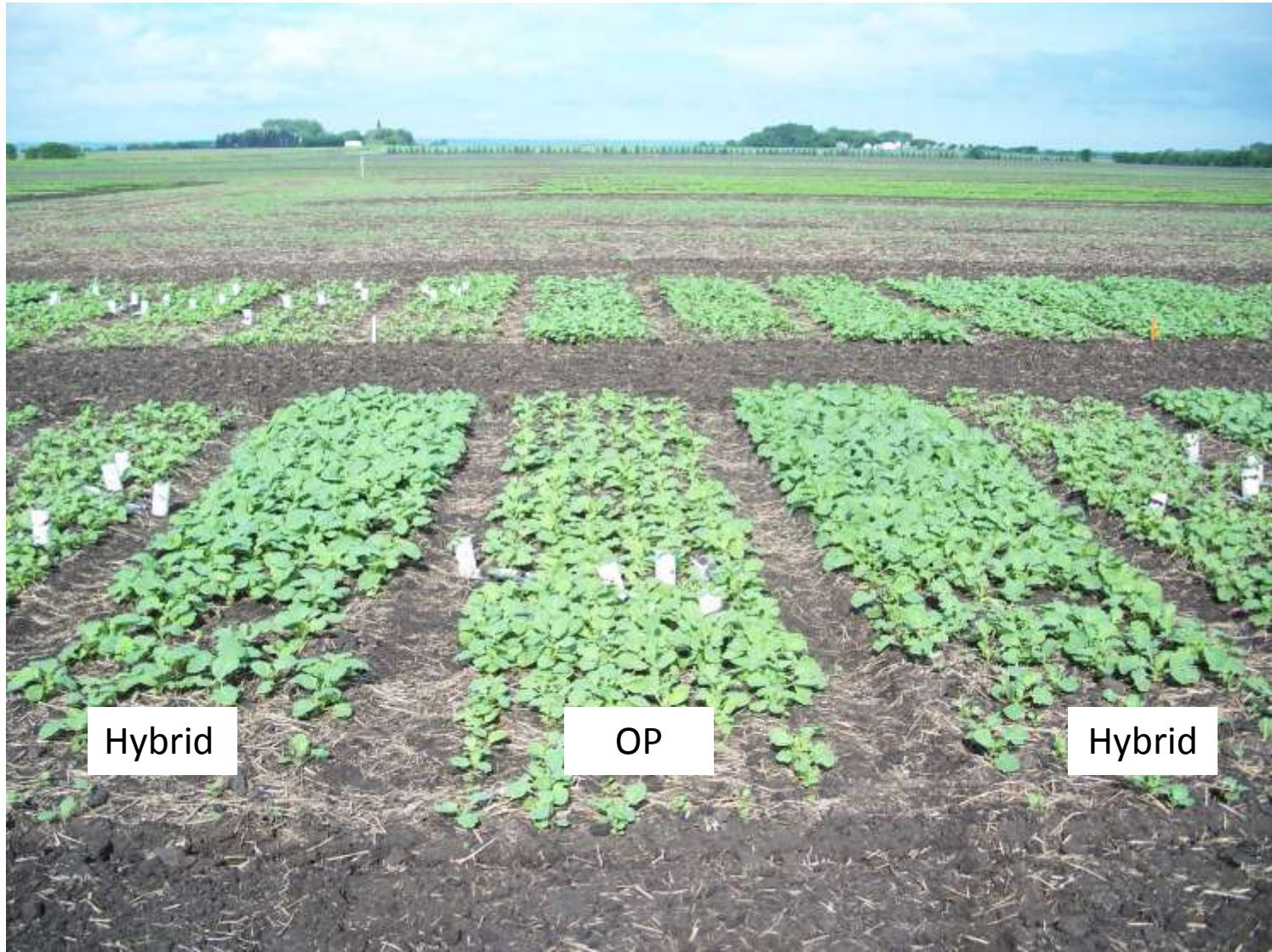
1-2 leaf



3-4 leaf Hyb



Field Experiment



Hybrid

OP

Hybrid

Field Experiment

- Traits collected
 - Root length
 - Root area
 - Root dry weight
 - Shoot dry weight
 - Leaf area
 - Physiological maturity
 - Seed weight
 - Moisture



Why only the 4 leaf stage?

- Mature wild oat plant had a root length of

86.9 km

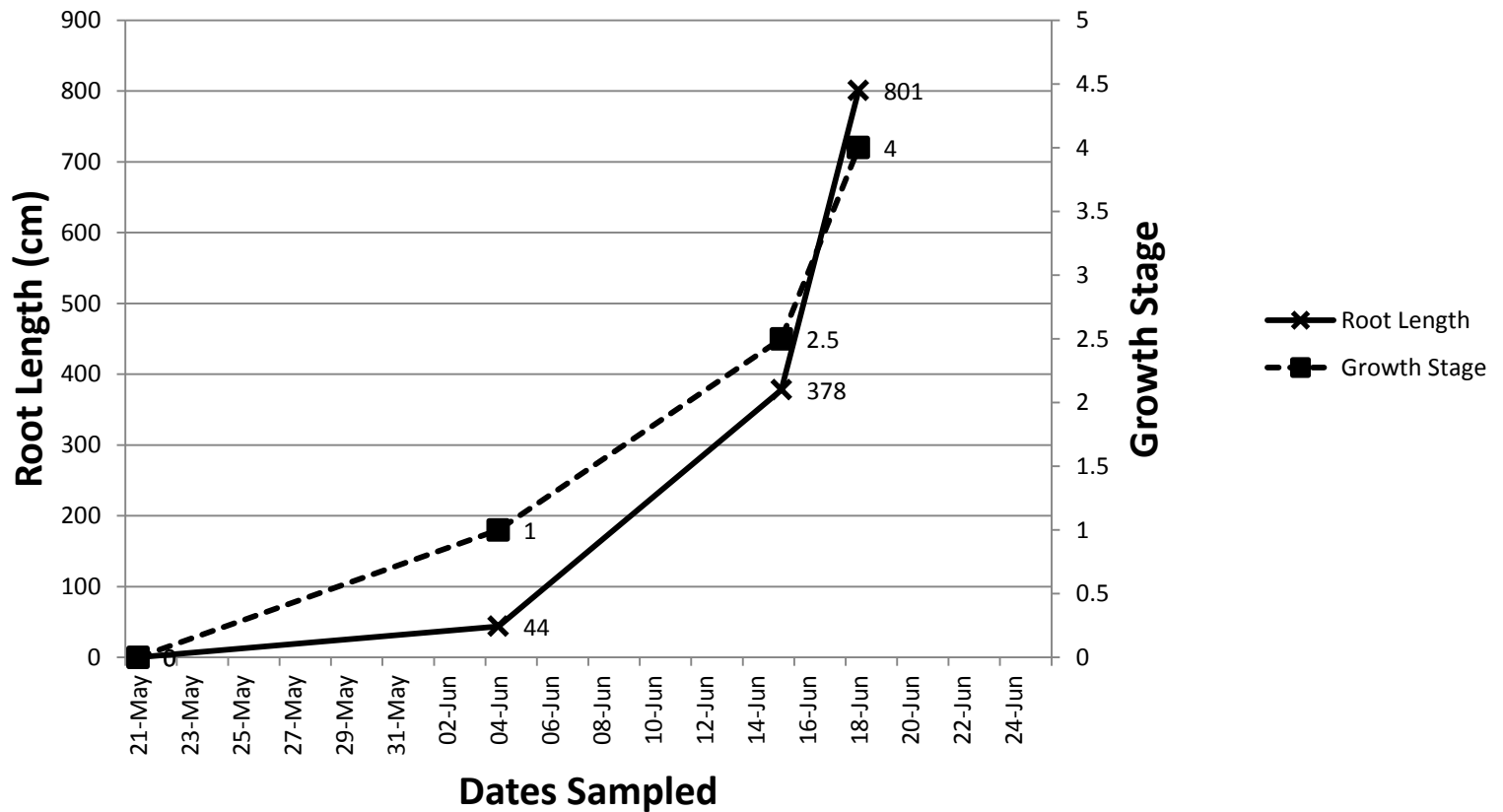


A block of soil excavated 40 days after the competing plants have emerged above the surface.

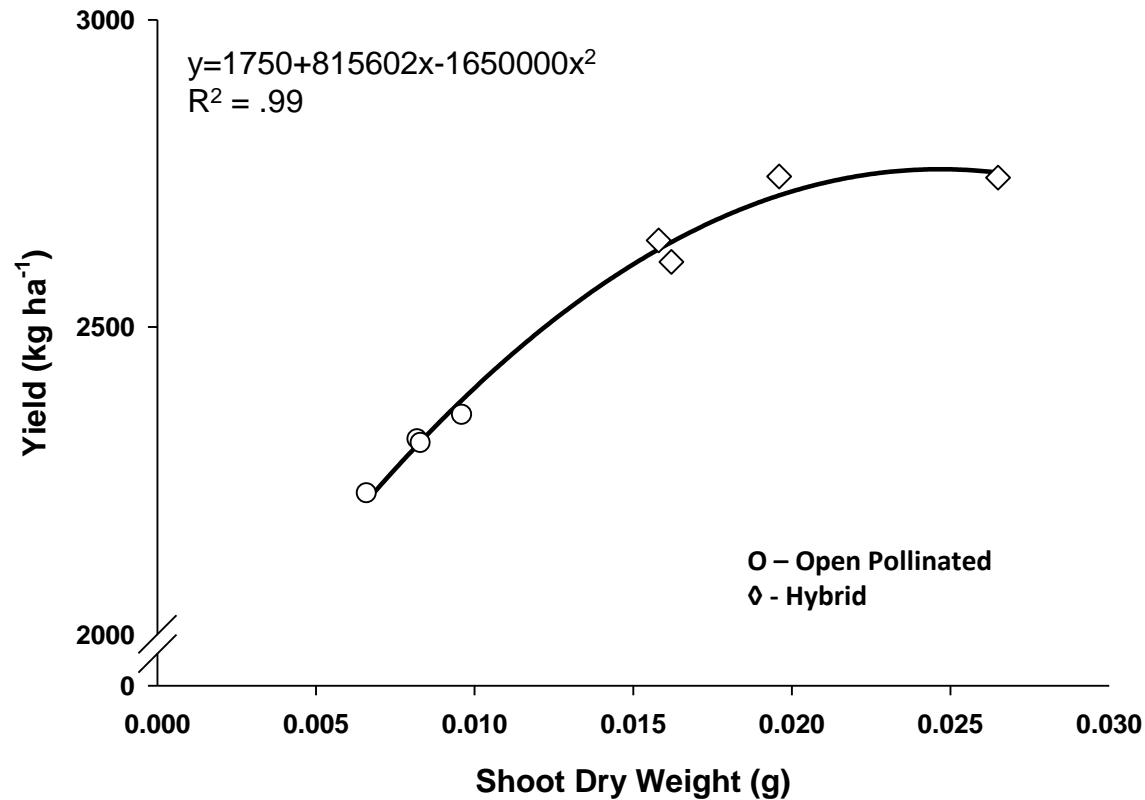


Method of extricating root systems from the ground in their entirety by washing.

Root length and growth stage across sample dates



Field Experiment

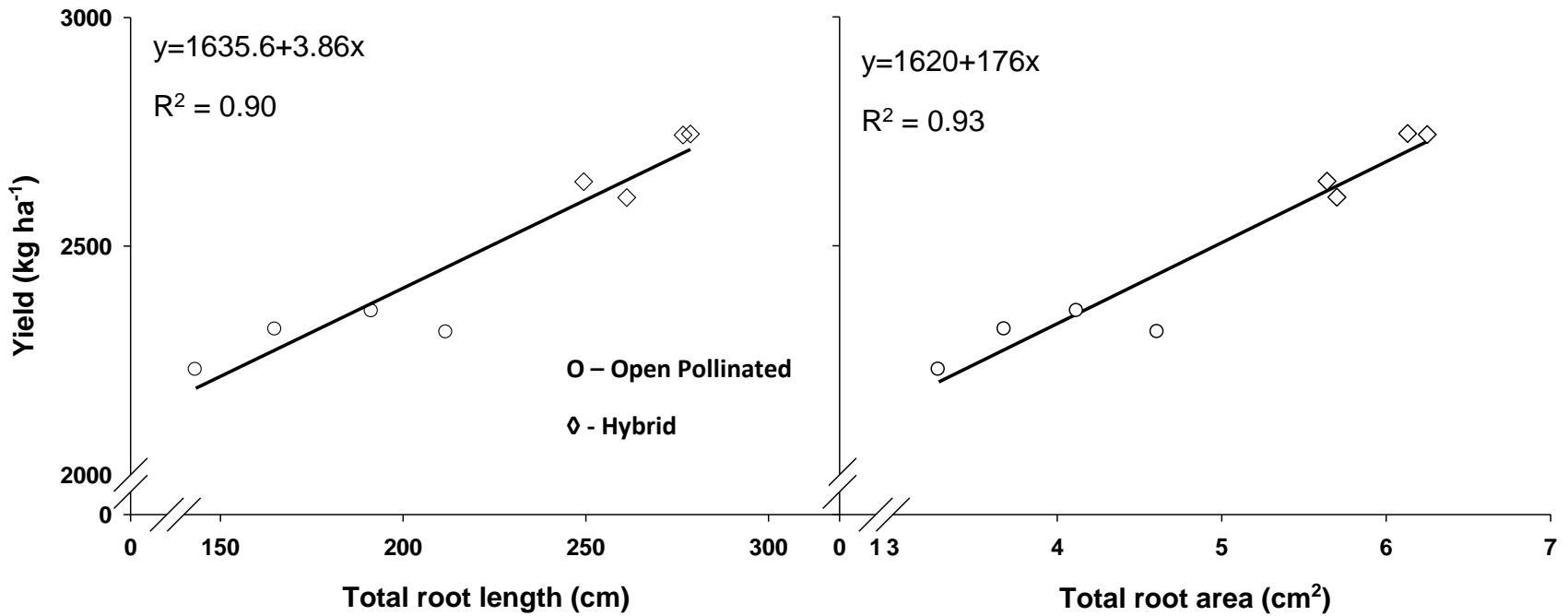


Shoot dry weight vs. seed yield at the cotyledon stage.

Field Experiment

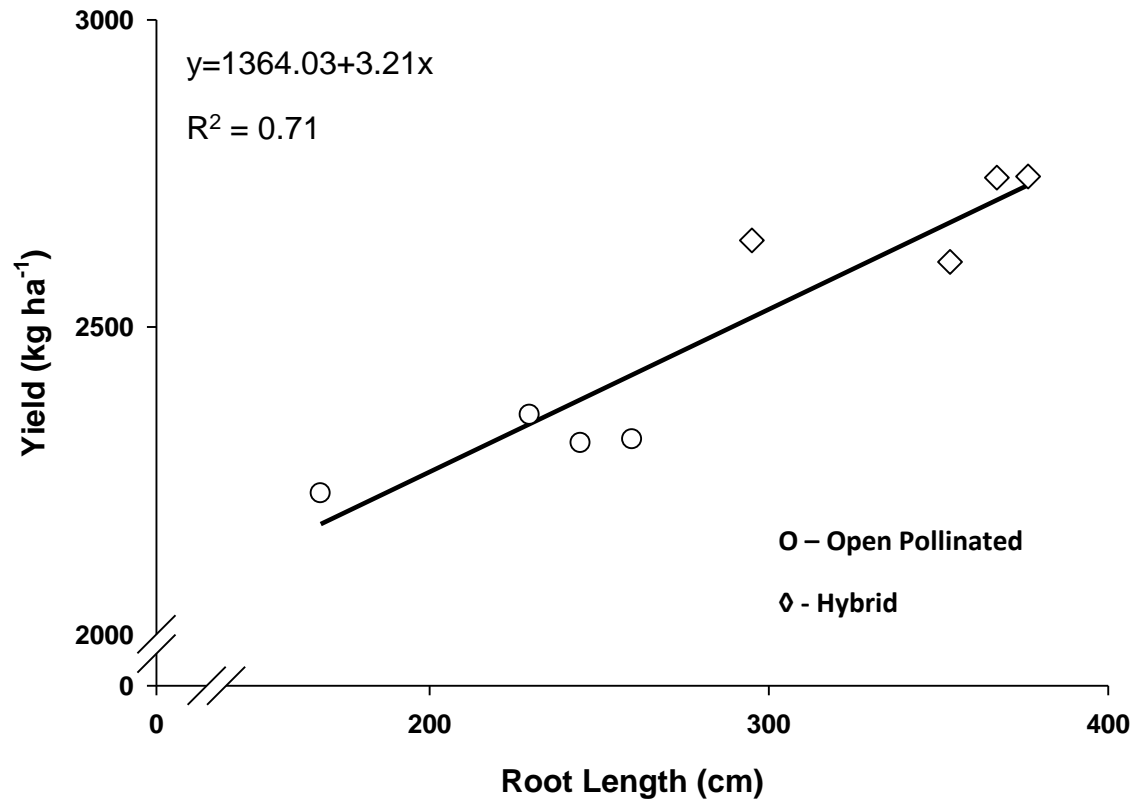


Field Experiment



Root length (right) and root area (left) vs. seed yield at the 1-2 leaf stage.

Field Experiment

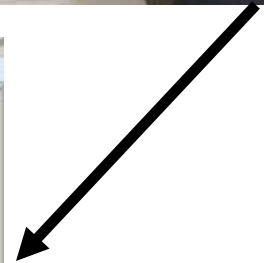
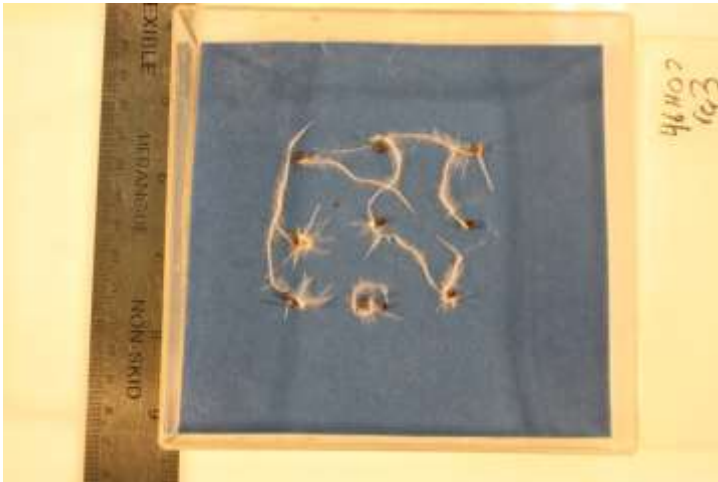


Root length vs. seed yield at the 3-4 leaf stage

Field Experiment



Growth Room

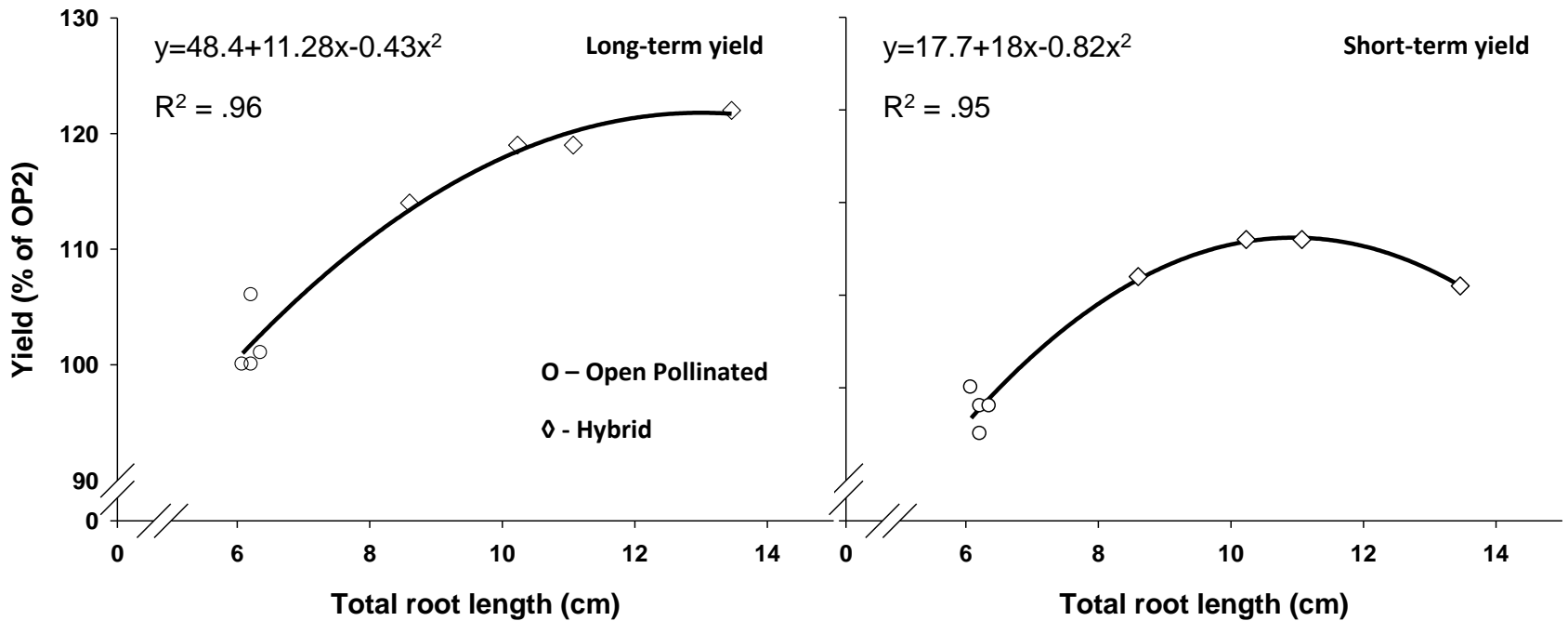


Growth Room

	Pair-Wise Comparisons	Years
Short-term	4	2
Long-term	88-2469	5-11



Growth Room Experiment



Seedling root length 7 days after imbibition vs. long-term (left) and short-term (right) seed yield expressed as a % of OP2.

Research Conclusions

- Early seedling root growth has a strong positive relationship with seed yield
- Heterosis appears to effect root development similar to shoot development
- This has potential to become a valuable breeding tool
- Platform for more research

Other Crops



Root Proliferation

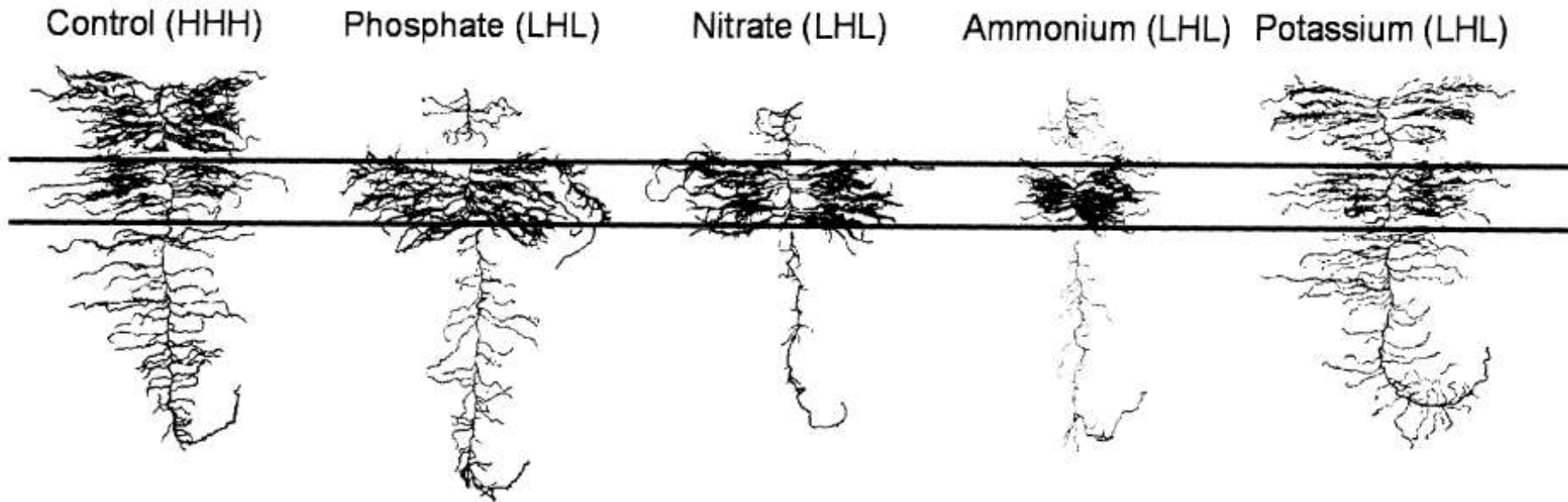


Fig. 1 Proliferation of primary and secondary laterals by barley (*Hordeum vulgare*) grown in solution culture with the middle root section exposed to a 100-fold greater concentration of phosphate, nitrate, ammonium or potassium ions compared with roots above or below (LHL). Controls were supplied with high concentration of nutrients in all zones (HHH). Abbreviations: H, high; L, low, referring to nutrient concentrations experienced by the top, middle and bottom sections of the root system. From Drew (1975) with kind permission from the trustees of the *New Phytologist*.

Root Angle

Simulation of bean root systems with differing basal root gravitropism



Models have identical root length and branching patterns

Drought Tolerance

- Agrisure Artesian™ technology



Drought Tolerance

- Optimum[®] AQUAmax[™]



Questions