Phenotypic Screening

Mutants to solve problems

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- Alter straw characters
- Alter plant phenology
- Improve disease resistance
- Improve quality characters
- Understand processes & pathways

Key Figures

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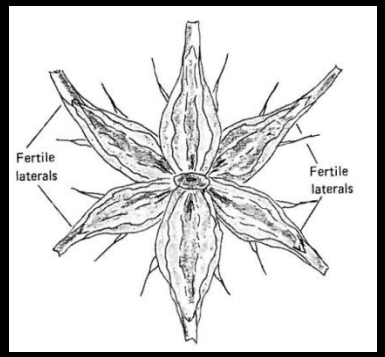
Three fertile grain at a rachis node

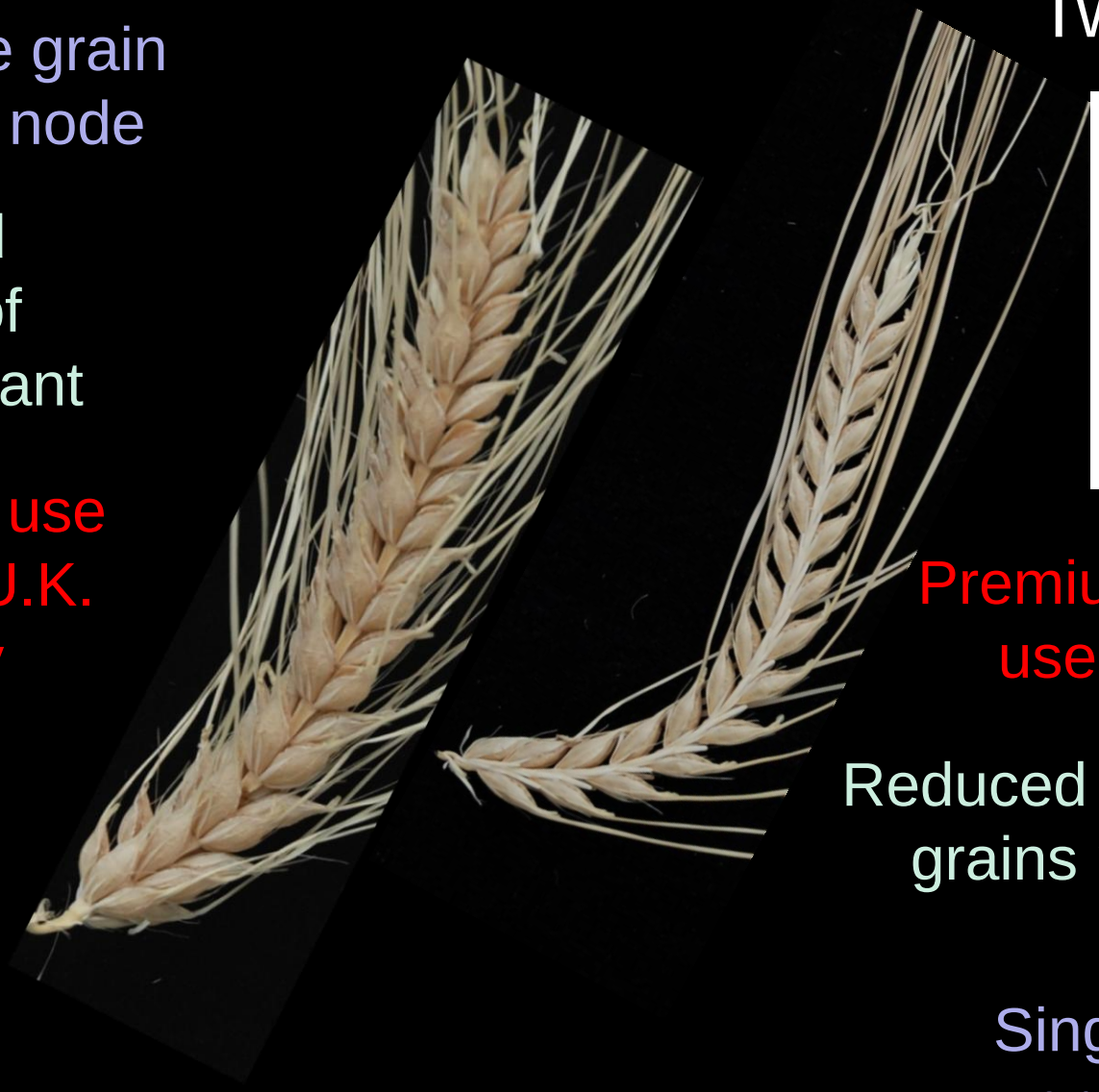
Reduced number of tillers per plant

Animal feed use only in the U.K. currently



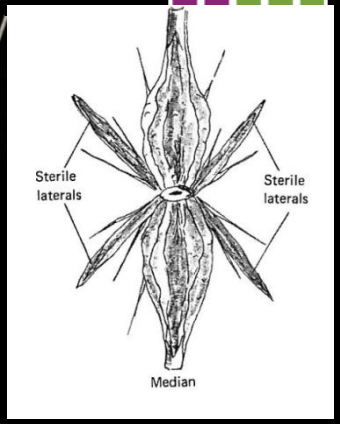
Six-rowed

8.4 t/Ha



8.2 t/Ha

Two-rowed

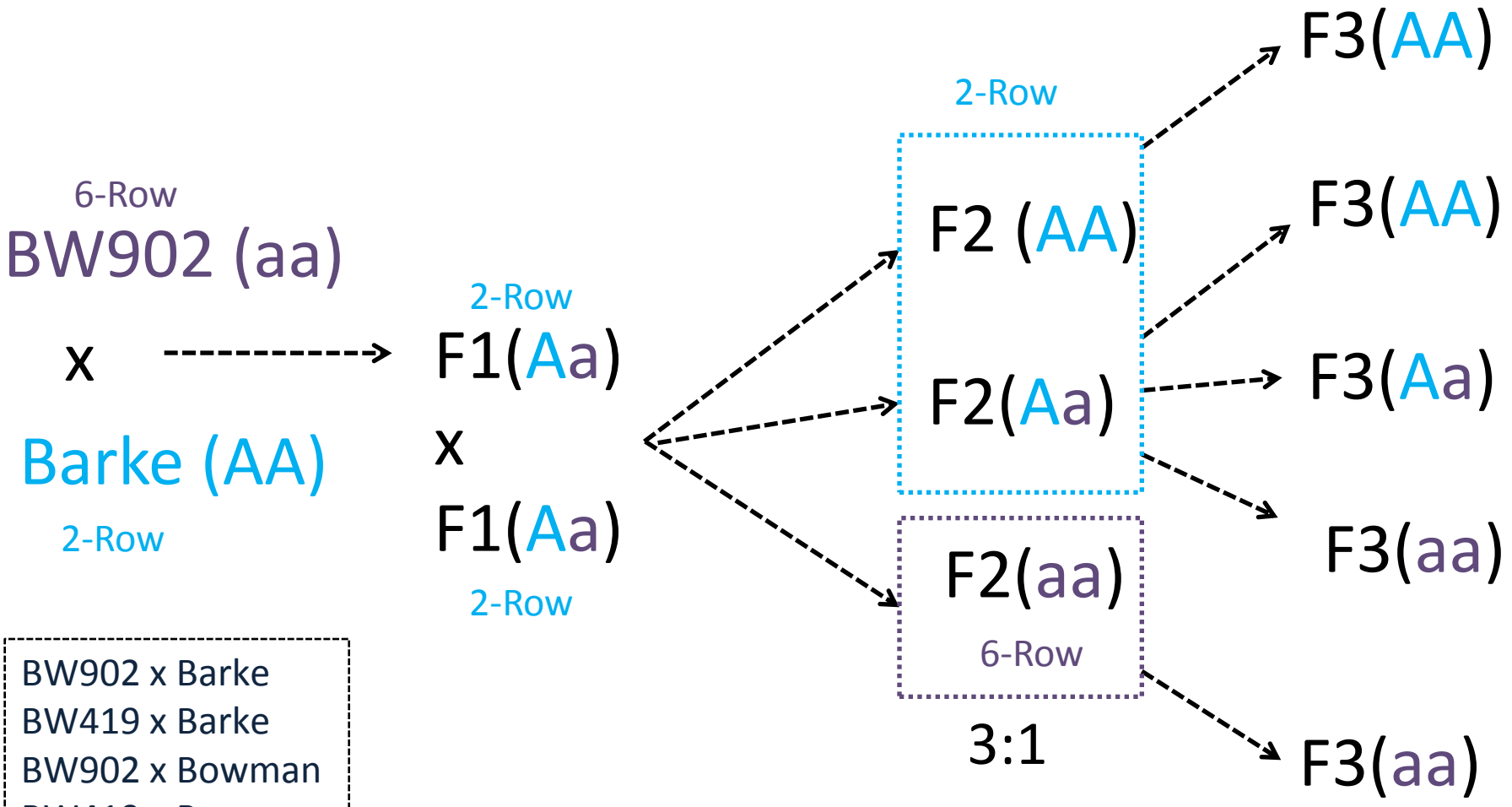


Premium malting use in U.K.

Reduced number of grains per tiller

Single fertile grain at a rachis node

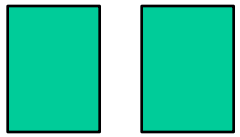
F2 Mapping.....



BW902 x Barke
BW419 x Barke
BW902 x Bowman
BW419 x Bowman

Plot Types

- Single Plants & Rows
  - ➢Fixing Major Genes and Purification
- Small Plot Trials
  - ➢Eliminate low yield and poor quality
- Large Plot Trials
  - ➢Identify high yield and good quality



Plot Types

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- Three basic modules to represent a genotype
- Single Plants
- Ear Rows or Plant Rows
- Plots, small or large
- Competition Effects
  - Reduced as plot size increases

Selection

Material	Agronomic	Quality	Numbers
SP	Appearance, Disease		~1,000,000
ERP/SPP (Early Ped)	Appearance, Disease		~50,000
ERP/SPP (Others)	Appearance, Disease	Surrogate Tests	~50,000
Y1 Trial	Appearance, Disease, -ve Yield	Surrogate Tests	~5,000
Later Trials (Sites)	Appearance, Disease, +ve Yield	Surrogate Tests, Product Evaluation	~1,000

SP – Single Plant
ERP – Ear Row Progeny
SPP – Single Plant Progeny

Spaced Plants

- Limited seed amounts
- Each plant may be unique
- Accurate reflection?

Rows

- Ear rows
- Seed still limited
- Compare between rows

Drilled Plots

- Small and Large Plots
- Drilled to a constant stand
- Representative of commercial sowings

Trialling System

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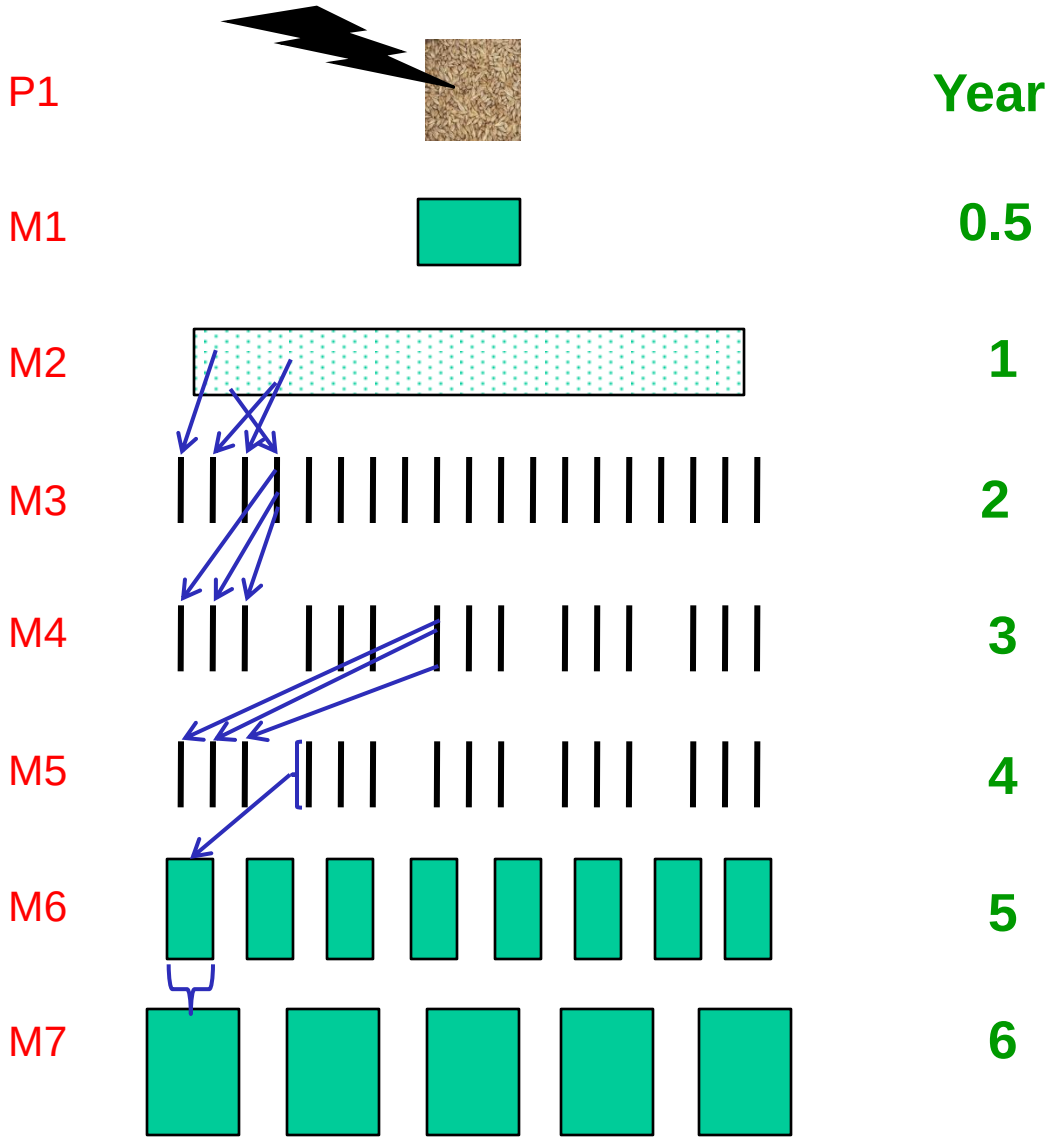
- Micro-farming to compare plots of different lines under same husbandry

- Drill & Harvest >100 plots/hr

Mutant Isolation Scheme



Mutant Germplasm

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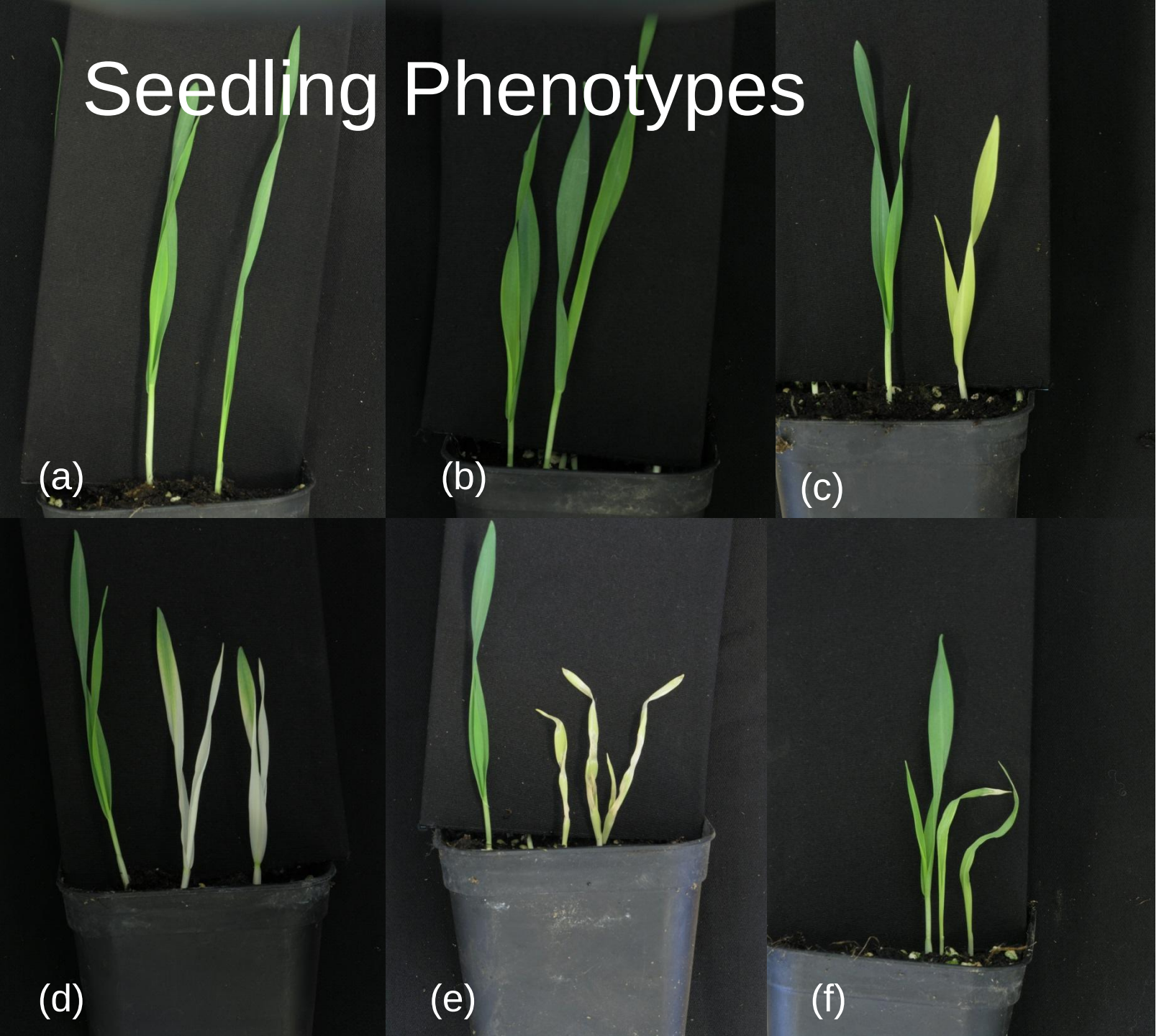
- Nordgen
- ARS-USDA
- Okayama University
- Tilling Libraries
  - Bologna
  - IPK Gatersleben
  - JHI

Seedling Phenotypes



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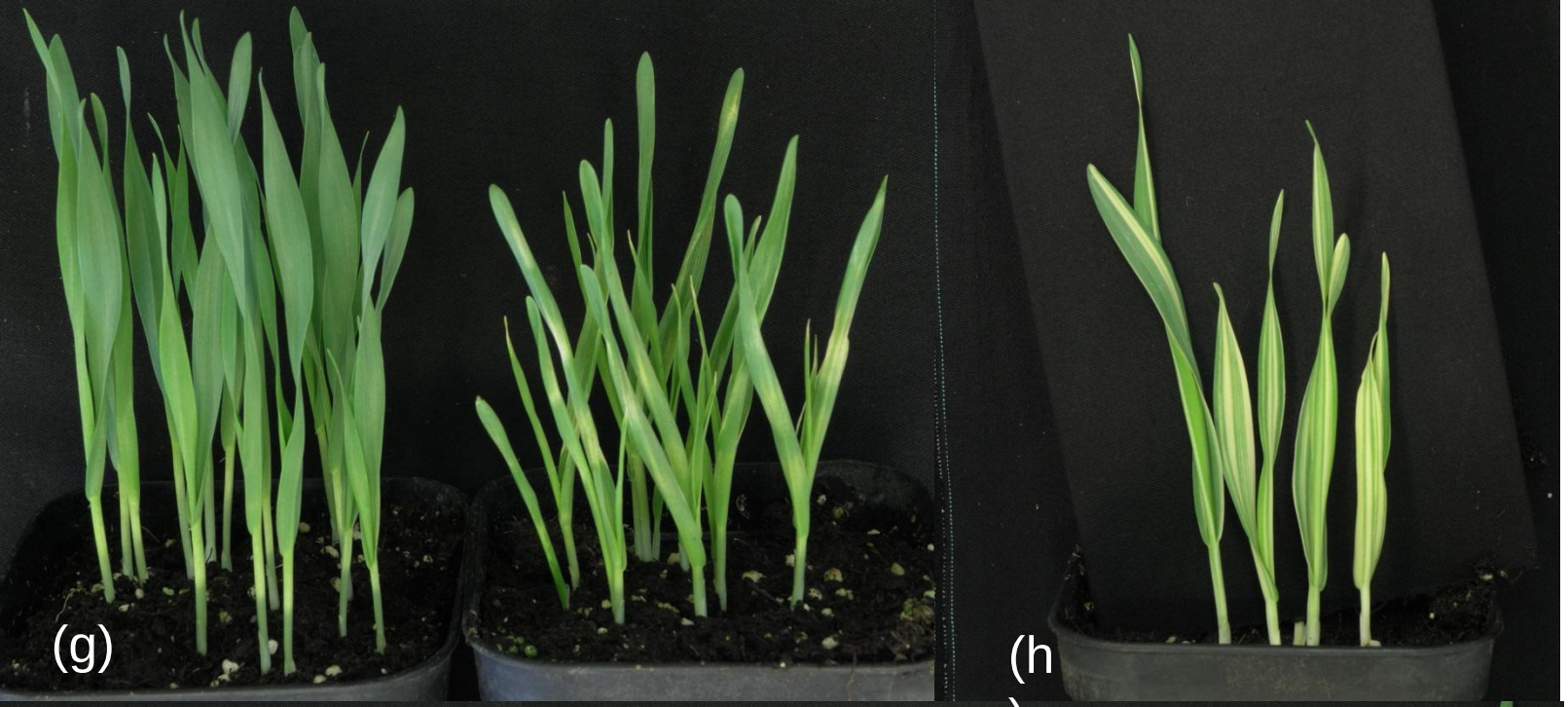

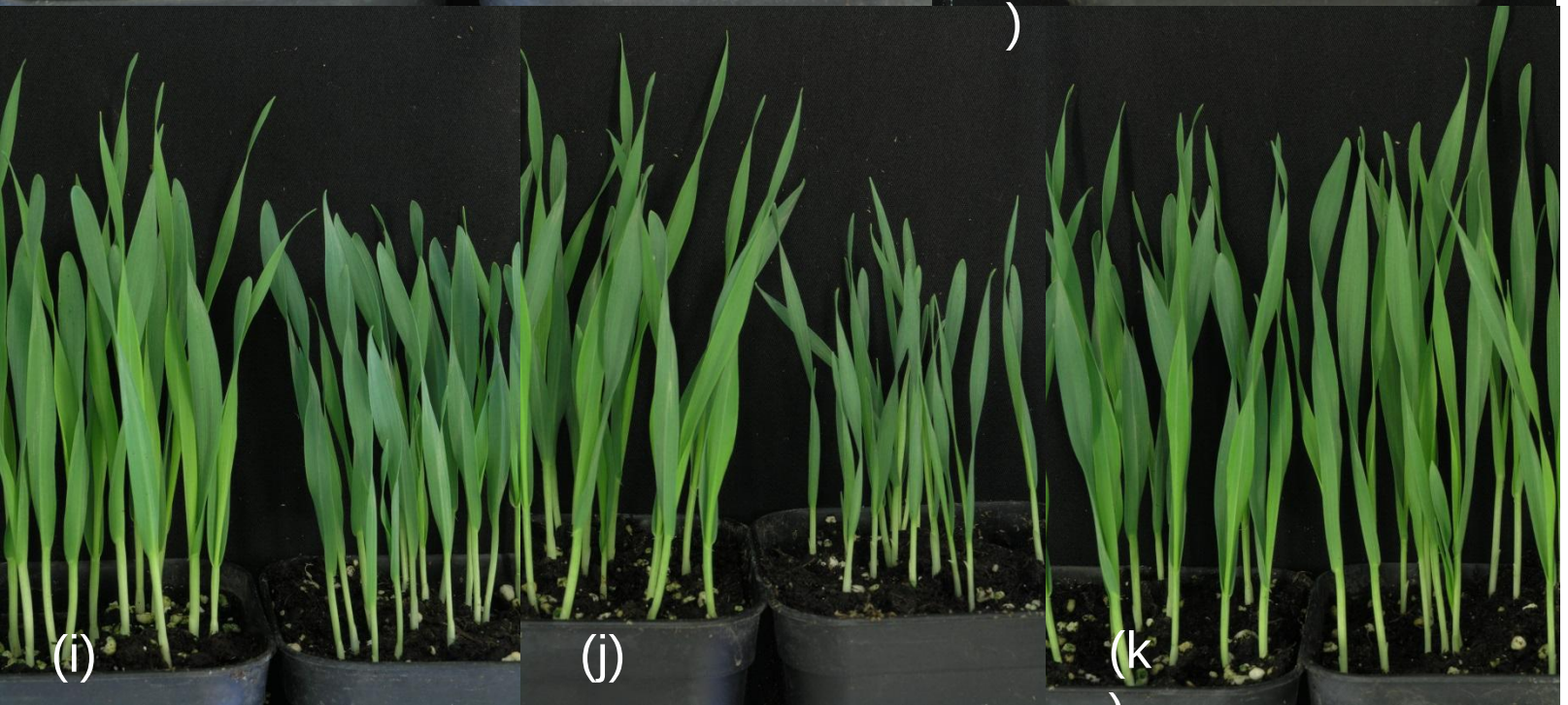

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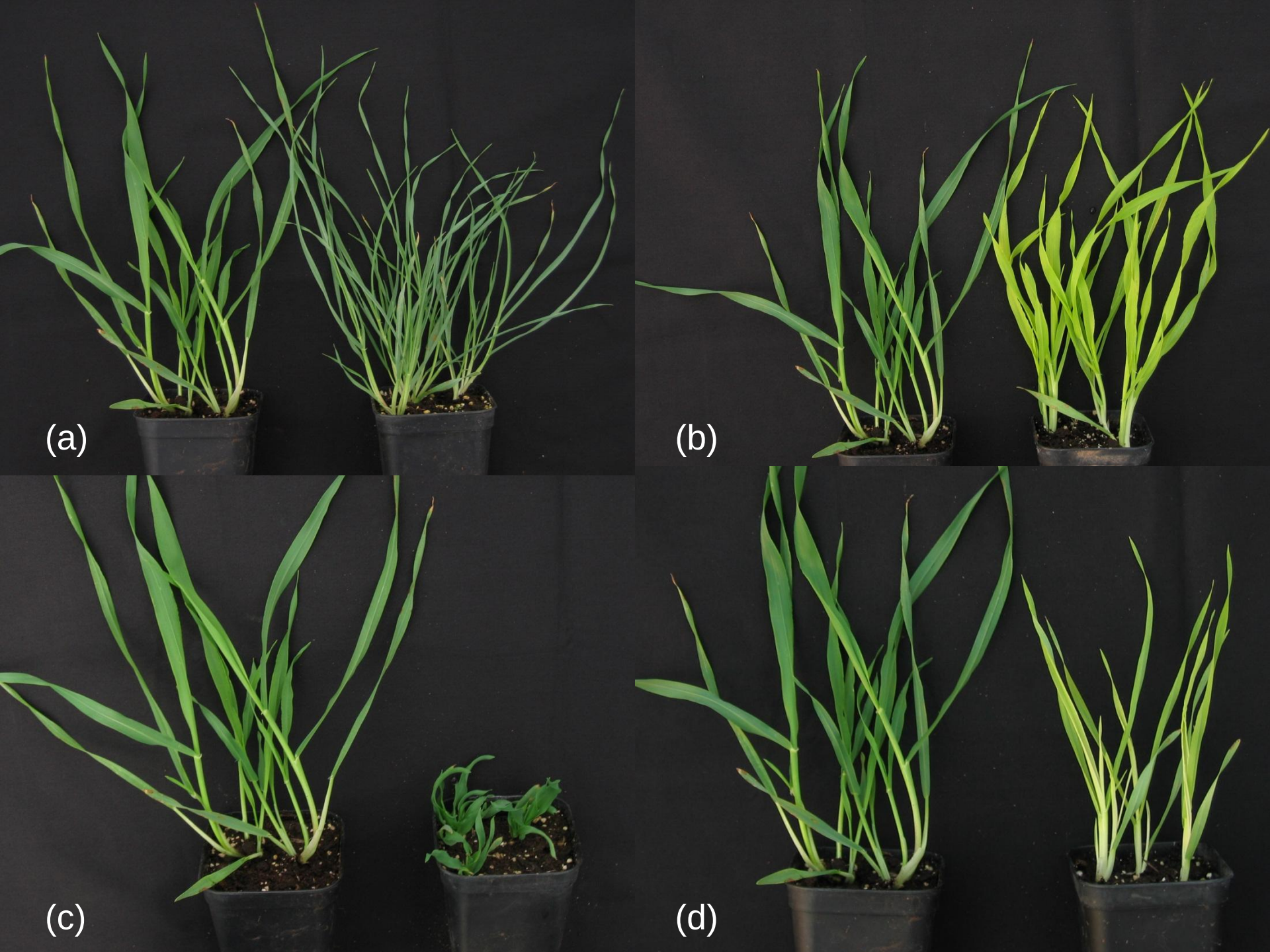
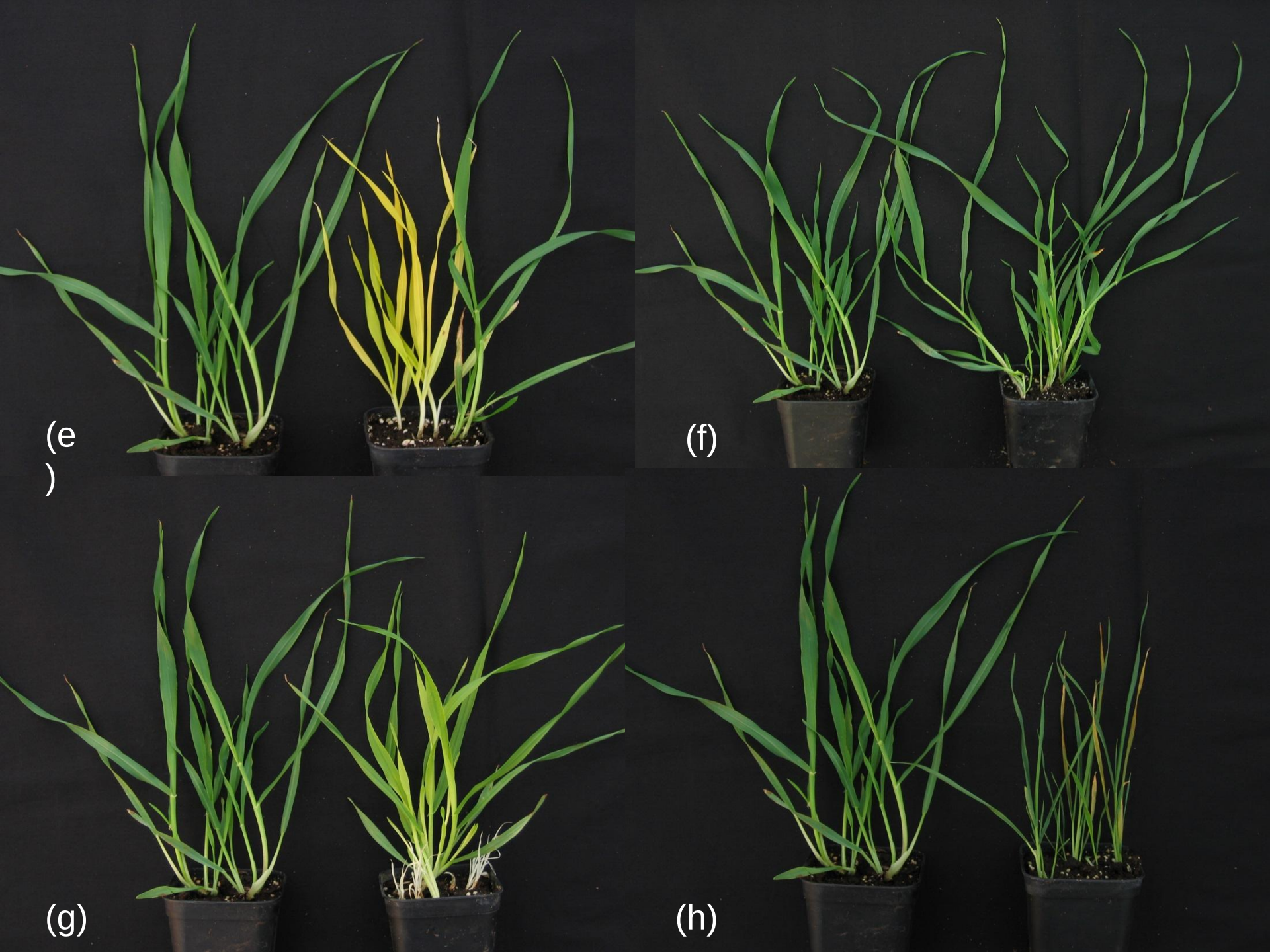
Seedling Colour Mutants


(e)
(f
)
(g)
(h)


(a)
(b)
(c)
(d)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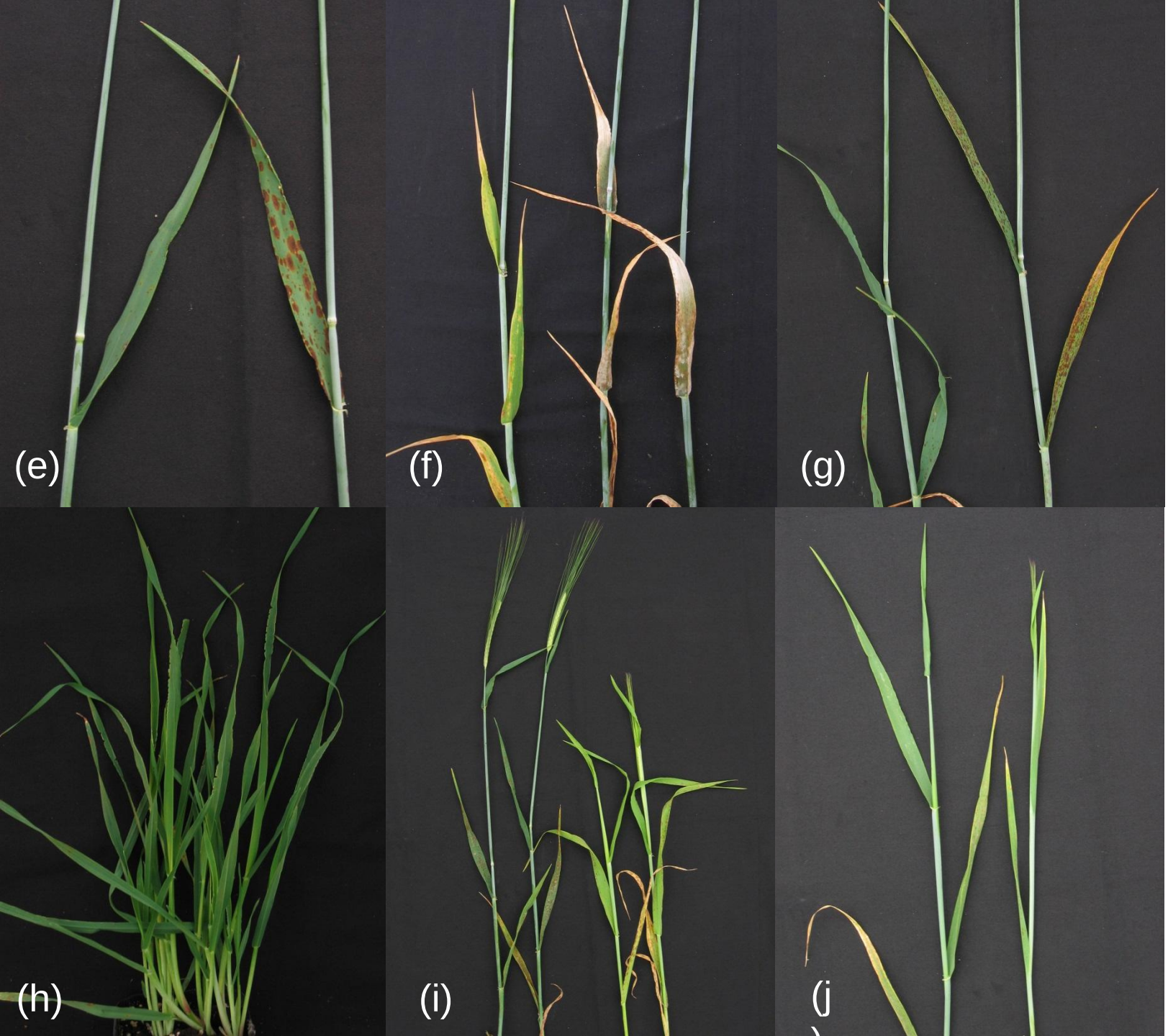

The James Hutton Institute


(a)
(b)
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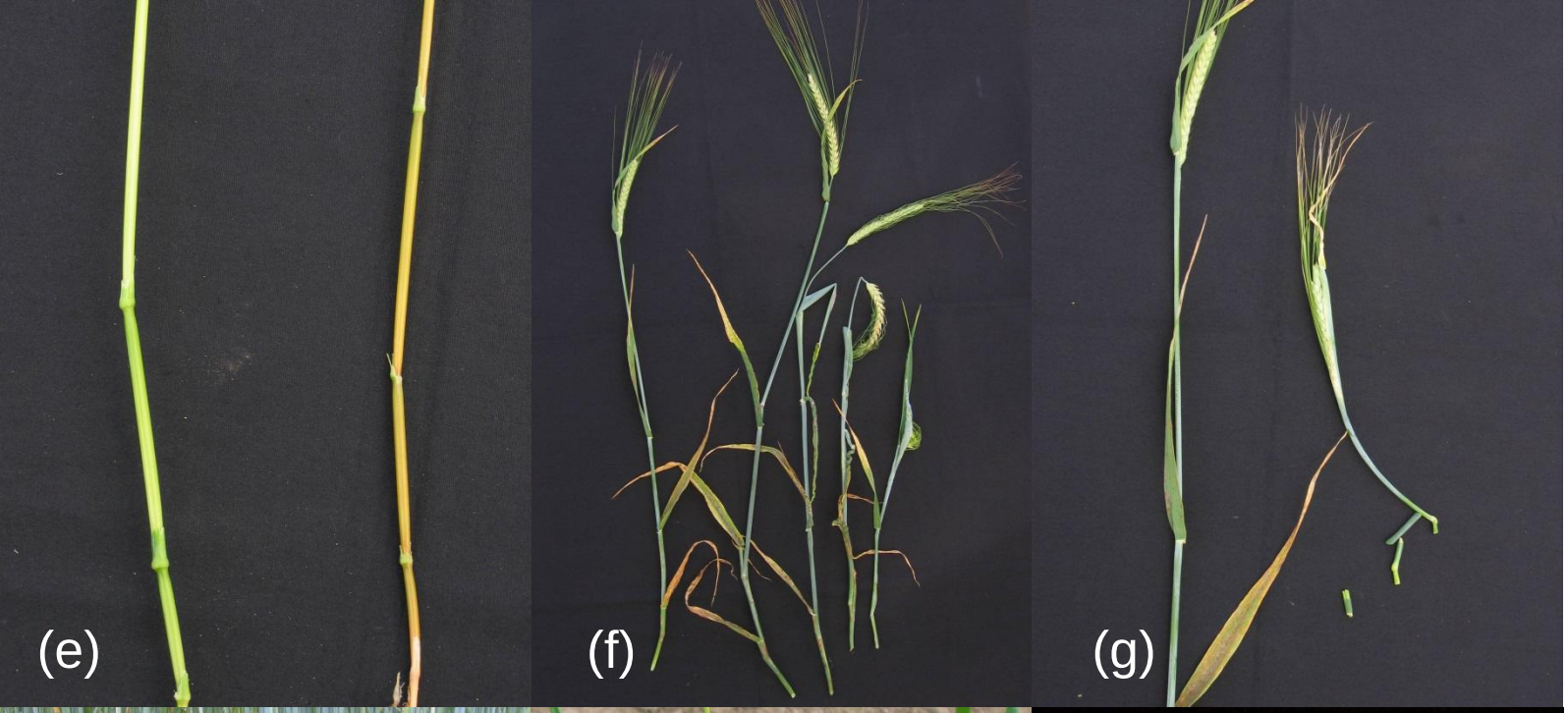

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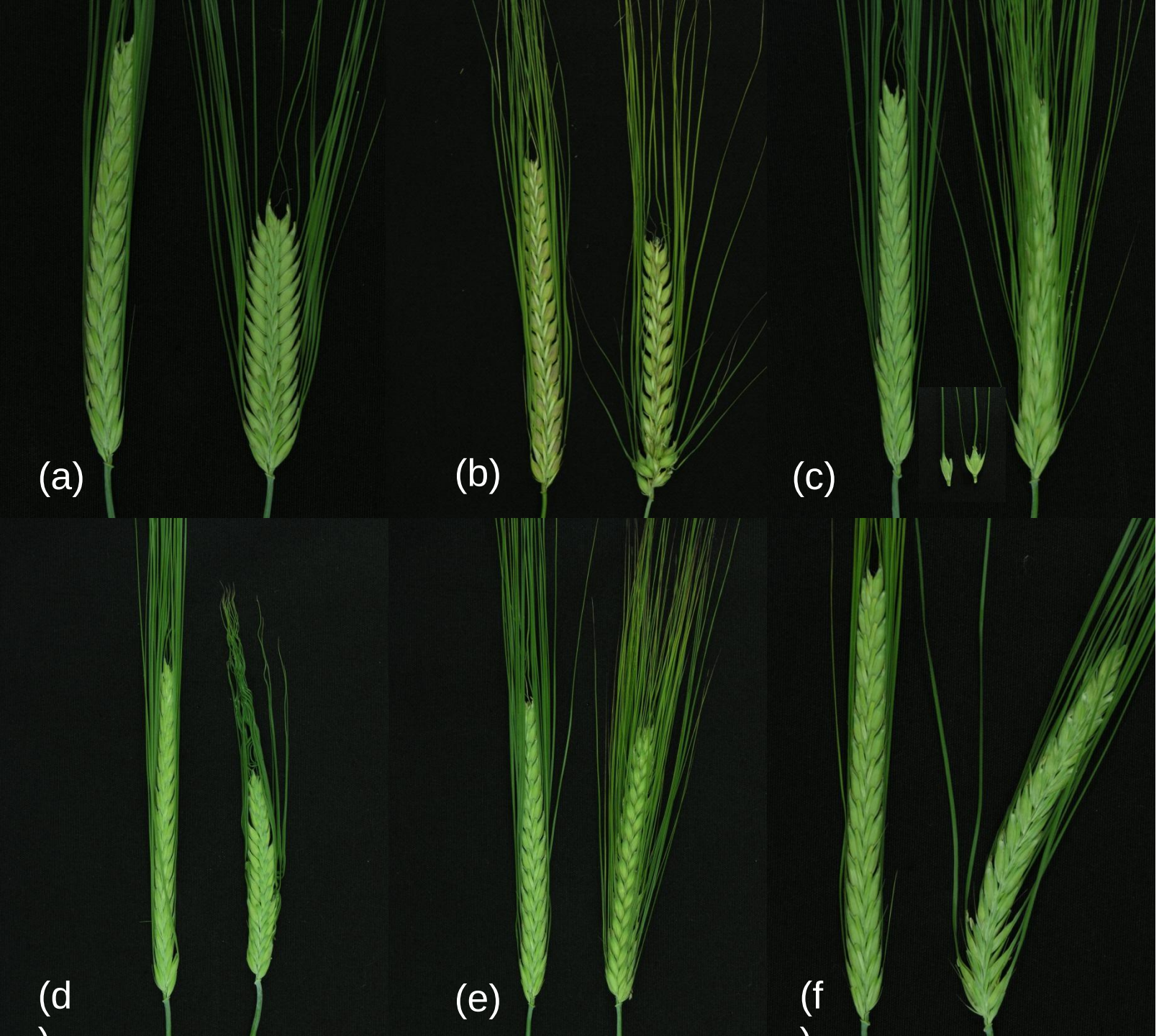

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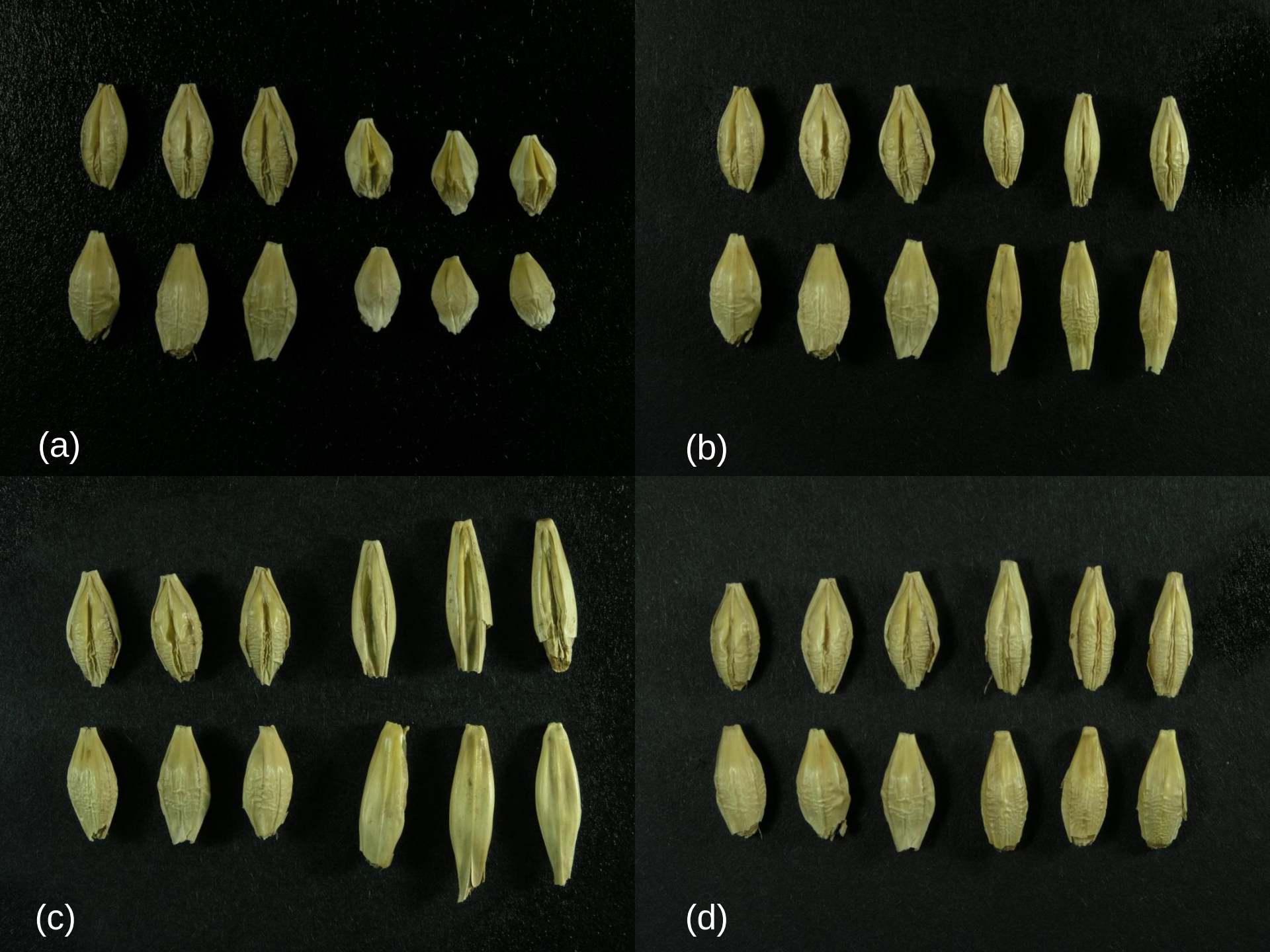
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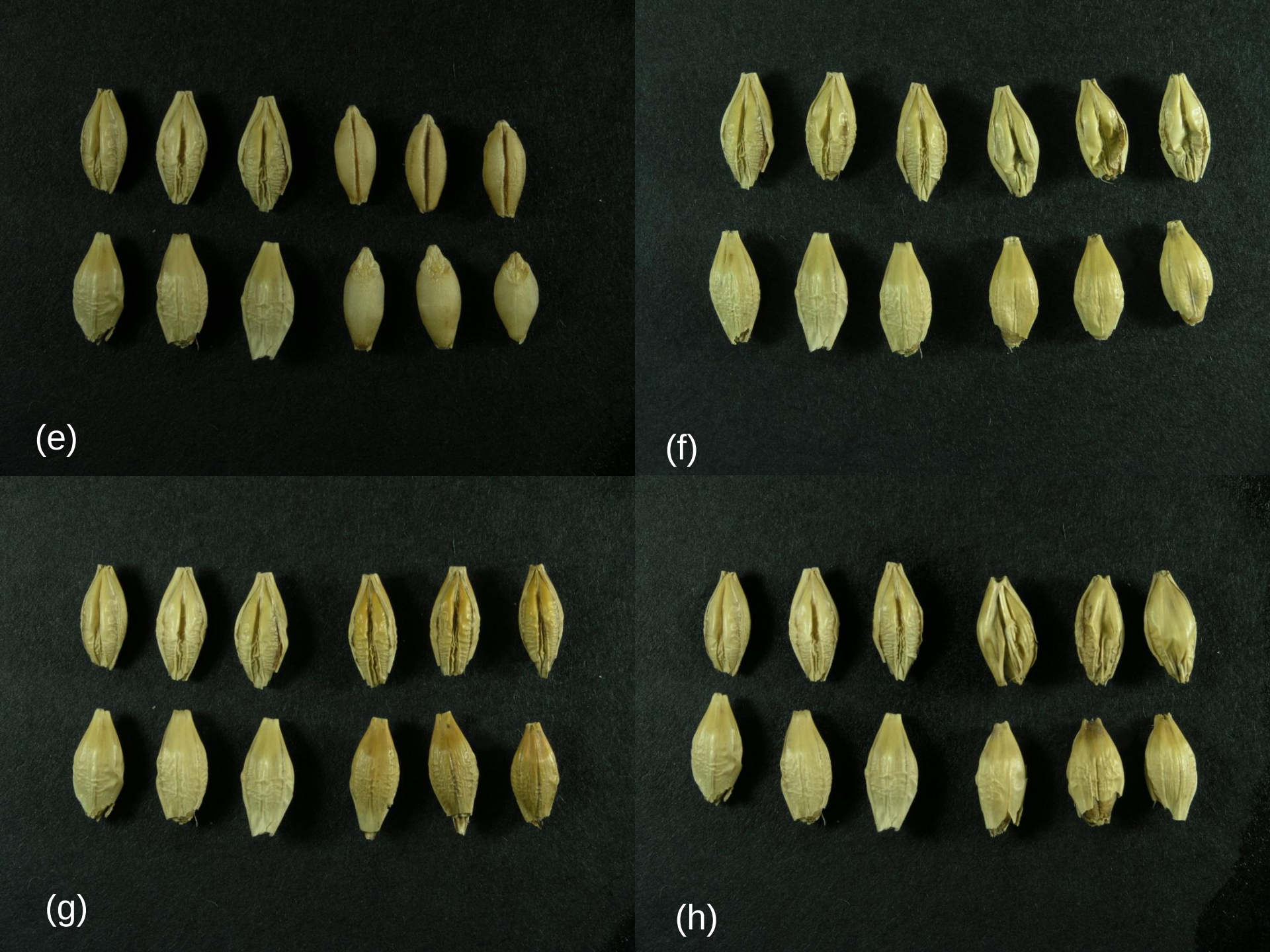
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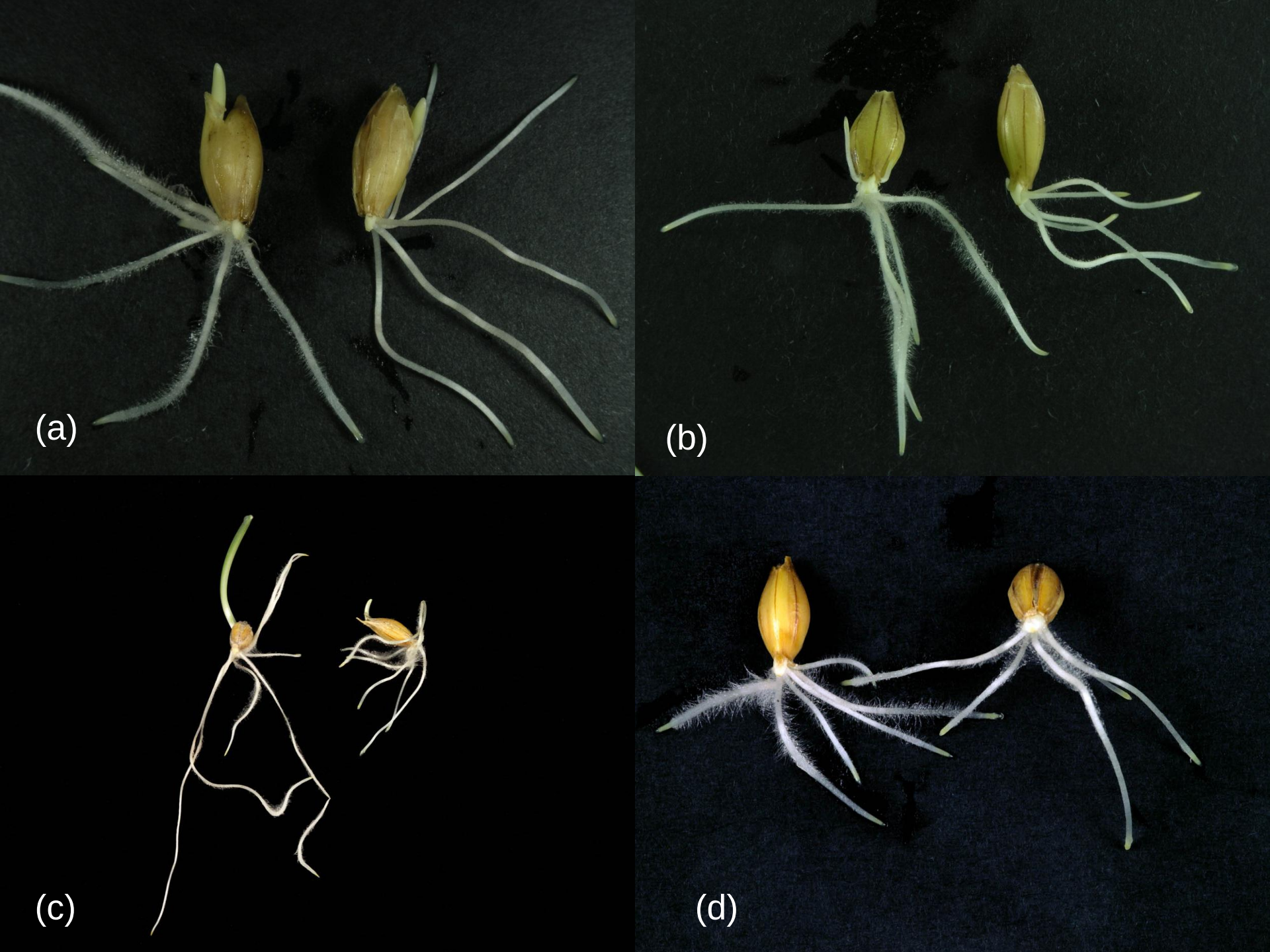
(a)
(b)
(c)
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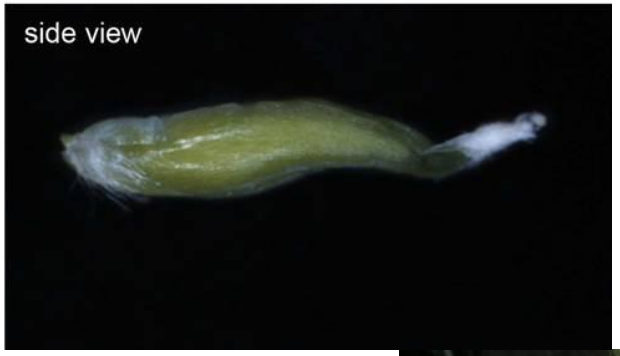
(e)
(f)
(g)
(h)
(i)

barley wild type (Bowman)

barley mutant (*seg8*)
deficient in endosperm development



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Colour Mutants

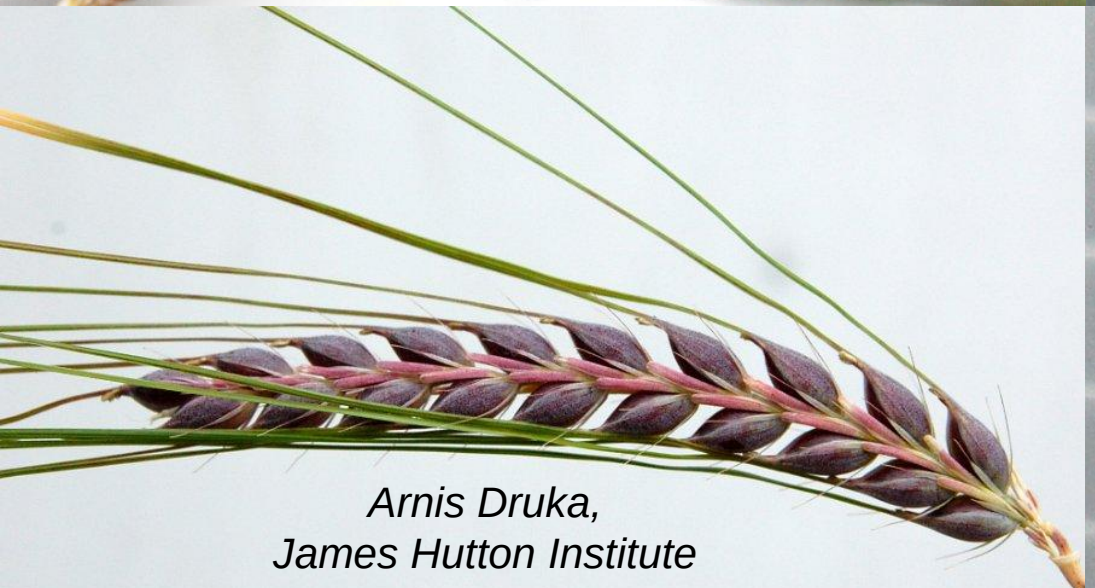
Similar mutant sold as
‘Variegated Cat Grass

Arnis Druka,
James Hutton Institute

Structure Mutants

Arnis Druka,
James Hutton Institute

Barley Grain Colour Mutants



Arnis Druka,
James Hutton Institute

Ear Mutants

Arnis Druka,
James Hutton Institute

Arnis Druka,
James Hutton Institute

Paragon Mutants Plant Morphology

Simon Orford

Waxless (right) – 11/6500

Monoculm (foreground) – 15/6500

Awned (left) – 8/6500

Paragon Mutants Plant Morphology

Simon Orford

Lines fixed (consistent in 1m row)

‘zebra leaf’ expression to cold 11/6500

grain shape 6/6500

EMS Paragon Senescence Mutants

Simon Orford




early v late
16/6500
30/6500

Mutant Paragon Ear Morphology

Simon Orford

club type (right)

spelt type (left)

Florets lost (left)

awn suppressor Knockout (left)

Alongside CV Paragon

Phenotypic Variation

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- Plentiful
- Needs checking constantly throughout growing season
- Use Bowman isoline chromosome walk to study different mutants