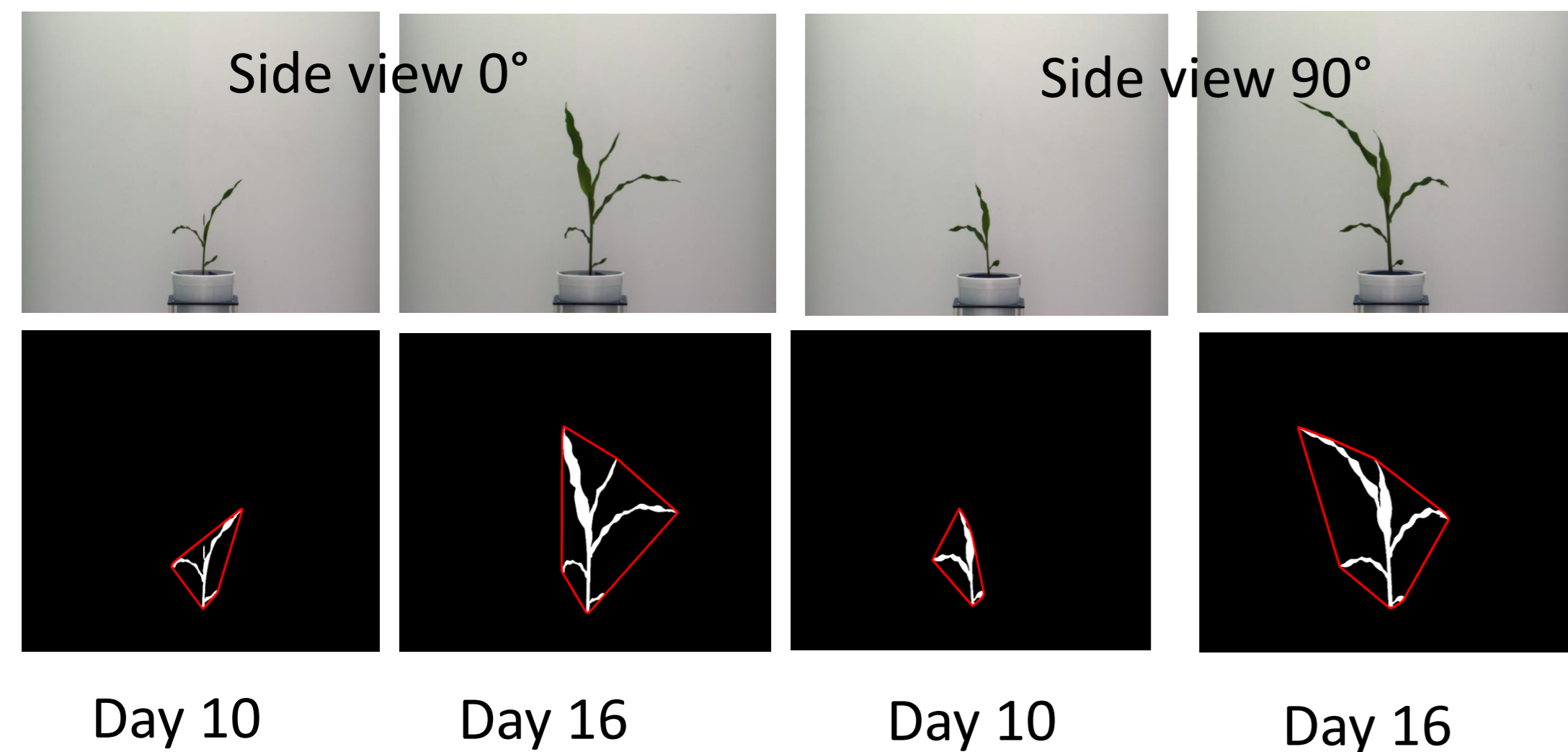


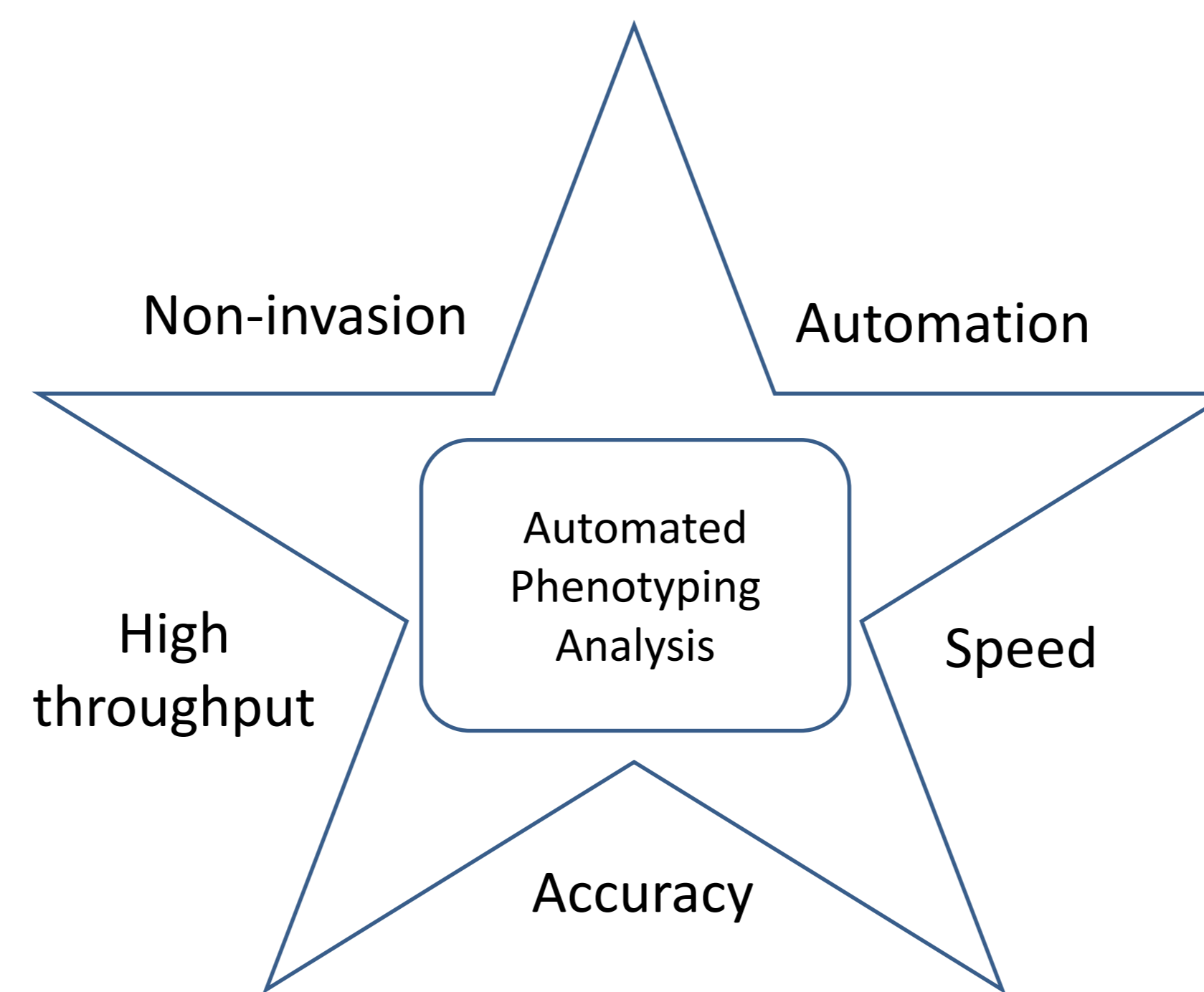
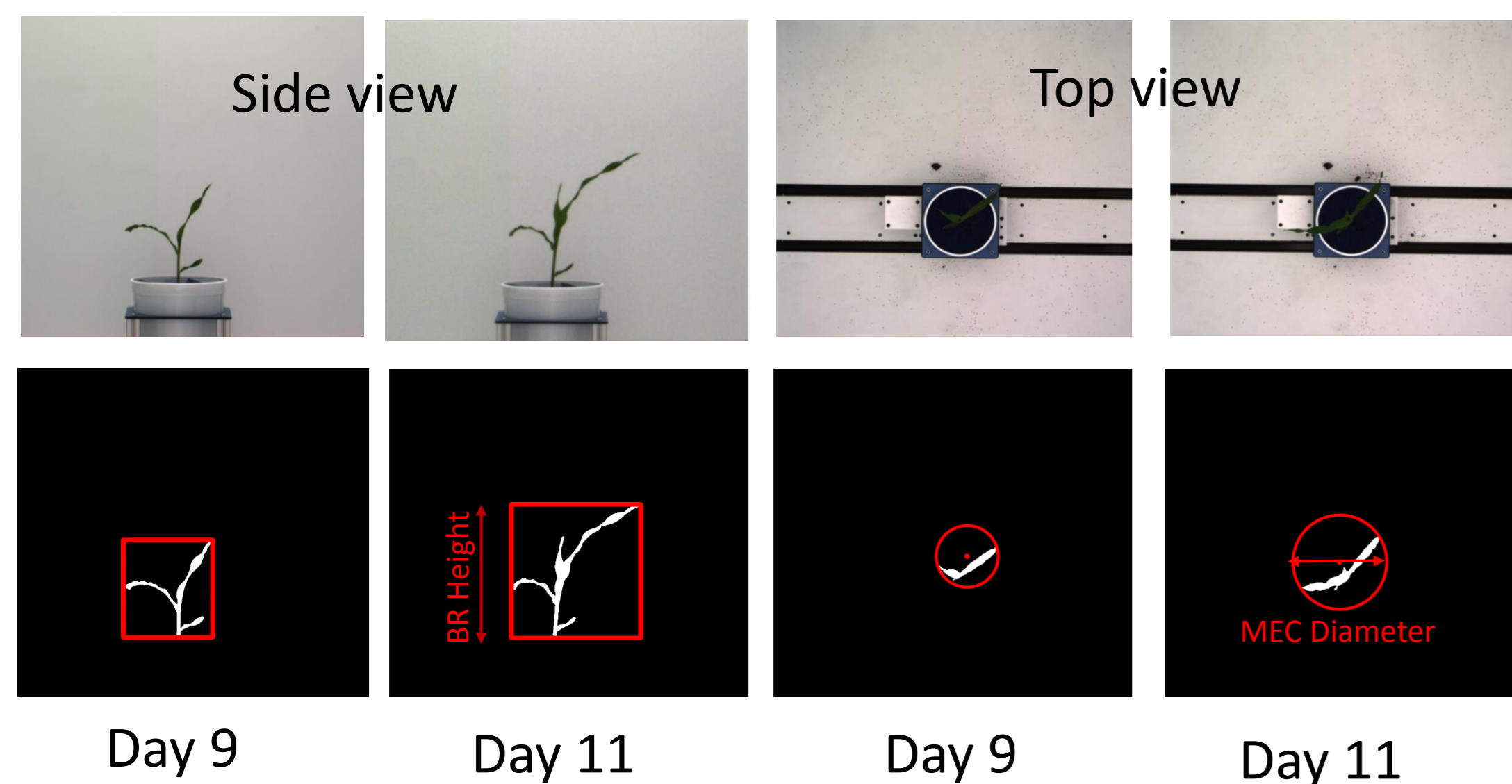
Image-based Automated Vegetative-Stage Dynamic Phenotyping Analysis of Maize Plants

¹Sruti Das Choudhury, ¹Ashok Samal, ²James Schnable, ¹Bashyam Srinidhi
¹Department of Computer Science and Engineering, ²Department of Agronomy and Horticulture
University of Nebraska-Lincoln, USA

Convex-hull Area Ratio



Plant Aspect Ratio



Holistic phenotypes

$$\text{Plant Aspect Ratio} = \frac{\text{Height of BR at side view}}{\text{Diameter of MEC at top view}}$$

Where, BR = bounding rectangle
MEC = minimum enclosing circle

Significance: Canopy architecture

$$\text{Convex-hull Area Ratio} = \frac{\text{Area}_{\text{Convex-hull}} \text{ at side view } 0^\circ}{\text{Area}_{\text{Convex-hull}} \text{ at side view } 90^\circ}$$

Significance: Plant rotation measurement

Component-based phenotypes

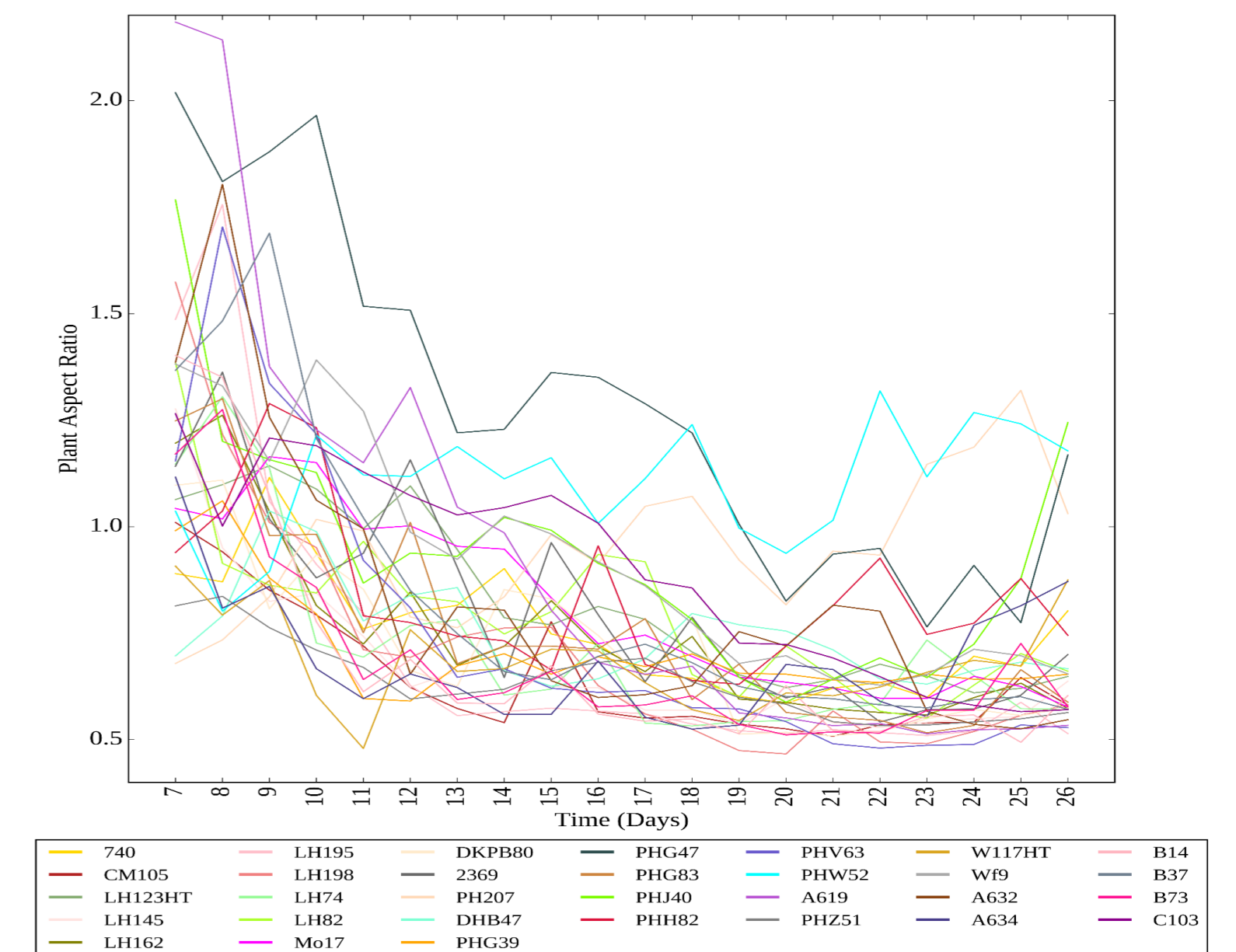
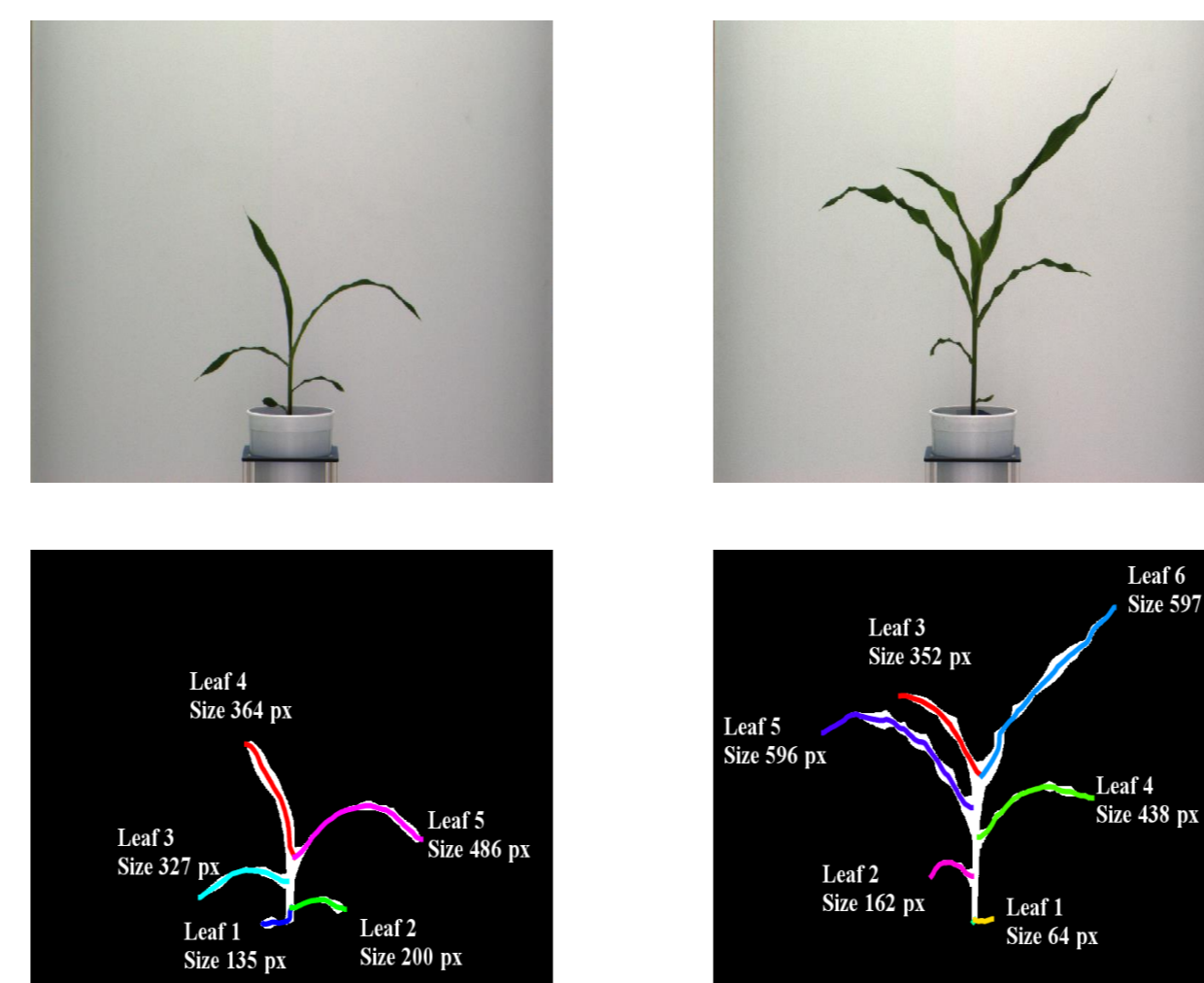


Fig: Illustration of genetic regulation of Plant Aspect Ratio

Inferences:

1. Plant Aspect Ratio decreases with time, i.e., rate of increase in plant width is more compared to the plant height.
2. For some genotypes (e.g., 2369 and C103) Plant Aspect Ratio decreases significantly with time, but for few others (e.g., PHW52 and PHG39) it fluctuates between similar values.
3. Some genotypes have higher Plant Aspect Ratios (e.g., PHG47) compared to the others (e.g., B73).
4. These data indicate that both Plant Aspect Ratio and the pattern of change in Plant Aspect Ratio are likely under genetic control.

LemnaTec Scanalyzer^{3D} plant phenotyping system in the UNL



1. 672 plant capacity (height up to 2.5 m), 3 watering stations.
2. Rotating lifters for up to 360 side view images.
3. 4 imaging booths- visible light, fluorescent, infrared, hyperspectral.

Panicoid Phenomap-1 Dataset

1. Consists of visible light images of panicoid grain crops captured once daily for 26 days.
2. There are 176 total number of plants for 40 genotypes.
3. Images are captured from 3 views: side view 0°, 90° and top view.
4. The dataset facilitates vegetative stage holistic and component based phenotyping analysis.
5. Dataset is freely available from: <http://plantvision.unl.edu/>

Acknowledgement

The work is funded by the Institute of Agriculture and Natural Resources of the University of Nebraska-Lincoln, USA.