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Fast plants and gene x environment interactions for the Biology 202 laboratory

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Introduction:

- Phenotypic plasticity is the ability for single genotype to produce multiple phenotypes in response to environmental variation, as described by its norm of reaction
- Wisconsin fast plants (*Brassica rapa*) are easy to grow, rapid-cycling, and bred for uniformity within strains
- Our goal is to develop a new lab exercise for Biology 202 students to generate and use norms of reaction to explore gene x environment interactions

Methods:

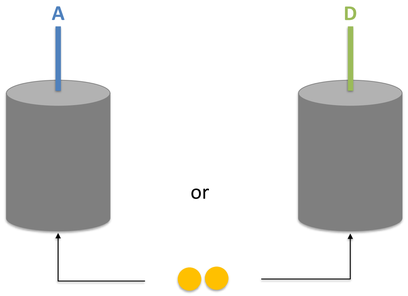

Figure 1. Method for establishing norms of reaction for Astro and Dwarf strains in response to variable soil fertility (0, 2, 4, 6, 8, or 10 fertilization pellets). Plants were grown for 30 days and data was collected.

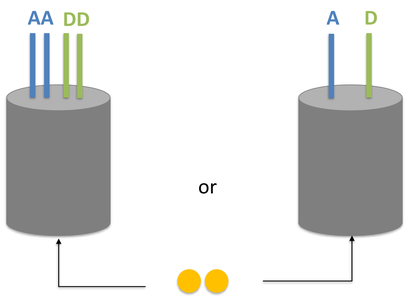

Figure 2. Method for establishing competition results for Astro and Dwarf strains. Soil fertility was varied between pots by using 0, 4, or 8 fertilization pellets. Plants were grown for 30 days and data was collected.

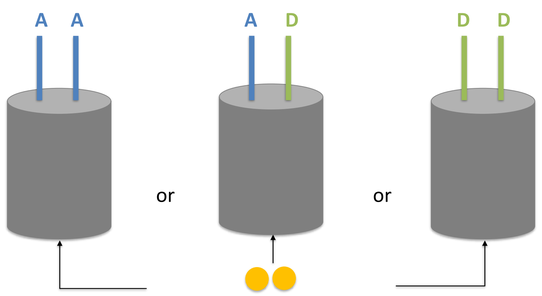

Figure 3. Biology 339 method for establishing competition results for Astro and Dwarf strains. Soil fertility was varied between pots by using 0, 2, 4, or 8 fertilization pellets. Plants were grown for 28 days and data was collected.

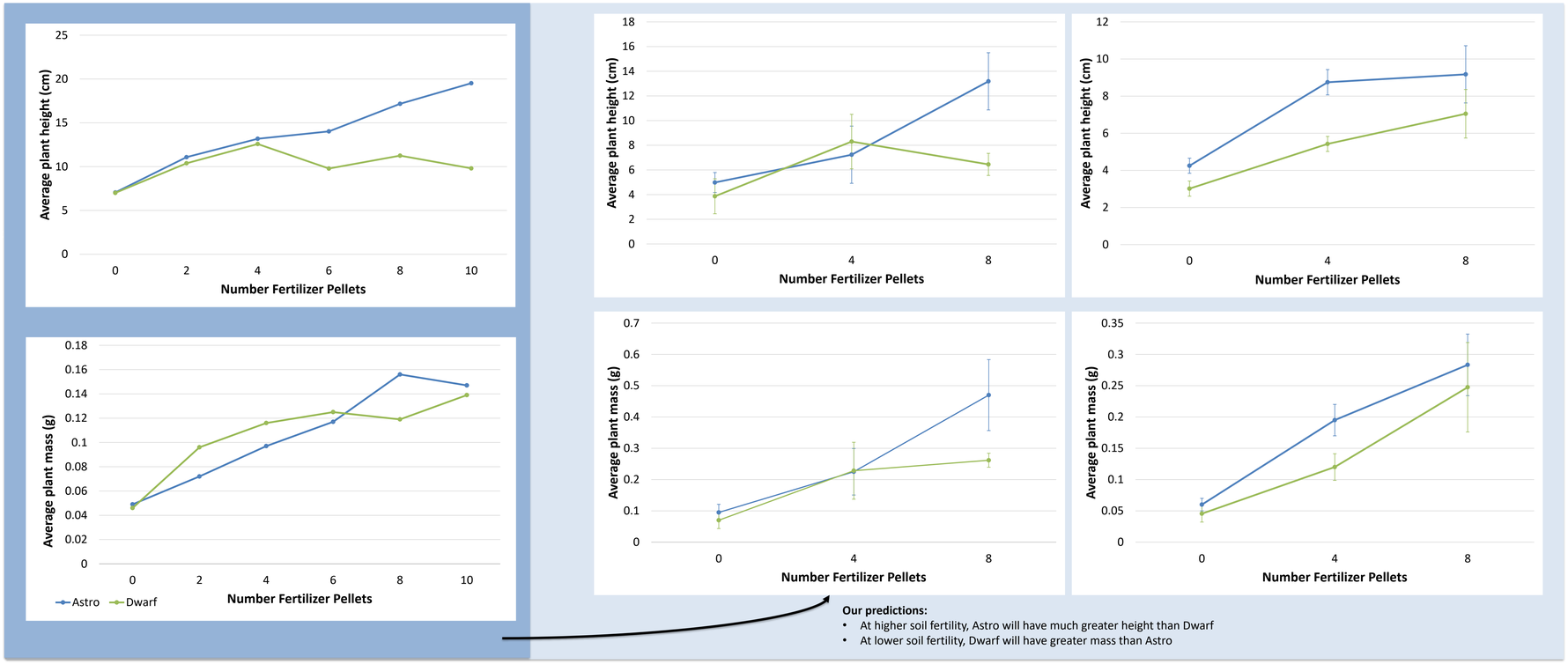

Figure 4. Dark Blue: Norms of reaction established (Fig. 1) for Astro and Dwarf strains. Light Blue: Competition (Fig. 2) responses to varied soil fertility. Two-plant competition results are shown on the left and four-plant competition on the right. Error bars represent one standard error of the mean.

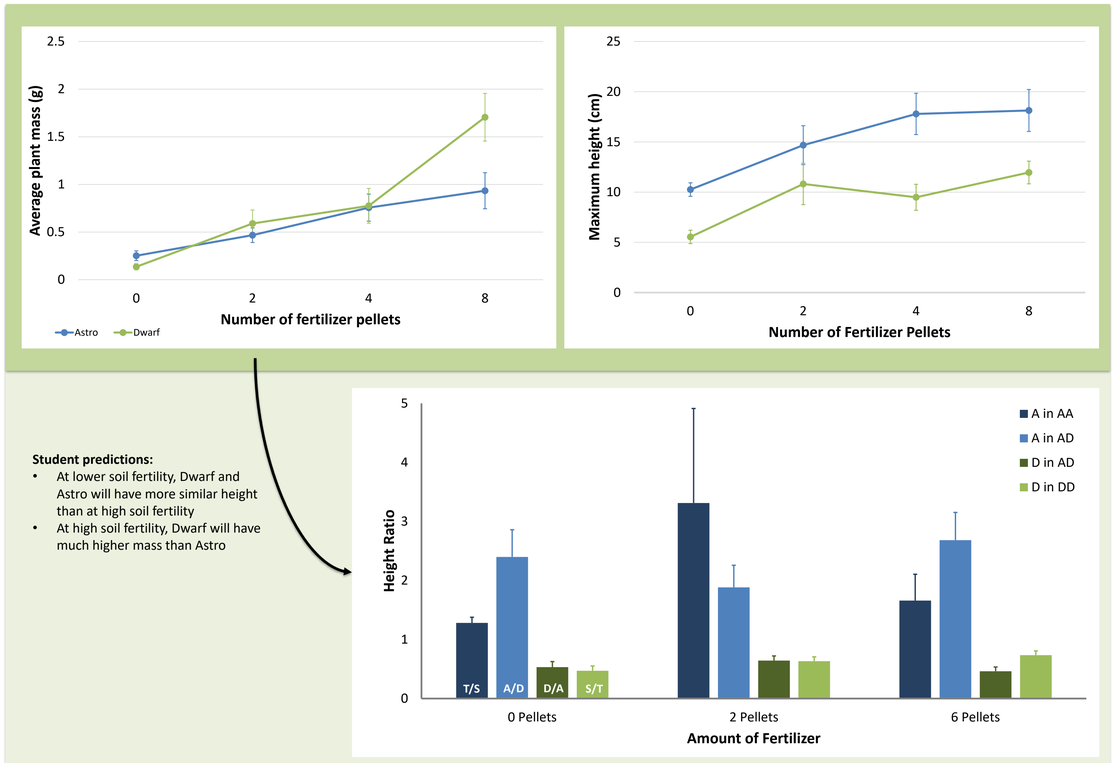

Figure 5. Dark Green: Norms of reaction established (Fig. 1) for Dwarf and Astro strains by Biology 339. Light Green: Competition (Fig. 3) responses to varied soil fertility. Error bars represent one standard error of the mean.

Results and Discussion:

- These fast plant strains produced distinctive norms of reaction that allow students the opportunity to make clear predictions
- Students can be creative in designing experiments to test their predictions
- Results from both the norms of reaction and competition studies illustrate and will help students understand gene x environment interactions.
  - Astro and Dwarf strains were more similar in mass and height at low fertility but diverged at high fertility
  - Differences between strains were more pronounced at higher density
- With a few improvements, this system will yield a successful lab exercise for students to learn about norms of reaction and gene x environment interactions

Acknowledgements:

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