

Advancing to a Black Walnut (*Juglans nigra*) Ideotype

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Abstract

- In the seasons of 2009 and 2010, we evaluated 5 to 10 trees per clone, with a total of 212 black walnut trees in a plantation in West Point, IN. According to the field survey, these 25 black walnut clones largely varied in growth (DBH, height, and crown expansion), quality (straightness), phenological characteristics (leaf flush), nut production, and foliar nitrogen.

Introduction

- In terms of crop tree breeding, ideotype is a tree model which can yield a maximum of its economic product under a certain management regime (Dickman 1985).
- Compared to traditional breeding, ideotype focuses on multiple traits and takes the whole tree into consideration instead of concentrating on a single trait (Donald 1968).
- Ideotype has been defined and applied for some agronomic crops, fruit trees, and conifer species, but never for a fine hardwood species, such as black walnut.

Objectives

We hypothesized that these 25 black walnut clones will vary in:

- 1). Growth of diameter at breast height (DBH), height, and crown dimensions;
- 2). Leaf flush dates;
- 3). Nut production and timber quality;
- 4). Foliar Nitrogen.

Methods

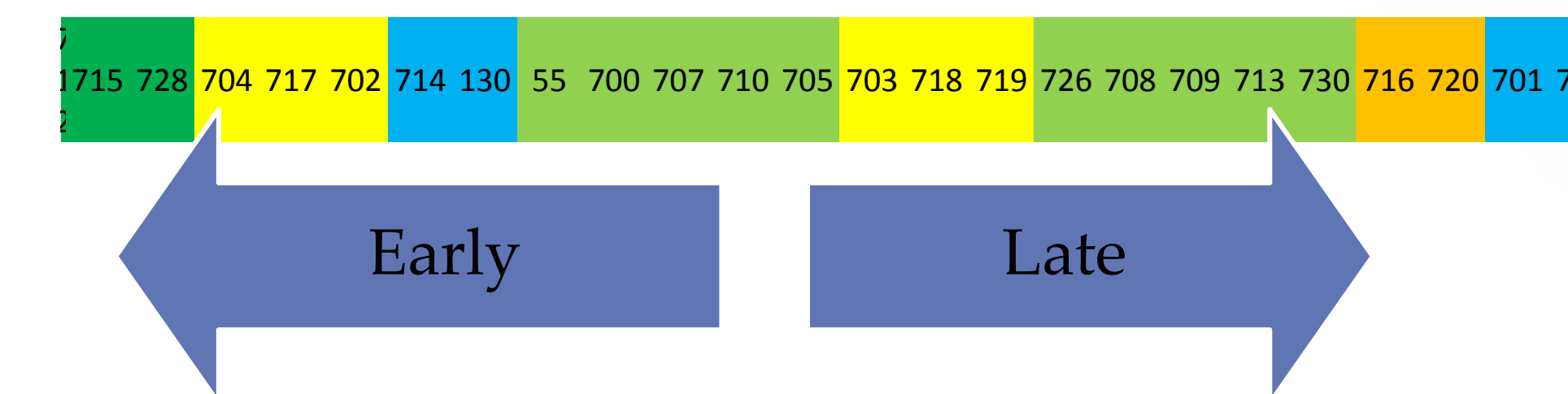
- The 25 black walnut clones were planted in 2002. The trees were identically managed by Arbor America, Inc.
- Five – ten trees were randomly selected from each clone for study.
- Leaf flush dates was recorded in April, May and early June in both 2009 and 2010.
- Leaf senescence was recorded in September 2010.
- DBH, Height, and crown dimensions were measured once per month from May to August in both years.
- Quality was evaluated in April, 2009.
- Leaf samples were collected in each August to determine the folia nitrogen content.

References

1. Dickmann, D. I. 1985. The ideotype concept applied to forest trees. In: M. G. R. Cannell and J. E. Jackson (eds.), Attributes of trees as crop plants. Institute of Terrestrial Ecology, Huntington, England. pp: 89-101
2. Donald, C.M. 1968. The breeding of crop ideotypes. Euphytica, 17: 385-403

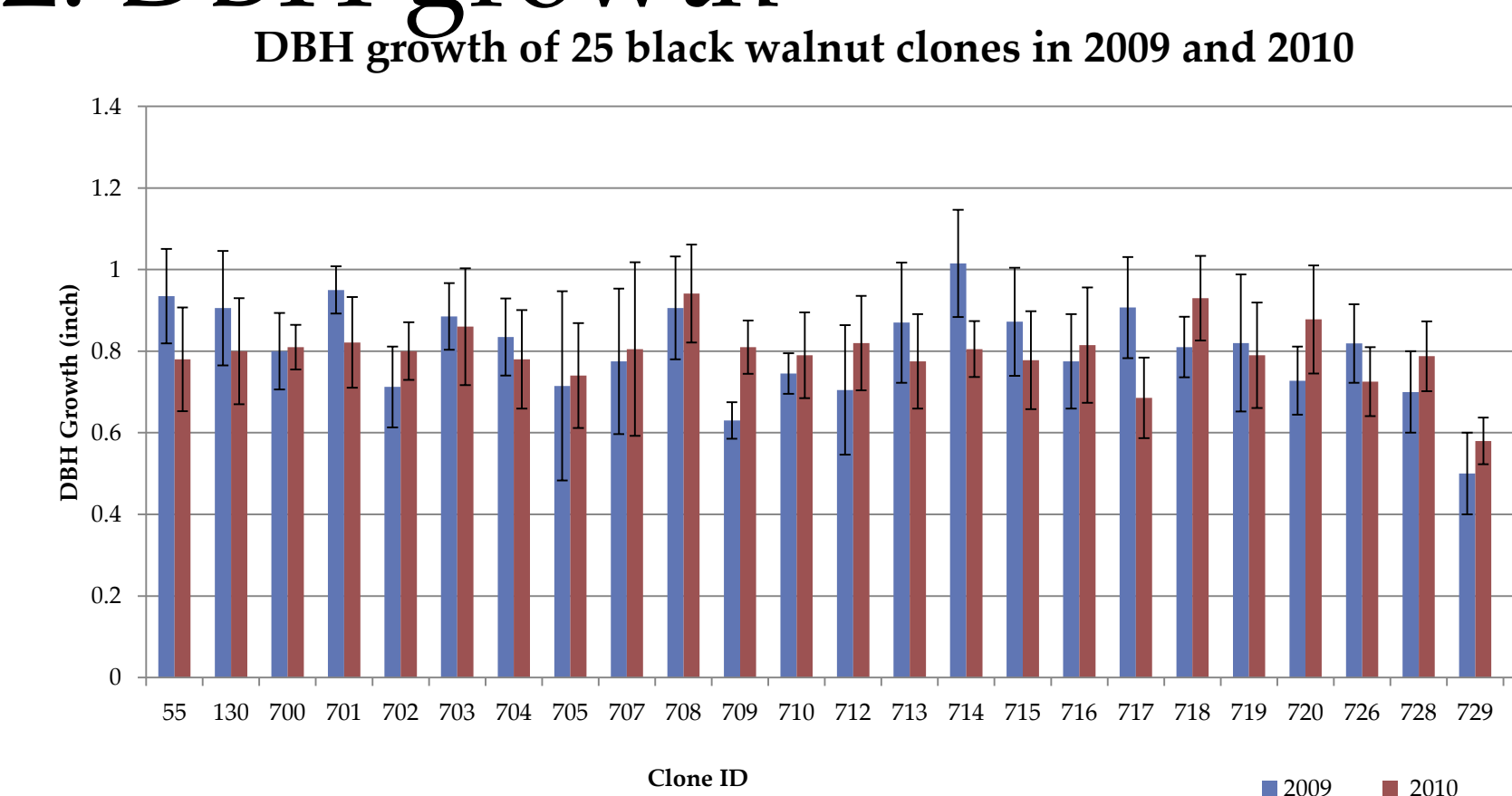
Results:

1. Leaf flush types

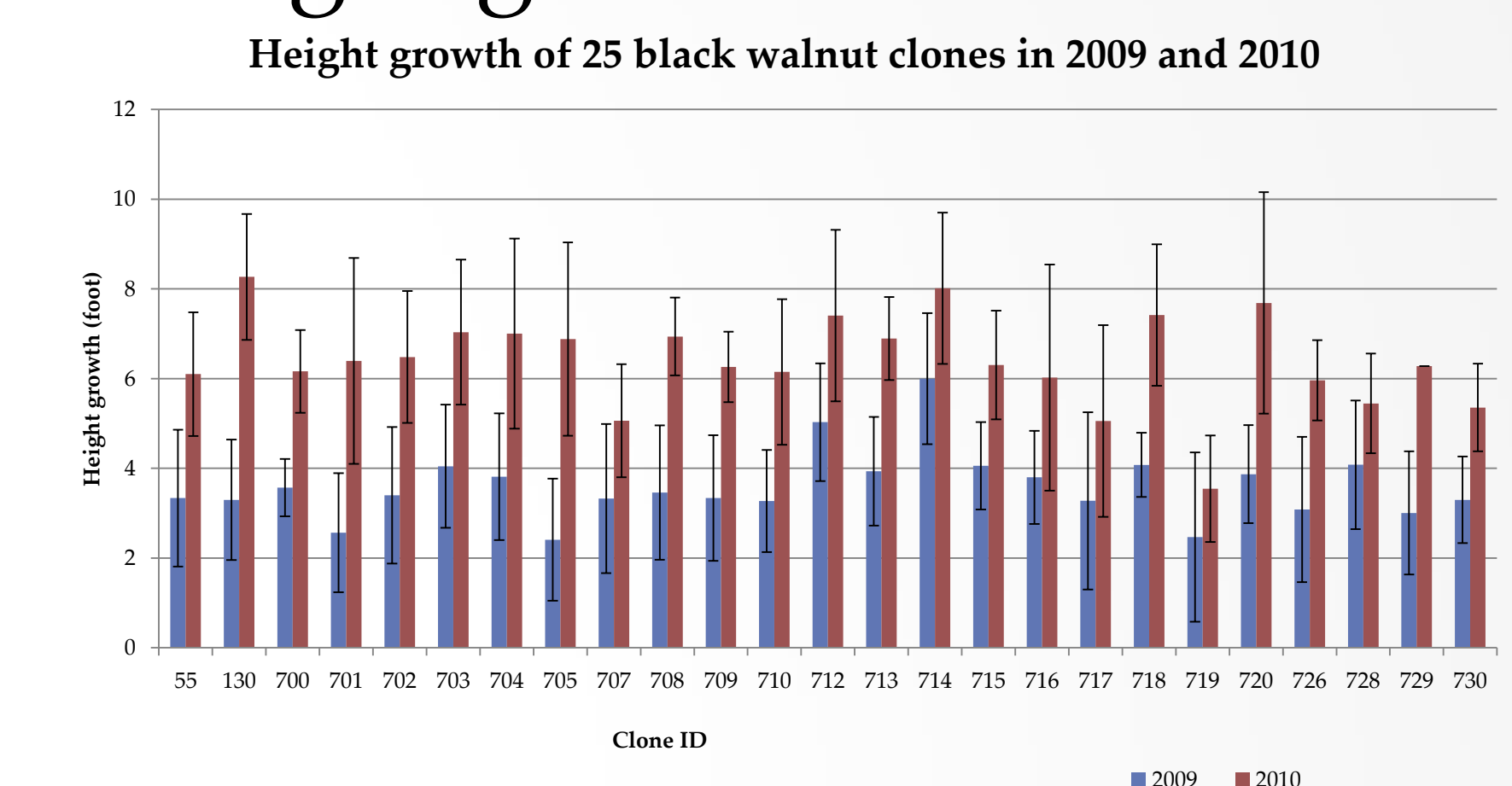


Dormant Bud swell Green tip Leaf burst Leaf Expansion

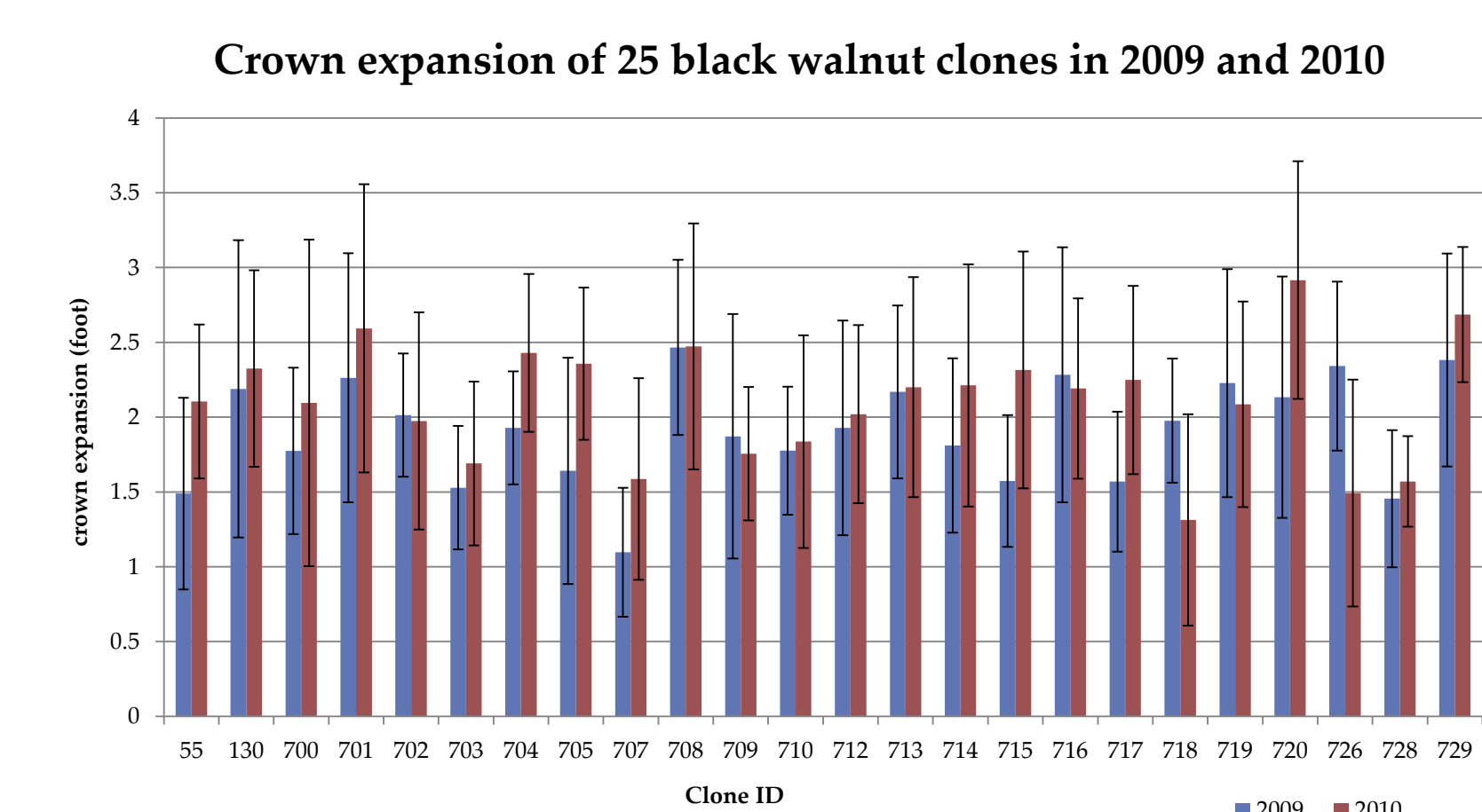
2. DBH growth



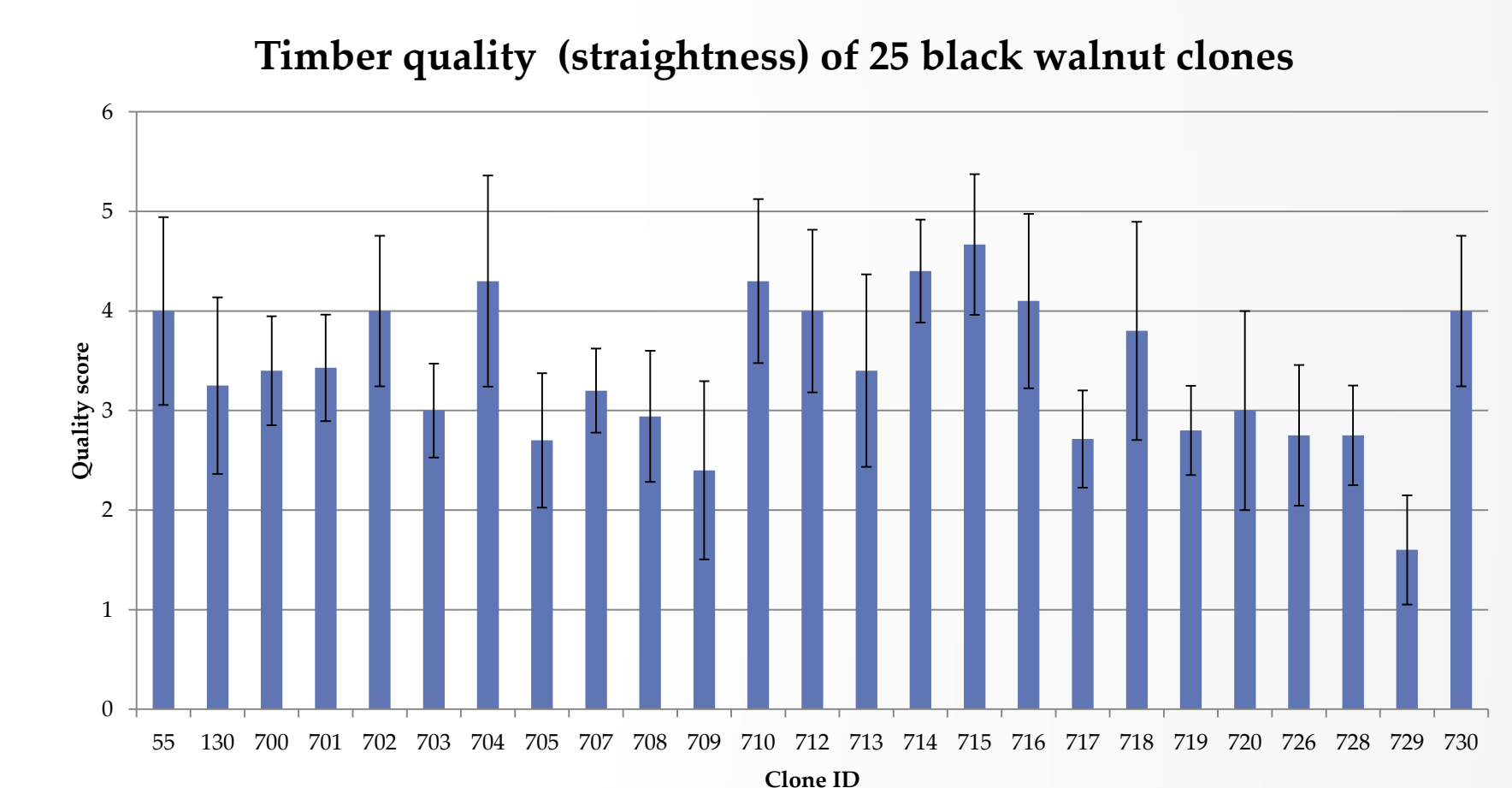
3. Height growth



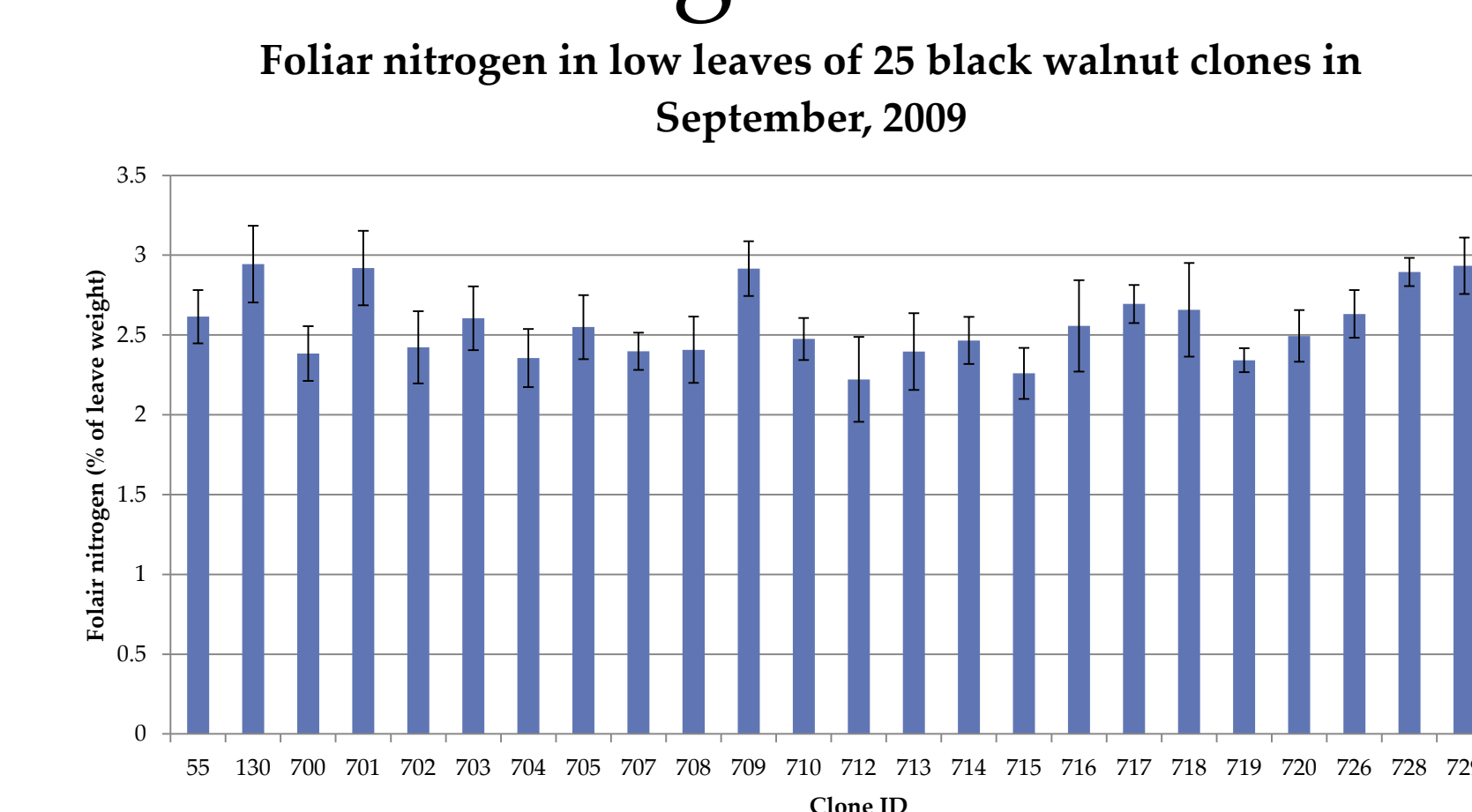
4. Crown expansion



5. Timber quality



6. Foliar nitrogen



Acknowledgements

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Discussion and Conclusion

- There are significant differences in DBH growth, height growth, crown expansion, timber quality, and foliar nitrogen at the level of $\alpha=0.05$, indicating a certain set of traits may be chosen from those characteristics for an ideotype.
- In the next steps, further physiological study, crown architecture modeling, and the parentage and clonal identification on those black walnut clones will be conducted to finalize the ideotype.