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Greenhouse selection improvements made in *Taraxacum kok-saghyz* persist in field trials

Brandon Wheeler, Ben Robinson, Debbie Zaborski, Nikita Amstutz, Katrina Cornish

ABSTRACT

Efforts are underway to domesticate rubber dandelion *Taraxacum kok-saghyz* (TK) as a domestic source of natural rubber. Three generations of TK were selected, consecutively, in greenhouses on the basis of quick emergence, plant size and vigor.

Seeds from the three selection generations and source material were planted for comparison in OARDC fields in Wooster, OH in 2018. Each successive generation outperformed the previous generation, in terms of plant size, root size and crown diameter, while root rubber concentration was unchanged. Thus, greenhouse selection improvements were maintained in the field.

INTRODUCTION

Natural Rubber (NR) is a critical natural resource in the global economy. Today, all commercially available NR derives from the tropics, and production of NR is out of reach for U.S. growers. TK is a dandelion species native to Central Asia, which is under development as a source of NR in the United States and other temperate regions. Rubber yield and plant vigor must be improved in order for TK to become a commercially viable domestic rubber crop.

Ideally, breeding selections for TK germplasm improvement should occur in the field. However, in order to accelerate domestication and yield performance, the ability to confidently make selections in a greenhouse environment becomes critical.

In 2018, four generations of greenhouse improved seeds were compared in a field trial to determine whether germplasm improvement selections made in a greenhouse environment translate to improved performance in the field.

METHODS

1. The selection criteria for the C, D, and E generations were quick emergence, plant size and vigor.
2. Approximately 2000 B seeds were sown into flats. Plants that took greater than seven days to germinate were discarded.
3. The plants that germinated in less than eight days were transplanted to greenhouse beds for grow-out and observation.
4. Before flowering, individual plants smaller in size or less vigorous in relation to neighboring plants were culled.
5. The remaining plants were hand-pollinated, and C seed was harvested.
6. The D and E generations were created in the same manner using C and D as source material respectively.
7. The four generations (B-E) were direct-seeded in field plots in May 2018 for a side-by-side comparison (Figure 1).
8. Plants were harvested in December, 2018. Roots were weighed and rubber concentration determined by NIR spectroscopy using an established model ($r^2 = 0.91$).

RESULTS

Each successive generation outperformed the previous generation in the field with respect to plant fresh weight, crown diameter, and root dry weight (Figure 2).

Rubber concentration analysis indicated that rubber levels remained the same even as the successive generations increased in size (Figure 3).

Rubber yield (rubber per plant) increased by 12, 38 and 47% in the C, D and E generations, respectively, when compared to source material B (Figure 4).

Figure 1. Field trial of four generations of TK selected in the greenhouse for fast emergence, plant vigor, and size

Figure 2. Root dry weight by generation

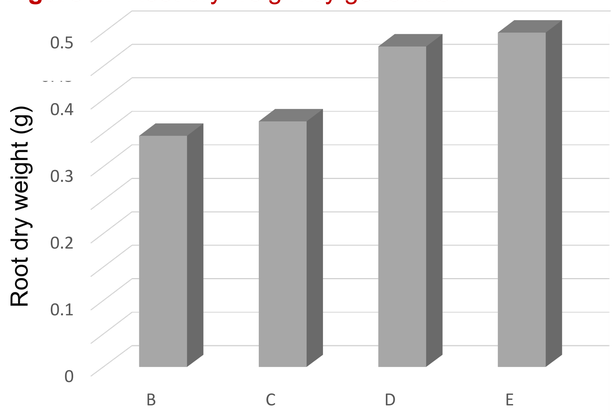


Figure 3. Rubber concentration by generation

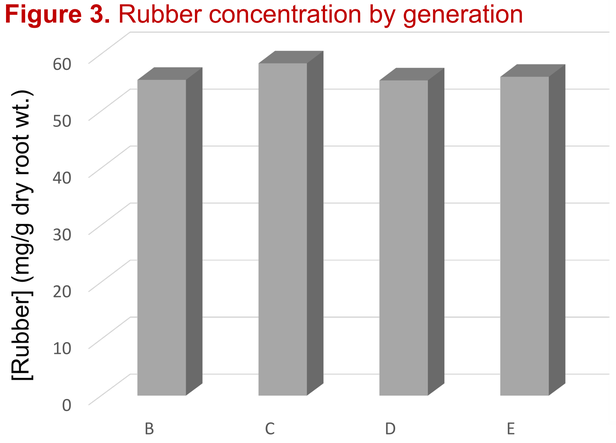
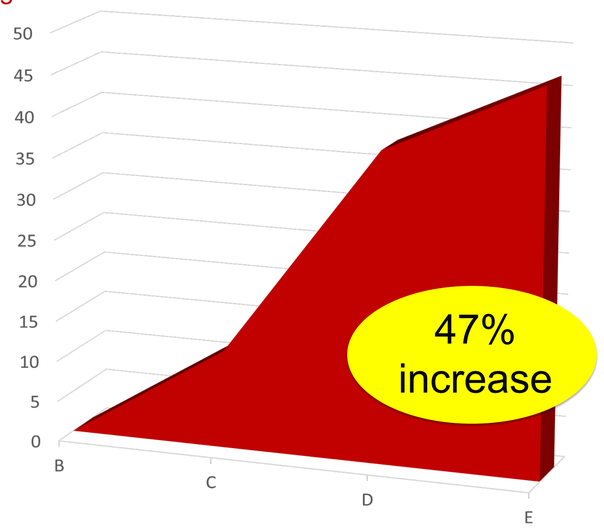


Figure 4. Percent increase in rubber yield by generation



CONCLUSIONS

Although field selections are still preferable in TK germplasm development, improvements in early emergence and plant size gained through greenhouse selections did persist in the field.

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THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

Department of Horticulture and Crop Science
OARDC, Wooster Campus