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Growth and Performance of *Taraxacum kok-saghyz* (Rodin) in Different Soil Types

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ABSTRACT

Taraxacum kok-saghyz (Rodin) (TK) is a natural rubber-producing root crop. These low-growing plants were grown and harvested for their high-quality rubber in the United States during WWII when the natural rubber supply, grown from the rubber tree (*Hevea brasiliensis* Müll. Arg.) in Southeast Asia, was interrupted. There is little known about optimum TK field growing conditions in Ohio. Studying which soil types TK plants prefer benefits our efforts to domesticate this crop for Ohio farmers and brings more jobs to the state. Using a randomized complete block design, TK was seeded into tree pots filled with one of three different Ohio field soil types and the common greenhouse peat-based media, Pro-mix™. Plants were grown in the greenhouse for three months and then transferred outside, still in their pots, for six more months. The plants were hypothesized to grow larger in field soil than in Pro-mix, and that they would also produce more rubber. As predicted, the plants grown in field soil were significantly larger than those grown in Pro-mix. Projected rubber yield (rubber concentration x dry root weight) showed that all soil grown plants had significantly greater rubber yields than Pro-mix grown plants. Although this study was performed in pots, it should inform future field trials.

INTRODUCTION

Figure 1. Prime TK plant in full bloom.

Global natural rubber (NR) consumption is expected to be 17 mega tons (mt)/y by 2023 [1]. Earlier this year, the Association of Rubber Producing Countries announced a 786,000 tonnes shortfall of NR in production [2]. TK (Fig. 1) is an excellent source of high quality NR similar to rubber from Hevea. This flat growing plant, of the Asteraceae family, produces rubber in root laticifers and can be grown across the northern United States. Agronomic requirements are not yet fully understood and developed.

MATERIALS AND METHODS

Soil was dug from three Ohio locations (OSU Western (W, silt loam), Moomaw Farms (M, silt loam-flood plain), and Horticulture Research Unit 1 (H, silty/clay loam). Forty tree pots of each soil type (W,M,H) were filled and two from each type, including a set of pots filled with greenhouse media Pro-mix (P), were placed into each of 20 crates using a fully randomized block design. The top 1cm of soil was loosened in each tree pot and multiple seeds from an improved population were sown in each. Pots were thinned to one plant per pot after 4 weeks. After 3 months in the greenhouse all plants (in pots) were transferred outside to better simulate field conditions. Nine month old plants were harvested, photographs (Fig. 2) and phenotypic data (plant weight, root weight, leaf and root morphologies) were taken. Roots were dried, at 50° C, then ground into a fine powder using an IKA A10 grinder. Rubber concentration was determined by a Near Infrared Spectrometer (NIR), using a validated quantification model.

Figure 2. Individual plants from each soil group, harvested from a single crate (left panel) to minimize inter-crate variability.

RESULTS AND DISCUSSION

As predicted, the TK plants grown in field soils were significantly larger than those grown in soilless greenhouse media (P) (Fig. 3). TK plants in each soil varied is size as expected from a heterozygous population. In general, TK plants in soil W were larger and had larger roots, followed by plants in soils M and H (Figs. 2 and 3). The shoot:root ratios were not significantly affected by soil type (data not shown). However, when the relationship of root size and rubber concentration on overall rubber yield was examined (Fig. 4), it became clear that the highest yields were attained in the largest roots with intermediate to high rubber contents.

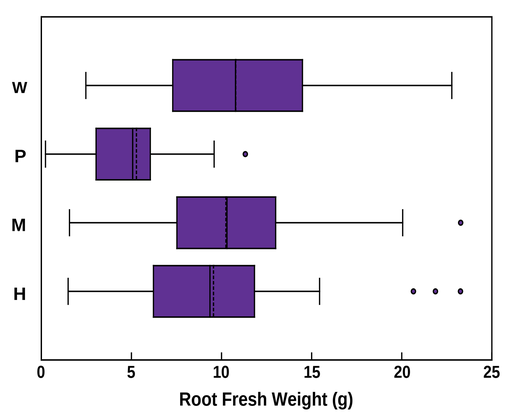

Figure 3. Pro-mix (P) grown plants have considerably less fresh root weight in comparison to plants grown in field soil from Western (W), Moomaw (M), and Horticulture Research Unit 1 (H). This is a fenced boxplot with outliers.

RESULTS (CONT.)

Thus, TK should not be grown in soils which significantly inhibit root growth.

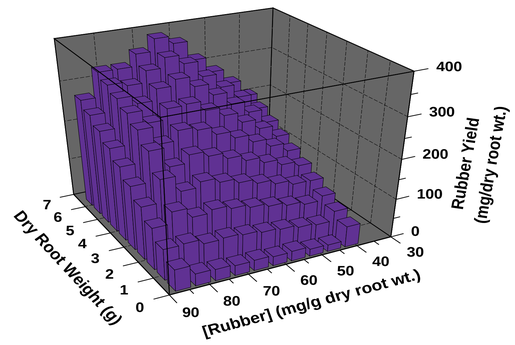

Figure 4. Interpolated 3D plot of rubber yield against root size and rubber concentration for 159 plants grown in this study (a very small plant with a high rubber content was removed because of its excessive skew effect).

CONCLUSIONS

- Field soil proved to be better growth media than soilless medium, which requires frequent fertigation to support good growth and plant health.
- Silt loam field soil appeared to be a slightly better soil type for TK than silty clay.
- Soil type should be considered during site selection for field trials.

REFERENCES

1. International Rubber Study Group IRSG, 2014.
2. *Ngoc Bich, Dr. Nguyen (2018, July)* "ANRPC Releases Natural Rubber Trends & Statistics, July 2018" http://www.anrpc.org/html/news-secretariat-details.aspx?ID=9&PID=39&NID=2081

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