Optimization of Planting Practices to Maximize Rubber Yield in *Taraxacum kok-saghyz*

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ABSTRACT

*Taraxacum kok-saghyz* (TK) is a promising domestic alternative for imported natural rubber. Planting practices like planting density and length of growing season are key parameters influencing crop biomass and rubber yield. We compared seven planting densities: 0.1, 0.2, 0.3, 0.5, 1, 2 and 4 million plants/acre spread over two different trials, one planted in the spring and the other in the autumn. In each trial, half of the plants were harvested after six months and the other half after one year. Harvested plants and roots were weighed, and root rubber concentration determined. Optimal planting density appears to range between 500,000 and 1,000,000 plants/acre. Plants respond differently to season depending upon planting date, plant age and length of the growing season. Overwintering of mature plants leads to a reduction in overall yield per acre. A prime TK selection target is rapid seedling growth, and a more balanced distribution of spring shoot-to-root ratio in autumn planted TK.

RESULTS

Healthy stands were obtained at all densities although the rosettes assumed a vertical orientation with crowding (Fig. 1). Rubber concentration in the high density trial was higher in the one-year-old plants, after overwintering, than in the six month-old plants harvested in the autumn (Fig. 2, upper panel). Planting density had little consistent effect on rubber concentration at both harvest times. However, half of the plants at all densities in this trial, died during the winter (data not shown), and overall yield per acre lessened as a result. When plants were established in the autumn and then overwintered (Fig. 2, lower panel), the rubber concentration in the six month old spring-harvest plants was dependent upon planting density, with concentration increasing with density. However, summer growth led to a leveling out of these differences, and, as for the first trial, one-year-old plants had a similar root rubber concentration across densities.

DISCUSSION

Remarkably, when TK was established in the autumn, and then overwintered, spring growth was almost entirely targeted toward rosette development (Fig. 3, lower left panel), and roots of these plants were much smaller than in plants of the same age planted the previous spring (Fig. 3, upper left panel). These small roots of these small rooted plants developed large roots, similar to those found in the six month-old plants in the previous trial at autumn harvest time (Fig. 3 cf. upper left panel and lower right panel). Very small plants (0.1 million plants/acre) happened to have fairly large roots (Fig. 3 for right panel). However, overall plant size declined between the spring and autumn harvests, due to loss of rosette biomass (Fig. 3 cf. lower left and right panels).

CONCLUSIONS

A planting density between 500,000 and 1,000,000 plants per acre is optimal for rubber yield. Our results indicate that a prime TK selection target is rapid seedling growth, and a more balanced distribution of spring shoot-to-root ratio in autumn planted TK. This plant type could allow an autumn or spring direct seeded planting of a production TK crop, followed by an autumn harvest. Planting techniques and germplasm advances will continue to accelerate the transition of TK from an experimental rubber source to an established, and major, domestic rubber crop.