STEVIA LEAF PRODUCTION

**Stevia rebaudiana (Stevia)** - Stevia leaf extract is a plant-based zero-calorie sugar alternative. Stevia is native to Paraguay and Brazil and is grown as a crop in a variety of regions throughout Asia. In regions experiencing mild winters, including California, Stevia is a robust summer active/winter dormant, herbaceous perennial growing to approximately 3’ (90 cm) tall.

**Propagation and establishment** – Stevia is propagated from seed or cutting and planted on beds up to 40,000-50,000 plants/acre. Once planted, Stevia is tolerant of a variety of soil types and in Northern California stands may be cut 2-4 times per year for 4-7 years. High quality seed is 75,000-85,000 seeds per ounce (2600-3000 seeds per gram) with germination between 50-92%. All Stevia acres currently growing in California were planted with transplants in Spring after last frost, however Stevia First Corp has successfully pelleted stevia seed without reducing germination success in artificial media. During Spring and Summer cut Stevia shoot tips root at approximately 95% rooting success if the cutting is removed from top 1/3 of the primary shoot with decreasing rooting success the lower on the shoot the cutting originates.

**Irrigation, nutrition, and harvest** – Stevia requires consistent soil moisture to support maximum shoot growth. Water may be delivered with drip, furrow or sprinkler applications. However, drip and furrow applications are recommended to ensure high leaf quality and decrease incidence of stem or leaf pathogens. Nutrition is satisfied with organic and conventional fertilizer programs. Dry stevia shoots consist of 1.4% N, 0.3% P, and 2.4% K and Stevia positively response to increasing N, P, K additions, however an effective nutrition program is coupled to nutrient replacement guided by crop/biomass removal. Shoots are harvested just above ground surface and either elevated into wagons and transported to drying facilities or windrowed and dried in the field. Following windrowing the shoots are baled, and transported from the field and stored before processing. Based on global averages initial leaf yields in Northern California will be approximately 1,750-3,500 lbs./acre, however 2014 test plot yields were approximately double at two field sites. Concentrations of the sweet molecules in Stevia (steviol glycosides) decrease after flowering begins in the fall when day lengths shorten to approximately 13 hours.

**Stevia First’s Role in the North American Stevia Market**

Stevia First is an agri-bio technology company located in Yuba City, California that is focused on modernizing and increasing output of the global stevia industry. It is leading the way and plans to enable the first significant North American commercial Stevia production system.

Stevia cultivation was introduced to California by the University of California extension service in 1982 and interest continues to grow where hundreds of acres have been planted in the past as feasibility trials and small commercial production. In comparison, 40,000-50,000 acres have been planted in mostly China, but also in Southeast Asia, and South America, which have been producing stevia commercially for decades primarily catering to the Japanese market.

However in 2008 with U.S. regulatory approval the global market remarkably changed. Sales were less than $200 million globally and since approval global sales of stevia products quickly climbed to over $1 billion dollars and were growing at a double-digit rate annually.

Stevia First is building a U.S. based stevia industry that will provide a reliable supply of stevia extract emphasizing product quality and supply chain control. To achieve this objective, Stevia First is organizing a network of growers to ensure a robust supply of California stevia leaf to meet local processing capacity (more than 1,000 acres initially). Prior to facility launch, Stevia First will purchase stevia leaf from a limited number of growers for use with R&D or for resale to existing overseas stevia processors.

**Pathogen, insect, and weed control** – The fungal pathogens *Septoria* leaf spot, *Alternaria* leaf spot, powdery mildew, and damping-off diseases, have been reported in Japan and Canada, but not in California. However, in California white flies have been observed on Stevia in greenhouse culture, but not in fields and *Sclerotium rolfsii* has been observed in the field. Glyphosate, in addition to several organic herbicides are registered in California for use in Stevia production.
HISTORICAL YIELDS and EXAMPLE PRODUCTION COSTS

Establishment year stevia leaf yields may be approximately 1,500 lbs. of dry leaf per acre based on global averages. However, trials located in southern Ontario, Canada yielded approximately 2,500 lbs. per acre similar to trials completed in the Bay-Delta region, and methods used overseas have produced much greater yields. Driven by California’s agricultural resources and updated Stevia cultural practices, growers can expect dry leaf yields greater than global averages by using straightforward nutrition, irrigation, and pest management practices. Stevia First supports growers that are efficient land stewards and successful business managers encouraging effective and profitable decisions regarding developing stevia cropping on their acreage.

Organic Production An organic grower faces several challenges successfully integrating Stevia into their cropping system. Commercial organic stevia seed is not available in the U.S. However, conventionally produced seed may be substituted without harming organic certification. In the Sacramento Valley, land preparation and cultivation costs are $100-200/acre depending on current ground status and cultivation history. Seedling propagation and deliver costs are $1,200-1,980 depending on planting density. Stevia seed can be drilled with a precision planter, however depending on the drill capacity a seed coating maybe necessary. Seedlings are tolerant of hot planting conditions so spring or summer planting dates are available, however sprinkler irrigation $300-350/acre maybe needed for early plant establishment and buried drip irrigation ($1,000/acre) is recommended for maintenance irrigation requirements. In addition, weed management ($200-225/acre) combined with buried drip will be needed. Stevia can be windrowed and baled in the field and these costs including field removal and bale transportation are variable and similar to local alfalfa or forage crop harvest costs. After accounting for fertilizer addition, land rent and additional labor the establishment year costs are $5,000-5,500/acre and subsequent years the Stevia field maintenance cost is approximately half or less than the establishment year cost. A conventional grower can expect similar costs and yields as the organic grower however, the weed and fertilizer management may be reduced and importantly overall labor costs and land rents are lower for a conventional grower.

Global Stevia leaf prices vary from $1,750-$2,500 year-to-year and if stevia leaf yields generated during the first year are approximately 1,500-2,500 lbs. than the grower recoups half or more of the establishment costs during that year. Stevia is a perennial and fields should produced for 4-7 years in the Western U.S before replanting is necessary thus during subsequent years when Stevia leaf yield doubles and triples from the initial planting, and maintenance costs of the field is half of the establishment cost U.S grown Stevia is clearly a profitable option for growers.

Important Considerations for Stevia Planting

The below items are considerations for local growers that are considering planting stevia.

- Limited local stevia leaf buyers exist today. Stevia First will agree to purchase stevia leaf from network growers by contract with set pricing per metric ton of dry leaf.
- Many services are available for field-scale production including: transplant production and planting through Grower’s Transplanting; adapting harvest equipment through local dealers, and high-quality seed. Through use of these service providers, fixed cost investment in specialized equipment can be limited or avoided.
- Flexibility with timing can help reduce startup costs, along with more experimental methods such as direct seeding.

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