Crop Profile for Beet Seed (Table Beet) in Washington

Prepared: January, 2000

General Production Information

- 95% of U.S. production, 50% of world production.
- 1000 acres grown annually in Washington State.
- Value of market seed sold to commercial growers is $5.5 million.
- Seed production costs are $1500/acre.

Production Regions

Major seed-producing areas are Skagit, Island, Snohomish, and Lewis counties in western Washington (1).

General Information

There is no open-market (non-contracted) small seeded vegetable seed production in Washington. Commercial vegetable seed production is under bailment contracts, where the seed companies (bailors)
provide growers (bailees) with the seed necessary to produce a crop. The seed company retains ownership of the seed, growing crop, and resulting harvested seed. Growers produce and harvest the crop and are then paid the contract price for the resulting seed if it meets quality criteria stated in bailment contracts, typically an 85% germination rate and a 99% purity. Weed seeds which are the same or nearly the same size/shape as the vegetable seed are difficult to remove at the conditioning plant and can cause seed companies to reject a seed crop. (10) Federal regulations for moving seed into interstate commerce require that seed must be completely free of all noxious weeds.

Table beet seed plant at the stage of swathing

Small seeded vegetable seed production takes place on approximately 6,000 acres in western Washington contracted by approximately 25 seed companies. The average field size for table beet seed production is 20 acres and fields are scheduled for 4- to 5-year rotation periods to mitigate disease problems. Companies control the location of seed crop fields in order to prevent cross-pollination of different varieties the same crops (spinach open-pollinated seed vs. spinach hybrid seed) and of cross-compatible crops (e.g. beet and Swiss chard). Isolation distances vary depending on whether the crops are wind or insect pollinated and whether they are grown for market or stock seed; distances can range from one-quarter mile to 3 miles or more. Beets are wind pollinated. Market seed is produced and used for vegetable production. Stock seed is grown specifically for use in planting seed crops.
Company representatives meet with county agents at the WSU Cooperative Extension Office in Mount Vernon each spring in a "pinning" meeting to plot map locations of seed crops planned for that year. It is worth mention that with the increased urbanization of the Skagit Valley, and the presence of hobby farmers, it is more difficult to control pollen flow and ensure the isolation necessary for hybrid seed production.

In Washington State, small seeded vegetable seed crops are considered nonfood and nonfeed sites for pesticides use (6).

**Cultural Practices**

Beet (*Beta vulgaris*) seed is a biennial crop. Typically, the crop is planted in seedbeds in mid-June in Island County. Plants not displaying true varietal characteristics are removed by hand. In early October, the beets are mechanically topped, dug, placed in windrows, and covered with one foot of soil to protect the roots against freezing. In early April, the over-wintered roots, called stecklings, are removed from the windrows and brought to Skagit County for transplanting into production fields. Stecklings are typically baseball size to softball sized roots. In the field, mechanical cultivation and hand-hoeing help control weeds. Seed harvest occurs in late summer and early fall. The crop is cut, placed in windrows, dried 10 to 14 days in the field, then threshed. While the crop is curing in the field, it may be turned by
hand to prevent molding. After harvest, the seed is taken to a conditioning plant, where it is cleaned to 99% purity.

Gravity separator

The beet root, when grown for fresh eating, is only a few inches wide and succulent. The beet root, when grown for seed production, is usually the size of a football at harvest. These enlarged roots are fibrous with an extremely woody consistency, making them completely unsuitable for human or animal consumption. Beet tops from seed crops are not used as an animal feed as they are not palatable either.
Drier bins

Seed conditioning area with clean seed bins
"Table beets" in this document includes red, white, yellow and striped table beet varieties.

Insect Pests

**Cabbage Aphid** *(Brevicoryne brassicae)*

**Turnip Aphid** *(Lipaphis erisimi)*

Cabbage aphids and turnip aphids are mealy gray "plant lice" which typically feed in colonies on foliage, shoots, and buds causing leaf and plant decline (3). Aphids may also spread the beet yellows virus, which causes poor root growth in seed plants and results in production of smaller seed with lower vitality. Beet yellows virus is not transmitted by seed (9). Potential yield loss is 25% if aphids are not controlled (1).

**Chemical Controls:**

**Pirimicarb (Pirimor 50-DF).** This product is used per a 1999 Washington Crisis Exemption (File No. 99-WA-44) that expired 9/15/99 (5). Pirimicarb is a selective aphicide with contact and systemic action as well as translaminar and vapor action (4). The recommended application rate is 1 to 3 oz. AI/A per
application, with a maximum of two applications per season. It is applied to 90% (900 acres) of beet seed crops at bloom (1).

**Armyworms, Cutworms** (several species)
- Western yellowstriped armyworm, *Spodoptera praeifica*
- Beet armyworm, *Spodoptera exigua*
- Redbacked cutworm, *Euxoa ochrogaster*

Variously marked moth larvae feed on foliage of plants, and may completely sever stems of young plants. Potential yield loss is 25% if larvae are not controlled (1).

**Chemical Controls:**

- **Diazinon (various trade names).** 14-day PHI. The recommended application rate is 2 to 4 lbs. AI/A as a preplant soil incorporation for control of cutworms and armyworms (3). Ten percent (100 acres) of beet seed crops are treated. This product also controls thrips (1).
- **Methomyl (Lannate).** 0-day PHI (14-day PHI if tops are used for feed) (3). The recommended application rate is 0.22 to 0.9 lbs. AI/A (3). It is applied to 10% (100 acres) of beet seed crops at bloom (1).

**Thrips** (several species)
- Western flower thrips, *Frankliniella occidentalis*

Tiny, slender, yellowish to brownish insects which typically feed in buds or flowers, damaging developing seed. Potential yield loss is 25% if thrips are not controlled (1).

**Chemical Controls:**
**Diazinon (various trade names).** 14-day PHI. The recommended application rate for control of cutworms and armyworms is 2 to 4 lbs. AI/A as a preplant soil incorporation (3). Ten percent (100 acres) of beet seed crops are treated (1).

**Diseases**
**Downy Mildew** (*Peronospora farinosa f. sp. beta*ae*)

This fungal disease affects all above-ground plant parts. Infected leaves are spotted and may wilt and die. Seed loss may occur due to flower and seed head infection. Crown infections damage bulb crown, affecting subsequent plant development and creating potential infection sites for root-decaying organisms. Systemic crown infection of stecklings may result in severe plant and seed loss. The fungus survives in infected crop debris, wild or volunteer beet species, and in seed to a limited extent. Potential yield loss is 100% if downy mildew is not controlled (1).

**Cultural Controls:**
Growers manage nitrogen fertilization by not over-fertilizing, and increase plant spacing to improve air circulation (decrease humidity) within the planting. The variety ‘F.M. Detroit Dark Red’ has reported resistance (9).

**Chemical Controls:**

- **Metalaxyl (Apron XL LS).** Seeds are treated at a rate of 0.32-0.64 fl. oz. per 100 lbs. of seed. Apron is used as a seed treatment at planting for 100% (1000 acres) of acres planted to red beet seed (1).
- **Metalaxyl (R-isomer = mefenoxam, Ridomil Gold).** Applied once as a preplant incorporated or soil surface application at 0.45 - 0.90 lbs. Al/A. This product is used on 100% (1000 acres) of red beet seed crops (1).
- **Copper hydroxide (Kocide DF).** Applied at 1.2 - 3.1 lbs. Al/A. Generally, more than one application is used on a 7- to 10-day interval. Approximately 10% of the beet seed crop acreage (100 acres) is treated with one of the copper fungicides to control downy mildew (1).
- **Copper hydroxide (C-O-C-S WDG).** Applications are made when conditions are favorable for disease. Usually more than one application is made at 7- to 10-day intervals at a rate of 2.67 - 3.56 lbs. Al/A. Approximately 10% of the beet seed crop acreage (100 acres) is treated with one of the copper fungicides to control downy mildew (1).

**Powdery Mildew** (*Erysiphe polygoni*)

Infection with the powdery mildew fungus causes patches on upper and lower leaf surfaces. The patches may spread to cover the entire leaf, eventually resulting in leaf death. Stems may also be affected. The fungus can overwinter on infected beets. Potential yield loss is 100% if powdery mildew is not controlled (1). Powdery mildew is usually more of a concern in eastern Washington (10).

**Cultural Controls:**
The cultivar ‘Red Ace’ has reported tolerance to powdery mildew disease (9).
## Chemical Controls:

- **Sulfur (Sulfur Flowable 6L).** Fungicide is applied at a rate of 3.96 lbs. AI/A when disease is observed. More than one application may be made at 18-day intervals. Approximately 10% (100 acres) of the beet seed crop is treated for powdery mildew control with a sulfur fungicide (1).

- **Micronized sulfur (Thiolux Dry Flowable).** Fungicide is applied at 2.4 - 4 lbs. AI/A when disease is observed. More than one application may be made at 10- to 30-day intervals. Approximately 10% (100 acres) of the beet seed crop is treated for powdery mildew control with a sulfur fungicide (1).

## Weeds

Weed competition can reduce the yield and performance of red beets planted for seed production. Crop competition can result in 75% yield loss if weeds are not controlled (1). Many weed species can also serve as hosts for diseases and insects that affect crop plants (9). Weed seeds can also be contaminants of harvested beet seed, potentially affecting marketability as contracts require a certain level of purity. Typical weeds in beets grown for seed include nightshade (*Solanum* spp.), henbit (*Lamium amplexicaule*), pigweed (*Amaranthus* spp.), shepherdspurse (*Capsella bursa-pastoris*), lambsquarters (*Chenopodium* spp.), mustard (*Brassica* spp.), chickweed (*Stellaria media*), wild buckwheat (*Polygonum convolvulus*), pale smartweed (*Polygonum lapathifolium*), common groundsel (*Senecio vulgaris*), curly dock (*Rumex crispus*), wild radish (*Raphanus raphanistrum*), Canada thistle (*Cirsium arvense*), pineapple-weed (*Matricaria matricariodes*), annual grasses (including annual bluegrass, *Poa annua* and others), volunteer grain (such as barley, *Hordeum vulgare* and wheat, *Triticum aestivum*), and seedling perennial grasses (such as quackgrass, *Elytrigia repens* and perennial ryegrass, *Lolium perenne*) (1,6,7).

## Chemical Controls:

- **Cycloate (Ro-Neet).** It is applied as a preplant incorporation to 30% (300 acres) of area planted to red beet seed to control nightshade, henbit, pigweed, shepherdspurse, annual grasses, lambsquarters, and volunteer barley. Successful weed control depends on degree of incorporation (1). This product should be applied to mineral soils only, at a rate of 3 to 4 lbs. AI/A (8). The industry has identified this chemical as a critical use as it provides preemergence control to weeds.

- **Phenmedipham + Desmedipham (Betamix).** (24c, WA-950019). Phenmedipham and desmedipham are postemergence herbicides. The combination product Betamix is applied from two-leaf stage to when beet plants begin to form buds (8). Rate of application ranges from 0.24 - 0.49 lbs. AI/A and depends on crop growth stage should be determined by consulting the product label (8). It is applied to 65% (650 acres) of red beet seed crops to control lambsquarters,
mustard, pigweed, chickweed, shepherdspurse, nightshade, and wild buckwheat (1). Crop injury may occur under unfavorable environmental conditions (8).

- **Ethofumesate (Nortron SC).** (24c, WA-950020). Application may be by preplant incorporation, preemergence, or postemergence (tank-mixed with Betamix). Crop injury may result when environmental conditions are unfavorable. Rate of application ranges from 1.5 - 3 lbs. AI/A and depends on timing and soil type and should be determined by consulting the product label (8). It is applied to 65% (650 acres) of red beet seed up to bloom to control lambsquarters, pigweed, smartweed, nightshade, annual grasses, shepherdspurse, and volunteer grain (1).

- **Chloridazon (= pyrazon) (Pyramin).** Chloridazon provides preemergence and early postemergence weed control (4). The recommended application rate is 3.2 to 3.7 lbs. AI/A; preemergence application is preferred west of the Cascades (8). It is applied to 95% (950 acres) of area planted to red beet seed up to bloom to control lambsquarters, mustard, smartweed, pigweed, henbit, shepherdspurse, nightshade, groundsel, dock, chickweed, and wild radish (1). Industry has identified this chemical as a critical use as it provides preemergence control of weeds.

- **Fluazifop-P-butyl (Fusilade DX).** (24c, WA-950029). Fluazifop-P-butyl is a selective grass herbicide applied "over-the-top" in broadleaf crops (4). It is applied to 20% (200 acres) of red beet seed crops up to bloom to control annual grasses and seedling perennial grasses (1). The recommended application rate varies depending on the growth stage of target grasses, with a maximum rate of 0.5 lb. AI/A/season (8).

- **Clopyralid (Stinger).** (24c, WA-970033). Clopyralid is a selective, postemergence herbicide for control of weeds in the Polygonaceae (buckwheat), Compositae (sunflower) and Leguminosae (pea, bean) families (4). Recommended application rates depend upon targeted weed species with a maximum rate of 0.25 lbs. AE/A/season. It is applied to 5% (50 acres) of red beet seed crops up to bolt to control wild buckwheat, smartweed, thistle, pineapple-weed, and groundsel (1).

- **Diquat (Diquat at 0.5 lbs. AI/A).** (24c, WA-930013). Applied at 1 1/2 - 2 pt/A three to ten days before harvest. Plants stop growth and cure better with application of a desiccant. Weeds that make harvest difficult are also killed with this treatment, resulting in a more uniform harvest. Wet weather in western Washington necessitates quick drying times for seed crops. This is the only desiccant available, thus is a critical use to the industry.

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References

10. Dr. Debra Inglis, WSU Mount Vernon. Personal communication, December 1998.

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