Crop Profile for Sugar Beets in Nebraska

General Production Information

Nebraska was ranked 6th in the nation in sugar beet production for the 1998 growing season. A total production of 934,000 tons of beets was produced on 47,400 acres with a total production value of nearly 33 million dollars. Average production from 1995 to 1997 was 1,037,333 tons of sugar beets per year harvested from an average production area of just over 61,000 acres. The average yield across Nebraska sugar-beet production acres from 1995-1998 was 17.7 tons per acre with the value of beets at approximately $38.50 per ton. The potential yield could be as high as 30 tons per acre, but this is uncommon. Average production costs in western Nebraska are around $600 per acre with costs going as high as $950 per acre.

Production Region

Sugar beet production in Nebraska occurs in the west end of the state and almost entirely in the panhandle. Much of the production occurs in the North Platte valley and surrounding regions. The sugar beet producing counties ranked in order of production are as follows: Box Butte (47%), Scotts Bluff (21%), Morrill (6%), Cheyenne (6%), Kimball (4%), Perkins (4%), Chase (3%), Sioux (3%), Keith (2%), and Banner (2%)counties. All other counties combined accounted for between 1 and 2% of production.

Cultural Practices

Under the semi-arid conditions (ca. 14-16 inches/year) of western Nebraska, all sugar beets are grown under irrigation. In the North Platte valley, furrow irrigation is the most common practice. In areas outside the canal system, center pivot sprinklers are used predominantly. Approximately two thirds of beet production in Nebraska is irrigated with center pivot sprinkler systems. Seventy to eighty percent of the crop is planted to stand and requires no hand thinning. Cultivation is used on all beets for weed control and soil tilth. Preemergence herbicides are used to some extent to control early germinating weeds but low rate sequential postemergence-banded applications are becoming the norm for weed control. One or two hand hoeings are often required to eliminate weeds surviving herbicide applications.

To determine pesticide usage and cultural practices, a survey was sent to growers to gain information about the 1999-growing season. Acres treated with pesticides and rates applied were taken from survey

results.

Weeds

A wide variety of weeds can be a problem in Nebraska production areas. Common weeds are kochia, nightshade, foxtail, lambs quarters, and pigweed. Early emerging weeds are often controlled with mechanical tillage in the spring before planting. Chemical management consists of using preplant or preemergence herbicides and/or the use of postemergent herbicides depending on the types of weeds present. Most treatments are applied in a band over the row with weed control between the rows accomplished by mechanical cultivation. Multiple postemergence treatments are almost always required for effective weed control. Essentially all beet acres in Nebraska are treated one or more times with herbicides.

Integrated pest management (IPM). Mechanical cultivation, hand weeding, proper identification of weed complex-s, and band spraying are used to minimize chemical applications and diversify control methods in sugar beets.

Herbicides

Preemergence

- **Nortron SC,** is a broad-spectrum herbicide used on approximately 53% of Nebraska sugar beet acreage. It is applied pre-planting and mechanically incorporated or incorporated with 0.5 inches of water. Broadcast rates range from 35.2 to 59.2 oz per acre. Banding rates range from 8 to19 oz per acre. The average rate applied in Nebraska was 17.3 oz per acre.
- **Ro-Neet 6E,** is a broad-spectrum herbicide used on approximately 22% of sugar beet acres in Nebraska. It is applied preplant and incorporated 2 to 3 inches in dry soil. Broadcast rates range from 32 to 52.8 oz per acre. Band rates range from 7.5 to 17 oz per acre. The average rate applied on Nebraska acres was approximately 30.7 oz per acre.
- **Roundup Ultra,** is a broad-spectrum herbicide applied in spring to kill cover crops or weeds before beets emerge. This product was used on approximately 3.8% of sugar beet acres. Broadcast rates range from 24 to 32 oz per acre. Band application rates range from 6.5 to 9 oz per acre. The average rate applied in Nebraska was approximately 10 oz per acre.

Postemergence

- **Betamix,** is a broad-spectrum herbicide that is usually applied in a band with 2 to 3 sequential applications. This product was used on approximately 75% of Nebraska sugar beet acres. Banding rates range from 7.5 to 15 oz per acre. The broadcast rate is 32 to 48 oz per acre. The average Betamix rate used in Nebraska was approximately 13.6 oz per acre. Most growers

following general practices and label instructions would have applied the average rate, of 13.6 oz per acre, twice to get effective weed control.

- **Upbeet,** is a broadleaf herbicide applied to approximately 63% of Nebraska acres. It is used to improve control of kochia missed by Betamix and is often applied with Betamix in two sequential band applications. Banded rates are 0.12 to 0.17 oz per acre. The broadcast rate is 0.5 oz per acre. The average rate used in Nebraska was 0.2 oz per acre.
- **Stinger,** is a broadleaf herbicide applied to approximately 46% of beet acres in Nebraska. Stinger is normally used in conjunction with Betamix or Betamix-Progress to increase control of harder to kill broadleaf weeds. Broadcast rates are 4.0 to 10.6 oz per acre. Banded rates are 1.0 to 3.4 oz per acre. The average rate applied in Nebraska was 1.9 oz per acre.
- **Progress,** is a product often used instead of Betamix to more effectively kill certain weed species. It is used on approximately 14 % of the acres. The use of Betamix-Progress is more phytotoxic to beets so pure Betamix is preferred if the weed spectrum permits. Broadcast rates are 20 to 36 oz per acre. Banded rates range from 4.7 to 11.4 oz per acre. The average rate used in Nebraska was 11.2 oz per acre.
- **Poast,** is a grass herbicide applied to approximately 9.4% of Nebraska beet acres. Poast is applied at 16 to 32 oz per acre broadcast and 3 to 10 oz per acre banded. The average rate used in Nebraska was 9.7 oz per acre.
- **Select 2 EC,** is a grass herbicide often used with Betamix. This product was used on approximately 8.9% of Nebraska acres. Broadcast rates are 6 to 8 oz per acre, banded rates are 1.4 to 2.5 oz per acre. Average rate applied in Nebraska was 3 oz per acre.
- **Eptam 7E,** was applied to approximately 7.6% of sugar beet acres. This product is normally used post-thinning as a lay by treatment to control annual grasses and nightshade. Banded rates are from 8 to 18 oz per acre. Broadcast rates are from 36 to 56 oz per acre. The average rate used on Nebraska acres was 3.1 pints per acre.
- **Assure II,** is used on susceptible grasses less than 4 inches tall and has good activity on volunteer cereals. Assure II was used on approximately 4.2% of Nebraska's sugar beet acres. Broadcast rates are 7-8 oz per acre, band rates are 1.6 to 2.6 oz per acre. The average rate used in Nebraska was 4.9 oz per acre.

Insect Pests

Sugar beet Root Maggot

The sugar beet root maggot is the most severe insect pest of sugar beets in Nebraska. The fly larvae over winter in the soil and emerge as adult flies when the soil warms up in the spring. In western Nebraska, the over wintering larvae will pupate in April and begin to emerge as adults in early May. The adults move to sugar beet fields where eggs are laid around newly emerging beet plants. Eggs hatch and larvae feed on the taproots of the young beets. The resulting damage weakens and often kills the plants resulting in significant yield loss, if untreated. Infestations of sugar beet root maggot occur only in the

North Platte valley growing region, which constitutes about 42% of the beet acreage in Nebraska.

Integrated pest management (IPM). Cultural practices will not eliminate but can help reduce the impact of sugar beet root maggot. Avoiding close rotations and maximizing plant vigor can help to minimize the impact of this insect. Irrigation can help to minimize damage after maggots begin feeding on the beets. Soil moisture will cause the maggots to move higher on the plant and reduce the possibility of maggot feeding severing the taproot. To avoid unnecessary pesticide applications, orange sticky stake traps can be used to monitor fly buildup and lay by treatments applied after an established population threshold is reached. Additionally, insecticide treatments are banded over the row resulting in only one third of the field area being treated.

Granular insecticides applied at planting time are a common method of controlling sugar beet root-maggot. Options include Counter 20CR and 15G, Lorsban 15G, and Temik 15G. Lorsban 4E can be an effective threshold based lay by treatment, but in hot weather some phytotoxicity can occur.

- **Counter 20CR,** was applied to approximately 40% of the acres. Applications are most often made at planting time in a 5 to 7 inch band and lightly incorporated. Rates vary from 3.3 to 8.9 lbs. per acre depending on row spacing with an average application rate in Nebraska of 6.8 lbs. per acre.
- **Counter 15G,** was applied to approximately 4.2% of the acres. Applications are banded in a 5 to 7 inch band at planting time. Rates vary from 4.4 to 11.9 lbs. per acre depending on row spacing with an average rate in Nebraska of 8.2 lbs. per acre.
- **Lorsban 15G,** was applied to less than 1% of the acres. Applications are made in a 3 to 5 inch band at planting or postemergence up to the 2-4 true leaf stage and incorporated. Rates were 4.9 to 13.4 lbs. per acre.
- **Lorsban 4E,** was applied to approximately 2.2% of the acres. Applications are made postemergence in a 5 to 7 inch band. Chemical should be incorporated either mechanically or with irrigation. Rates range from 10.7 to 32 ounces per acre. Applications should be applied based on field trap monitoring from 7 days before until 3 days after peak adult emergence. Plant damage can occur with this product in connection with hot temperatures and interaction with some herbicides.
- **Temik 15G,** was applied to approximately 3.4% of the acres. Applications are banded at planting, or at cultivation, or drilled 2 inches deep on the waterside of row in furrow irrigation systems. Rates range is from 7 to 14 lbs. per acre. Due to solubility, care must be taken with this chemical to avoid groundwater contamination.
- **Thimet 20G,** was applied to approximately 2% of the acres. Granules are banded over the row at cultivation. Rates range from 4.9 to 6.7 lbs. per acre.

Sugar beet Root Aphid

Sugar beet root aphids are common insect pests in western Nebraska.. They can be recognized in beets by the white waxy masses that surround their colonies in the soil immediately around and on the sugar

beets. These aphids have a fairly involved life cycle. In the fall, a sexual generation produces eggs that overwinter in narrow leaf cottonwood trees at elevations generally above 4500 ft. In the spring, aphids hatch and feed on emerging cottonwood leaves. The aphid creates a gall at the base of the leaf, which serves as a protective shelter for colonies of reproducing aphids. The aphids produced in the galls are a winged form, which leave the galls from mid June to mid July and migrate back to the sugar beet fields. Arriving aphids colonize and reproduce non-winged aphids which buildup on the sugar beet roots. Moderate to heavy infestations can cause significant tonnage and quality loss in sugar beets. In late August or September, winged aphids develop and migrate back to the cottonwoods. A small proportion of root aphids may overwinter in the soil and remain in the cropping area over the winter.

Integrated pest management (IPM). Effective management of the sugar beet root aphid is most effectively accomplished by the use of resistant beet varieties. However, growers often need to choose aphid susceptible varieties because of better disease resistance or better yield potential. Sugar beet varieties offering good resistance are available from most companies. Cultural practices can also help minimize the buildup of sugar beet root aphids. These practices include avoiding a close rotation of sugar beets, and controlling lambs quarter and pigweed**, which** are an alternate host for sugar beet root aphids and offer potential overwintering sites. Irrigation during the aphid colonization period may help reduce the establishment of arriving aphids.

Counter 15G and 20CR are the only insecticides labeled for sugar beet root aphid control. Use of these chemicals however, has not proven effective and is not recommended.

Army cutworms

Army cutworms can be a devastating problem in seedling beets. They overwinter as partially grown larvae or eggs and begin extensive feeding early in the spring. During the period of sugar beet emergence and stand establishment in the spring, growth is slow and the crop is highly susceptible to stand loss from cutworms. Army cutworms may be particularly bad in fields that had a cover crop on them over the winter. This cover crop provides food for the cutworms during the fall and early spring.

Integrated pest management (IPM). There are few management options available to reduce the damage from army cutworms. Lorsban 15 G will give reasonable control when applied at planting time but may also have a phytotoxic affect on the beets. It=s effectiveness will also be variable depending on dryness. The best option for controlling cutworms is to closely scout fields during the period of emergence and establishment. If emergence or stand start to decline, the extent of the infestation must be thoroughly evaluated and treatments made immediately. Border infestations near grassy areas are common and may only require a spot treatment. The most effective control can be obtained by using a lay by insecticide. Lay by applications of Asana XL and Lorsban 4E are used to control cutworm infestations.

Occasional Insect Pests:

Other insects such as wireworms, and grasshoppers are occasional pests that require treatment but are not of great economic significance.

Wireworm damage in beets is very difficult to predict. Populations are dependent on the inherent number of wireworms in the soil and the environmental conditions existing during emergence and establishment. Serious damage does not frequently occur. Field history is an important factor in predicting wireworm problems. In fields with a high risk of wireworm damage, control is accomplished with the use of soil insecticides, or seed treatments.

Grasshoppers can cause significant damage both during early season establishment and later in the season. The incidence of grasshopper infestations depends on regional population levels and long-term environmental conditions. Where significant populations develop, insecticide treatments need to be used to control damage.

Nematodes

Sugar beet Nematode

Sugar beet nematode, *H. schachtii*, was reported as early as 1907 in Colorado and was reported in the North Platte valley in 1926. Today this nematode is reported at economic levels in all the older sugar beet production areas of Colorado, Nebraska, and Wyoming. It is gradually spreading into most of the newer production regions also. If unchecked, damage from the sugar beet nematode can be very significant. Damage to plants is greatest in a dry summer following a warm wet spring, which is favorable to the nematode.

Integrated pest management (IPM). Combining a 3 or more year rotation with non-host crops, good sanitation, tare dirt management, weed control, and planting a trap crop, if available, will reduce the soil population of sugar beet nematodes. Laboratory analysis of the soil is made to determine nematode density in relationship to planting and whether a nematicide application is necessary. The economic threshold for treatment is from 2-5 eggs per cc of soil. Use of nematicides has been declining because of the extreme costs involved with treatment. Some areas have been taken out of sugar beet production because of the seriousness of the pest.

False Root-Knot Nematode

The false root-knot nematode, *Nacobbus aberrans*, was first reported in western Nebraska in 1956. It has since been reported in Montana, Wyoming, South Dakota, Colorado and Kansas. Though native it has not spread throughout the entire sugar beet growing region as heavily as the sugar beet nematode. This nematode causes severe damage to the sugar beet crop.

Integrated pest management (IPM). Management approaches include sanitation such as proper disposal of tare dirt away from the sugar beet growing area, controlling weeds that are alternative hosts, crop rotation, early planting, trap crops, resistant varieties, and nematicides. Control with nematicides is generally less effective than for the sugar beet nematode because the false root-knot nematodes are better protected and isolated within the root tissue.

Nematicide use in Nebraska for 1999 has been reported as follows:

- **Telone II Soil Fumigant,** was applied to approximately 6.6% of the acres in the fall or pre-plant during the early spring. Effectiveness of fumigants depends on the application technique, depth of application, soil temperature and moisture, soil type, compaction and organic matter content. Rates are 9 to 12 gallons per acre. The average rate of application in Nebraska was 12.11 gallons per acre.
- **Temik 15G,** was applied to approximately 1.4% of the acres. This is a granular at-plant nematicide, and has dual activity on both nematodes and insects. It is applied in a band at planting and incorporated. The registered rates range from 27 to 33 lbs. per acre. The average rate used in Nebraska was 20 lbs. per acre.

Diseases

Rhizomania

This viral disease was first identified in the high plains and intermountain regions in 1992. It has currently been identified in a number of locations in western Nebraska. It has caused limited losses in root and sugar yield. The most obvious symptom of this disease is a mass of fine, hairy secondary roots consisting of both dead and living roots. Infection early in the season can cause severely stunted fleshy roots. In some plants the taproot may be severely restricted a few inches below the soil surface causing a Awineglass@ shaped root.

Beet necrotic yellow vein virus is the causal agent of rhizomania. *Polymyxa betae*, a soilborne fungus, is the vector of the rhizomania virus, and carries it from diseased to healthy roots during periods of saturated soils. Sugar beets are a host to both fungus and virus. The resting fungus spores and the enclosed virus particles inside can survive well over fifteen years in the absence of a suitable host. Diagnosis of rhizomania cannot be based on visual symptoms alone. It is necessary to conduct an ELISA procedure in the lab to confirm the presence of rhizomania.

Integrated pest management (IPM). Sanitation is the most practical method to slow down or prevent the spread of rhizomania. This includes proper tare dirt disposal, thorough cleaning of equipment that is borrowed or moved from infected areas, care in waste water flow, and also avoiding livestock movement

from infected areas to non-infected areas. Early planting and irrigation management are also helpful in managing rhizomania. Tolerant or resistant beet varieties perform well in the presence of infection, particularly when used in combination with Telone II soil fumigation. Telone II at label rates for rhizomania will help suppress the disease, apparently by the control of the *Polymyxa betae* fungus vector. Nematicidal rates of Telone II are within label rates for rhizomania. However, expense limits the use of this fumigant for rhizomania alone, but applications used for nematodes will benefit the crop in helping to suppress the virus as well.

Cercospora Leaf Spot

This disease caused by the fungus, *Cercospora beticola*, is a serious leaf disease of sugar beets. Cercospora has caused significant reductions in root and sugar yields in the state of Nebraska and other production regions. A wide range of weeds, vegetables, and field crops serve as hosts for this fungus and provide overwintering inoculums for the next season's sugar beets.

Symptoms initially occur on older leaves and then move to the younger leaves. The disease causes leaf spots about 1/8th inch in diameter with ash colored centers and purplish borders. With a hand lens, the distinguishing black spore-bearing structures can be seen in the center of the spots. Severely infected older leaves wither and die.

Cercospora leaf spot epidemics are dependent upon the presence of susceptible varieties, adequate overwintering inoculums, and long periods of leaf wetness accompanied by warm temperatures in the canopy. The potential for Cercospora infection can be predicted by evaluating meteorological conditions during the warmer months of summer. The method assumes the presence of inoculums and susceptible varieties. A daily infection value is calculated based on the duration of relative humidity and warm temperatures. Based on daily infection values summed over two days the likelihood of a Cercospora infection can be determined and careful scouting for symptoms and treatment can follow.

Integrated pest management (IPM). Management primarily involves the use of resistant varieties and/or the use of fungicides. The prediction system described above is the best method to determine if conditions are favorable for infection. If conditions are favorable, careful scouting for symptoms should occur followed by treatment if Cercospora is detected and the beet variety is susceptible. Rotation of chemicals is recommended to avoid development of resistant strains of the disease.

- **Dithane F-45,** was applied to approximately 0.4% of the acres. It is applied aerially or by ground application to foliage of the sugar beet plant. Application rates range from 38.4- 51.2 oz. per acre. Limited information in Nebraska indicated a use rate of approximately 24 oz. per acre.
- **Dithane DF,** was applied to approximately 2% of the acres. It is applied aerially or by ground application to foliage of the sugar beet plant. Application rates range from 1.5- 2.0 lbs. per acre. Information in Nebraska indicated a use rate of approximately 1.6 lbs. per acre.
- **Maneb,** was applied to approximately 1.1% of the acres. It is applied aerially or by ground application to foliage of the sugar beet plant. Application rates range from 1.5- 2.0 lbs. per acre.

Limited information in Nebraska indicated a use rate of approximately 2.0 lbs. per acre.

- **Penncozeb,** was applied to approximately 0.3% of the acres. It is applied aerially or by ground application to foliage of the sugar beet plant. Application rates range from 1.5- 2.0 lbs. per acre. Limited information in Nebraska indicated a use rate of approximately 1.5 lbs. per acre.
- **Super Tin 80 WP,** was applied to approximately 11% of the acres. It is applied aerially or by ground application to foliage of the sugar beet plant. Application rates range from 0.16- 0.3 lbs. per acre. Information in Nebraska indicated a use rate of approximately 0.3 lbs. per acre.
- **Topsin M WSB,** was applied to approximately 8% of the acres. It is applied aerially or by ground application to foliage of the sugar beet plant. Application rates range from 0.375- 0.5 lbs. per acre. Information in Nebraska indicates a use rate of approximately 0.375 lbs. per acre.

Powdery Mildew

This is a selective host plant disease, which infects sugar beets. After a severe outbreak in the mid 1970's it now occurs wherever sugar beets are grown in the United States. Beet plants are infected by wind-born microscopic spores. Under the right conditions the infectious spores reproduce and form a visible white film that can be seen within four to five days from infection. Leaves become yellow then purplish brown. The disease can cause a significant reduction in yield and percent sugar. The fungus does not survive the winter in Nebraska, Colorado or Wyoming production areas, but is blown in on an annual basis from regions to the southwest.

Integrated pest management (IPM). Currently there are not sugar beet varieties with good resistance to powdery mildew. Careful field monitoring and fungicides are the best management tools. In general, low humidity and dry conditions are most favorable for powdery mildew infection and development. Flowable sulfur products provide effective control of powdery mildew. Bayleton 50 DF, Microthiol Special, and Thiolux 80 are products for supression of this disease.

Rhizoctonia

Rhizoctonia root and crown rot is caused by the soil fungus *Rhizoctonia solani*. This disease can cause significant damage to sugar beets if not managed correctly.

Integrated pest management (IPM). IPM practices are important for the control for this disease. They include a minimum 3 year rotation with non-host crops, weed control throughout the rotation, minimizing crop injury, altering practices that throw soil into the crowns of the beets, maintaining balanced nutrition, minimizing soil compaction, establishing proper plant density, and maintaining optimum soil moisture for sugar beet growth.

In 1999 and 2000 an emergency, section 18, registration was allowed for the use of Quadris fungicide to help control rhizoctonia. Registration of this fungicide is possible in 2001. The 1999 survey did not indicate the use of Quadris to control rhizoctonia on Nebraska sugar beets acres.

Aphanomyces

The soil fungus, Aphanomyces cochlioides, causes Aphanomyces root and crown rot. Reduction of stand due to seedling disease can be improved with the use of Tachigaren as a seed treatment at the rate of 45g/1000 seeds. To protect plants from late season root infection good cultural practices, such as 3-year rotations, optimizing plant health, and maintaining optimum soil moisture, are critical.

Minor Diseases:
Some other sugar beet diseases exist such as curly top, and fusarium yellows, but are not generally a significant problem in sugar beet production.

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Contacts

Paul Burgener
Agricultural Economic Research Analyst, University of Nebraska
Panhandle Research and Extension Center
Scottsbluff Nebraska
Phone: (308) 632-1241

Bob Harveson
Extension Plant Pathologist, University of Nebraska
Panhandle Research and Extension Center
Scottsbluff Nebraska

Phone: (308) 632-1239

Gary Hein
Extension Entomology Specialist, University of Nebraska
Panhandle Research and Extension Center
Scottsbluff Nebraska
Phone: (308) 632-1369

John Smith
Extension Machinery Systems Engineer, University of Nebraska
Panhandle Research and Extension Center
Scottsbluff Nebraska
Phone: (308) 632-1247

Bob Wilson
Extension Weeds Specialist, University of Nebraska
Panhandle Research and Extension Center
Scottsbluff Nebraska
Phone: (308) 632-1263

Prepared by:

John A. Thomas
Research Coordinator, Entomology
Panhandle Research and Extension Center
4502 Ave. I, Scottsbluff, NE 69361
(308) 632-1250

Dr. Gary Hein
Extension Entomologist
Panhandle Research and Extension Center
4502 Ave. I, Scottsbluff, NE 69361
(308) 632-1369

Dr. Shripat Kamble
Professor of Entomology and Extension Specialist
University of Nebraska, Lincoln
Plant Industry Bldg. 202
Lincoln, Nebraska 68583
(402) 472-6857