# Crop Profile for Dry Beans in Nebraska

(*Edible*)

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## General Production Information

The state of Nebraska plays a significant role in dry bean production in the United States. Production is primarily in the market classes of great northern, pinto, red kidney and navy. In 1998, Nebraska ranked 3rd in overall dry bean production in the U.S., producing 3,666,000 cwt, which represents nearly 12% of total U.S. production. Nebraska ranked 1st in great northern bean production, producing 1,855,000 cwt which represented 85% of the nations= production. In 1998, 188,000 acres of dry beans were harvested with an average yield of 1,950 lbs. per acre. The average value was $18.00 per cwt giving a total value of $65,988,000.

More than 90% of the commercial acreage is produced under irrigation. Average yields vary from 250 to 500 pounds per acre under dry land conditions and 1600 to 2200 pounds per acre under irrigation.

**Production Region**

The central high plains (Colorado, Wyoming, and Nebraska) are among the highest producing dry edible bean regions in the United States. In Nebraska, dry beans are grown mainly in the panhandle and southwestern counties. The top ten bean producing counties in rank for 1998 are Scottsbluff, Morrill, Box Butte, Chase, Sheridan, Cheyenne, Perkins, Holt, Kimball, and Keith counties. These counties produced 3,193,400 cwt or 87% of Nebraska=s total dry bean crop. The Panhandle counties collectively produce 74% of the states dry beans.

## Cultural Practices

Bean seed does well when planted in a firm, non-compacted seedbed in the spring after soil temperatures have warmed up, (May 20 to June 10). The seeding rate should be chosen to establish 60,000 to 90,000 plants per acre under irrigation and 18,000 to 30,000 under dry land conditions. Row spacing in beans is often 30 inches, but studies indicate that narrower spacing such as 22-inch rows can increase yield but can also increase the incidence of diseases such as white mold.

Dry beans should be grown in a rotation with at least two or three years between bean crops. Weeds are primarily managed with herbicides and cultivation, but hand weeding is sometimes used to deal with late season weeds. Most bean herbicides are applied broadcast at planting, but banded herbicide and insecticide applications are used commonly and reduce pesticide application rates. Seed treatments, fungicides and irrigation management are used to deal with disease problems.

Information in this crop profile about pesticide rates, and acres treated were obtained from a grower survey conducted after the 1999 growing season. The survey responses cover 11,503 acres of the 187,000 dry bean acres grown in Nebraska.

## Weeds

Weed competition has a tremendous impact on dry bean yield and quality. Because growers understand these negative impacts, combinations of mechanical, chemical, and cultural weed control are used on most dry bean fields. When compared to other pest inputs, more dollars are spent on weed control than any other pest management practice.

To minimize the effects of weed competition, control techniques must suppress weeds from crop emergence through the first flowering stage, which is 4 to 5 weeks after crop emergence. Weeds emerging during this period are more competitive than later emerging weeds that remain below the crop canopy. As the crop develops and begins to shade the soil surface, the growth of weeds that emerge later in the season will be reduced.

There are normally two major flushes of weeds, one occurring with crop emergence and a second occurring approximately10 days later. These early season weed flushes account for 85% of the weeds that emerge during the season. The final weed flushes follow cultivations, resulting in late season weed problems. Herbicides that are band or broadcast applied at planting are best for controlling weeds emerging with the crop. Under most conditions, preplant incorporated or preemergence herbicides will provide 4 to 6 weeks of residual activity. Weeds emerging after that time will need to be controlled by cultivation and/or the use of lay by herbicides.

Producers need to select herbicides based on the weed spectrum in each field. This will require a record of weeds occurring in a field or the ability to identify seedling weeds. Herbicides applied at planting may not control certain weed species or may not provide adequate weed control because of enhanced degradation or inadequate moisture for activation. This means that postemergence herbicide applications will be needed to control weeds within the row.

**Herbicides**

| Herbicide | % Crop Treated 1999 | Application Rate per acre<br><br>Labeled Average | | Timing | Weeds Controlled |
|---|---|---|---|---|---|
| Basagran | 10% | 16-32 oz | 18 | Post-emergence | broadleaves 1-2 inches tall |
| Dual II Magnum | 18% | 16-26.7 oz | 19 oz | Pre- emergence | grasses, broadleaves |
| Eptam 7E | 53% | 40-72 oz | 41 oz | Pre and Post emergence | grasses, broadleaves |
| Eptam 20G | 5.2% | 11-20 lbs | 11 lbs | Pre- emergence | grasses, broadleaves |
| Frontier 6.0 | 9% | 20-30 oz | 21 oz | Pre and post emergence | grasses, broadleaves |
| Gramoxone extra | 0.4% | 16-24 oz | 24 oz | Harvest | desiccant |
| Lasso | 4.3% | 40-96 oz | 44 oz | Preplant incorporate | grasses, broadleaves |
| Partner WDG | 4.1% | 3-4.5 lbs | 3.6 lbs | Preplant incorporate | grasses, broadleaves |
| Poast | 0.3% | 16-24 oz | 16 oz | Post emergence | grasses, vol. corn |
| Prowl 3.3 EC | 3% | 19-57.6 oz | 43 oz | Pre emergence | grasses, broadleaves |
| Pursuit DG | 18% | 1.08 dry oz | 1 dry oz | Post-emergence | grasses, broadleaves |
| Roundup Ultra | 2% | 12-48 oz | 24 oz | Pre emergence | All Weeds |
| Sonolan HFP | 69% | 24-72 oz | 37 oz | Preplant incorporate | grasses. broadleaves |

# Insect Pests

Many species of beneficial and damaging insects can be found in dry bean fields in Nebraska. Recognition of the harmful pests, awareness of thresholds for economic damage, and the proper selection and timing of insecticides are necessary to produce a healthy crop, ensure survival of beneficial insects and minimize environmental impacts of the insecticides.

Numerous species of insects feed on dry beans in Nebraska, but serious damage results from only a few species on a consistent basis. The major insect pests are the western bean cutworm and the Mexican bean beetle. Thrips and grasshoppers can occasionally cause damage to dry beans. Soil insects sometimes causing damage are the seed corn maggot and wireworms.

### Soil Insects

**Seed corn maggot** adult activity begins in early May during corn planting. Offspring of these adults mature to form a second generation of adults in late May or early June when beans are planted. The adults are attracted to areas of high organic matter that have just been tilled. In this region small grain stubble can increase problems. Maggots will feed on the germinating bean seed and hollow out or otherwise damage the cotyledons. If maggots damage the growing point of the plant, a Snakehead@ or leafless plant may result. Later feeding by maggots may be evident as burrowing within the stem, which may cause rotting in the stem.

**Wireworms** are soil dwelling larvae that may feed on the seeds, roots, or hypocotyls of the germinating bean plants. Damaged areas in the field will show up as spotty areas with reduced stand. Later feeding on the hypocotyls may result in stunted or wilted plants. Adult beetles are attracted to grasses to lay their eggs. Therefore, rotation with cereals and fields with pour grass weed control are more likely to be affected by this insect. Several species of wireworm exist in the region with life cycles ranging from 2 to 5 years, extending the period of potential damage. Wireworm damage to dry beans is not common because beans are planted in late May or June when soil temperatures allow for rapid germination and establishment of the bean plant. Wireworms move deeper in the soil and cause less damage when soil temperatures rise in early summer.

### Defoliating Insects

**Mexican bean beetle** adults overwinter in debris in fields, along field margins and in fence rows. The beetles move out into the dry bean fields over an extended period of time in June and July. Females begin to lay eggs on the beans after they have fed for 1 to 2 weeks. Each female may lay up to 500 eggs over a 5 week period. Eggs will hatch in 5 to 10 days and these larvae will feed and mature over the next 4 weeks to pupate and create a second generation of adults.

Larvae and adults of the Mexican bean beetle feed on the underside of leaves, stripping the epidermis from the leaf and leaving skeletonized damage. Leaf consumption increases as larvae increase in size. Two thirds of the leaf area is consumed by the final (fourth) instar larva. An adult beetle will also do considerable feeding and can consume over three times the daily leaf surface area as the fourth instar larvae. Significant Mexican bean beetle populations are more likely to occur when beetle populations the previous year were high followed by a mild winter. Cold temperatures and minimal snowfall will result in increased winter mortality.

**Grasshoppers** will occasionally invade bean fields. The grasshopper species that invade cropland begin to hatch from eggs in late May and early June. After this time populations will begin to build and the damage potential will increase through June and July as the hoppers increase in size. Infestations are usually limited to field margins but occasionally spread throughout the field.

## Sucking and Leaf-Curling Insects

**Onion thrips** may sometimes attack dry beans in Nebraska.. Onion thrips are most commonly associated with furrow irrigated beans grown in close proximity to winter wheat. Infestations commonly occur as the wheat matures and the thrips move in search of new food sources. Onion thrips feeding results in leaf cupping and distortion that is made more severe by plant stress. The crop often outgrows the damage with little yield loss although treatment may occasionally be needed.

**Western flower thrips** feed in developing flowers and can cause flower and pod abortion. Five flower thrips per blossom can reduce the number of pods per plant although the economic level of infestation would be higher than this. Both species of thrips are more prevalent during dry periods, and populations are often reduced by rainfall or sprinkler irrigation. Onion thrips have not been difficult to control, but flower thrips may prove difficult to reach with contact insecticides.

## Pod and Seed-feeding Insects

**Western bean cutworms** damage beans by boring through the pod and feeding on developing bean seeds. Feeding occurs primarily at night and on cloudy days. During a sunny day, worms hide in the soil at the base of the plants.

The western bean cutworm overwinters as a prepupa within earthen cells formed in the ground. They pupate in May and emerge as moths in July. Emergence of adults from the soil is aided by rainfall and irrigation. Peak moth activity in Nebraska usually occurs the last half of July. Shortly after emergence females lay clusters of eggs on the lower side of the leaves. After mature larvae stop feeding, they enter the soil for overwintering. There is only one generation per year. Corn is also a host for western bean cutworm.

Many insecticides are labeled for dry beans in Nebraska. The following table represents insecticides used in Nebraska in 1999 on the surveyed acres.

## Insecticides

| Insecticide | % Crop Treated 1999 | Application Rate per acre Labeled Average | | Timing | Insects Controlled* |
|---|---|---|---|---|---|
| Asana XL | 10% | 2.9-9.6 oz | 4.5 oz | Late season | mbb, wbc |

| | | | | | |
|---|---|---|---|---|---|
| Thimet 15G | 0.8% | 6.5-13.6 lbs | 11.5 lbs | Planting, early cultivation | mbb, ww, wbc, thr |
| Thimet 20G | 1% | 5.3-10.2 lbs | 6.5 lbs | Planting | wbc, scm |
| Sevin XLR | 0.7% | 16-32 oz | 24 | Late season | mbb, wbc |

- mbb= Mexican bean beetle, wbc= western bean cutworm, thr= thrips, scm= seed corn maggot, gh= grasshopper, ww= wireworm

## Diseases

Pathogens that cause diseases in beans are subdivided into four classes: fungi, bacteria, nematodes, and viruses. These pathogens can live from season to season and be transported by contaminated seeds, wind currents, wind or rain-splashed soil particles, irrigation runoff water, and by other means. The diseases they cause can be prevented or managed by reducing the population of pathogens in the field, or by anticipating or detecting their presence early in the season and applying management measures that prevent or reduce their development in the crop.

Commonly employed disease management strategies include control of volunteer beans, tillage to remove previous crop debris and alleviate stresses such as soil compaction, fertility applications based upon soil testing, selection of adapted varieties suitable to the region, irrigation management, and timely application of appropriate pesticides when economically justified.

**Management Practices**

**Fusarium root rot:** 1) Seed treatment with fungicide to delay initial infection. 2) Cultural practices that reduce plant stress. 3) Rotate with non-host crops such as corn, barley, wheat, and alfalfa.

**White mold:** 1) Rotate with non-host crops such as sugar beets, corn, alfalfa, sorghum, and small grains. 2) Avoid planting in fields with history of white mold for at least 3 years. 3) Plant upright vine bean varieties. 4) Use plant populations, row widths, and irrigation practices that promote rapid drying of soil surface between irrigations after flowering. 5) Apply fungicides during R2-R3 growth stages.

**Rust:** 1) Plant certified resistant varieties and avoid susceptible varieties when planting after June 25$^{th}$. 2) Monitor fields closely for disease appearance and apply fungicides early if there is a severe infection.

**Common bacterial blight:** 1) Plant tolerant varieties. 2) Use seed treatments with streptomycin. 3) Incorporate debris after harvest and maintain a minimum 2 year rotation with other crops. 4) Avoid activity in the field

when plants are wet. 5) Avoid putting bean straw on fields that will be planted to beans. 6) Do not reuse irrigation water. 7) Consider copper sprays during mid vegetative to flowering stages (V3-R2).

**Halo blight:** 1) Use same management practices as used for common bacterial blight.

**Fungicides and Nematicides**

| Fungicide/ Nematicide | % Crop Treated 1999 | Application Rate per acre Labeled Average | | Timing | Diseases Controlled* |
|---|---|---|---|---|---|
| Champ IV | 1.2% | 20.8- 64 oz | 32 oz | Early | blt |
| NuCop | 3.4% | 10.6-64 oz | 48 oz | Late | wm, blt |
| Tilt | 0.74% | 4 oz | 4 oz | Early | rst |
| Seed Treatments | | | | | |
| T-22 | 4.6% | 4-6 oz/ cwt | 3oz/cwt | Seed treatment | rhz, blt, fsd |

* blt= blights, fsd= fusarium seed decay, rhz= rhizoctonia, wm= white mold, rst= rust

## References


1. Crop Protection Reference. 1999. 15th Edition. C&P Press. New York.

2. Dry Bean Production and Pest Management. 1996. Regional Publication by: Colorado State University, University of Nebraska, University of Wyoming. Regional Bulletin 562A. Cooperative Extension Resource Center, Colorado State University.

3. Guide for Weed Management in Nebraska. 2000. University of Nebraska Cooperative Extension EC 00-130-D.

4. High Plains Integrated Pest Management Guide for Colorado-Western Nebraska-Wyoming. No. 564A. 1998. Colorado State University.

5. Nebraska Agricultural Statistics service, http://www.agr.state.ne.us/agstats/nebpubs2.htm.

6. University of Nebraska, Entomology Website. entomology.unl.edu

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