with quality seed

Grow Blight-Free Field Beans[1]

Blighted area in Navy bean field. This bulletin tells what to do to prevent this disease.

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SELECTING DISEASE-FREE SEED is one of the first steps in producing a commercial crop of field beans. This is especially important because the pathogens responsible for bacterial blight, anthracnose, and bean common mosaic diseases in beans may be carried in bean seed from season to season.

An outbreak of any one of these diseases will reduce yield and affect the quality of harvest. Fortunately, most Navy bean varieties grown in Michigan are resistant to all races of anthracnose and bean common mosaic virus formerly predominant in Michigan. Consequently, bacterial blights are of main concern today.

What is Bacterial Blight?

Bacterial blight is a collective term used to describe the symptoms on beans caused by one or more species of bacteria. We are especially concerned with three bacterial diseases of beans: common blight, fuscous blight, and halo blight caused by *Xanthomonas phaseoli* (E.F. Sm.) Dows., *Xanthomonas phaseoli* var. *fuscans* (Burkh.) Starr & Burkh., and *Pseudomonas phaseolicola* (Burkh.) Dows., respectively (Figures 1-7). All are seed-transmitted and spread from plant to plant by rain, hail, or wind. All can survive in plant debris in the soil for at least 1 year.

Plant infection occurs either through natural leaf openings, or through wounds created by hail, blowing soil particles, sucking insects, or mechanical injury. Pod infection can occur rapidly, after which developing seeds are invaded by the bacteria; such infected seed, if planted, will almost certainly transmit blight to the resulting bean crop. All Michigan bean varieties are susceptible to common and fuscous bacterial blights.

Common and fuscous bacterial blight shows its first symptoms as brown necrotic lesions at the leaf margin surrounded by a bright yellow zone. The lesions enlarge rapidly under ideal conditions to cover most of the leaf, giving the plants a "burned" appearance. Pod lesions appear as small, brown "scabby" spots (Figures 1-2).

Ordinarily, the disease begins early in the development of the plant, but to the untrained individual, it does not appear until the time of blossom. Spread is then very rapid, especially in warm, humid weather.

Internal seed infection occurs at the time the pods become infected, and such seed may then serve as sources of infection the following season (Figure 7).

Halo bacterial blight, on the other hand, is a cool-temperature disease. In Michigan, only the colored bean types such as red kidney, cranberry, and yelloweye are susceptible. This disease appears early in the field and remains active throughout the growing season. The characteristic symptoms (Figures 3-6) of plant infection include prominent greenish-yellow zones or halos surrounding infection centers on the leaves. In later stages of disease development, a systemic chlorosis (yellowing) of the entire plant occurs. Pod infections develop rapidly under ideal conditions, causing circular dark green "greasy" lesions to appear. Such lesions often have glistening bacterial ooze on their surfaces. Bacteria may then invade the developing seeds. If contaminated seeds are planted, they produce infected seedlings that serve as sources of contamination of the field. Although the application of copper-containing sprays effectively reduces the spread of halo blight in the field, the sprays do not prevent the initial establishment of the disease that is the result of infected seed. For this reason, only blight-free seed should be planted.

Certified Seed

Only two sources will assure Michigan bean producers maximum freedom from bacterial blight: (1) seed grown and certified in the semiarid regions of the West where

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conditions are unfavorable to the survival of blight bacteria; and (2) Michigan certified seed only two generations removed from the breeder's blight-free seed fields in the Western states.

Because of cost and the large quantity needed, certified seed has to be grown in Michigan. In order to qualify for certification, seed must pass the rigid standards established by the Michigan Crop Improvement Association. These standards are incorporated into the regulations of the Michigan Department of Agriculture. In 1969, approximately 30 percent of Michigan bean acreage was planted with certified seed.

Principles of Certification

Without a well-developed, coordinated seed program, bacterial blight cannot be kept under control in Michigan.

Thus, the certified Navy bean seed program in Michigan starts from *Breeder Seed* grown in some dry, blight-free areas of the USA.

Breeder seed is planted for *Foundation Seed* production in the northern Lower Peninsula of Michigan, a region removed from the commercial bean growing areas. Foundation fields are thoroughly inspected several times for the presence of blight and other seed-borne diseases, and for varietal purity.

Foundation seed is sold the following year to *Certified Seed* producers throughout Michigan. Prior to harvest, all prospective seed fields are inspected by representatives of the Michigan Crop Improvement Association. Following successful field inspection, samples of cleaned seed are examined in the Crop Improvement Laboratory to assure that the seed meets all other certification requirements. During this laboratory inspection, additional tests are performed on seedlots where bacterial blight is suspected.

A similar program is used for the production of certified colored bean seed. However, only colored bean seed fields north of an east-west line running through Clare County are eligible for certification.

Other Seed Sources

Non-certified seed—This seed may be of high quality, as to freedom from disease and other quality aspects. If the origin and history of the non-certified seed is positively identified, and if current laboratory tests indicate good seed quality, such seed should represent a low risk. Otherwise, the seed should not be planted.

A recent drill box survey of Navy bean seed indicated that 45 to 50 percent of all uncertified seed planted in Michigan is one year removed from certification. About one-third of this seed was purchased from local elevators. Most of it is not field inspected, hence, meets only the disease or seed standards required by the merchandiser. Since neither genetic identity nor freedom from disease of the *year-from-certified* seed can generally be assured, it does represent a risk to the prospective seed buyer.

Verified seed—Other non-certified seed is sold as verified seed. Some seed merchandisers use this term to designate a class of seed one year from certified, and inspected by one of their own employees in the field and laboratory.

Home-grown seed—About one-third of all bean seed planted in Michigan is home-grown. Many growers plant some certified seed every year so they will have enough to plant their main crop the following year. In other words, they are producing their own year-from-certified seed. This is a sound practice only if the growers are able to recognize the presence of bacterial blight and other seed-borne diseases. Most growers cannot recognize it, and the extensive use of home-grown seed has been a major factor in the buildup of bean bacterial blight in Michigan. A similar situation existed prior to the introduction of the bush-type Navy beans and before the Western seed program was initiated.

Selecting Blight-Free Seed

You can substantially reduce the risk of planting blighted seed if you follow three simple, but effective practices:

1. **Purchase certified seed**—A list of growers is available from the Michigan Crop Improvement Association, MSU, East Lansing, Michigan 48823.

2. **Know the history of your seed**—If certified seed is not available, then buy seed from your neighbor, local elevator, or use your own seed. However, be sure that the seed came from bacterial blight-free fields. Do not buy seed from fields known to have contained blight.

3. **Test your seed lots for blight contamination**—At the MSU Plant Disease Diagnostic Laboratory it is now possible to test seed samples. Approximately 5 pounds of bean seed is needed for this test. Your county agent can give you the details of cost, and tell you where to send the sample.

NOTE: This test is for detecting the presence of bacterial blight organisms inside the seed. Tests on the 1969 seed crop showed over 80 percent had bacterial blight organisms on the outside. So all seed should be chemically treated as explained below.

Seed Treatment

Seed treatment materials for controlling bacterial blight-producing organisms on the surface of seed, are relatively inexpensive and easy to apply. A water solution containing a bactericide should be used to prepare a standard seed treatment slurry containing fungicide and insecticide.

Since chemical seed treatment recommendations for disease control are subject to frequent change, they have been omitted in this paper. Contact your county agent for the latest recommendations.

Figures 1 - 7. Bacterial blight symptoms. (1) Common or fuscous blight-infected Navy bean plant. (2) Common or fuscous blight on leaves and pods. (3) Bacterial blight-infected pods. (4) Halo blight-infected leaves. (5) Halo blight-infected red kidney bean plant. (6) Dark red kidney bean seeds: left — healthy; right — infected. (7) Common or fuscous blight-infected Navy bean seed: left — infected; right — healthy.

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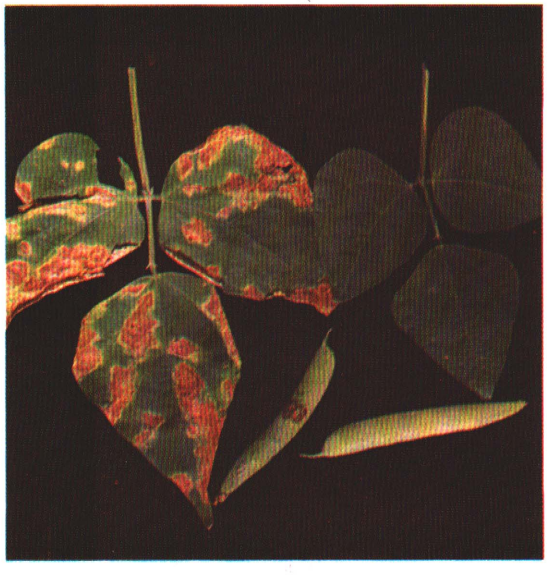

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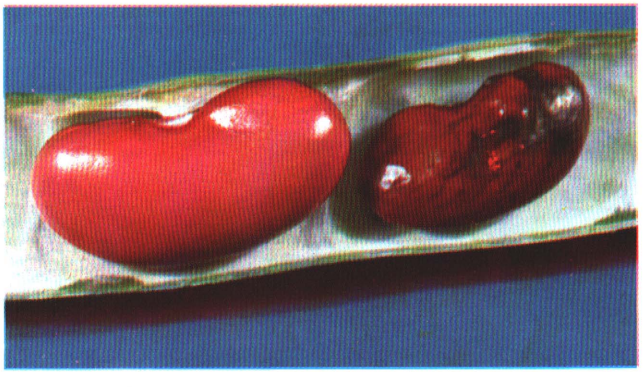

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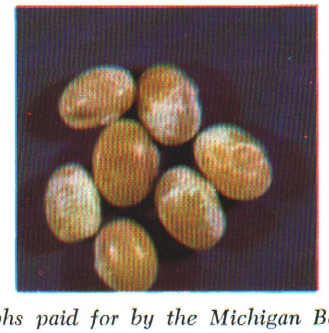

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Management Practices To Eliminate and/or Prevent Bacterial Blight

You can grow bacterial blight-free field beans by following all of 11 recommended farming practices. Elimination of any one recommendation increases the chances of bacterial blight in the field. See producers should pay particular attention to the following recommendations:

1. Plant High-Quality Disease-Free Seed

Use only the best quality seed, free of internal bacterial blight infection.

2. Treat Seed with a Bactericide

Chemically treat all bean seed prior to planting with a slurry containing a *bactericide*, a *fungicide*, and an *insecticide*. Ask your county agent for the most recent recommendations. This combination of chemicals should protect the plant from infection by blight-causing bacteria present on the surface of the bean, prevent seed decay and damping-off, and protect seed and seedlings from the seed corn maggot. Do not use treated seed for food or feed.

3. Do Not Plant Beans After Beans

Practice a 2- to 3- year crop rotation, not only to protect the seed from blight organisims that have been known to survive in the soil for 18 months or more, but also to protect the plant from other disease-producing organisms that build up in the soil when beans follow beans too closely in the rotation.

4. Plow Down All Bean Refuse After Harvest

Fields with infected bean straw should be deep-plowed as soon as possible after harvest to prevent contaminated plant leaf tissue and straw from being carried by high winds and water to other parts of the farm where beans may be planted the following year. This practice is especially important if a 2- to 3-year crop rotation cannot be followed. Fields subject to wind and water erosion should be planted with a cover crop before winter.

5. Sanitize Seed Equipment and Storage Facilities

If bacterial blight was a problem the year before, disinfect planting, cultivating, and harvesting equipment and storage facilities. Use a bactericide such as Oxine (chlorine dioxide at 1,000 ppm). The disinfectant can be applied with a sprayer or hand-fogging equipment. Also disinfect cultivating and harvesting equipment used in a blighted field before going into a non-blighted field.

6. Prevent Field Infection by Isolation

Beans grown for seed should not be planted adjacent to neighboring commercial bean fields because blight can be spread from the adjacent field by wind, water, man, or animals. Nor should they be grown where water runoff from last year's contaminated bean field can contaminate the new (unused) field. Because westerly winds prevail in Michigan, greater separation should be made to the west side of fields. The more isolated the field, the greater the chances of avoiding this infection. By all means avoid unnecessary traffic in bean fields.

7. Use Good Herbicides to Control Weeds

Weed-free fields permit better aeration around the plants so that they dry off more quickly. The shorter the exposure to continued wetness, the shorter the blight infection periods and consequently the less the infection in plants.

8. Be Alert — Detect and Eliminate Early Infection

Seed producers, especially, should be aware that (1) it is absolutely necessary to detect blight early, and (2) the infected plants (and those plants in the 4 or 5 rows immediately surrounding the infection center) must be eliminated. The plants should be sprayed with a blue vitriol (copper sulphate) solution (1 lb. to 3 gals. water). It may be necessary to pull and burn the plants.

9. Plant Beans In Smaller Parcels

Seed growers should plant four 10-acre fields separated by divider strips of corn or a grain crop rather than one 40-acre field. If blight appears in one field, it can be more effectively contained, and spread can be prevented.

10. Stay Out of Fields As Much As Possible

Never work in fields while the plants are wet with dew or rain, since bacteria spread and infection takes place easiest under these conditions. Furthermore, every time you enter a field, there is a chance of contamination by animals, humans, or equipment.

11. Copper Spray for Halo Blight Only

A chemical spray program should not be necessary if the preceding recommendations are followed. Only in the case of halo bacterial blight is there evidence that a copper spray will help prevent the spread of blight. We do not have sufficient evidence to recommend spraying for control of common and fuscous blight on beans.

All agricultural chemicals recommended for use in this bulletin have been registered by the U.S. Department of Agriculture. They should be applied in accordance with the directions on the manufacturer's label as registered under the Federal Insecticide, Fungicide, and Rodenticide Act.

Mention of a trademark or proprietary product does not constitute a guarantee or warranty of the product by MSU and the USDA and does not imply approval to the exclusion of other products that may also be suitable.

Issued in furtherance of cooperative extension work in agriculture and home economics, acts of May 8, and June 30, 1914, in cooperation with the U. S. Department of Agriculture. George S. McIntyre, Director, Cooperative Extension Service, Michigan State University, E. Lansing, Mich.

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