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CONTROL OF BEAN RUST

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A disease known as "bean rust" has developed in certain bean-growing areas of Oregon to the extent that it is limiting production. This is especially true in some areas where the Blue Lake variety of snap beans is grown for canning purposes. The distribution and severity of the disease seems to be increasing from year to year. The purpose of this circular is to give suggestions on control and cultural practices which should help prevent serious losses.

Nature of the Disease

Bean rust is caused by a fungus parasite^{1/} which has several stages of development on the bean plant. Since each stage plays an important role in the control program, a brief discussion of each is given below.

Early White Blister Stage (first infection). Early in June when the bean plants are only a few inches high, white, glistening blisters appear on the upper side of the leaf. Within two to three weeks the lower side of this blister turns white and begins to shed a white powder. This white powder consists of thousands of spores or tiny seeds of the parasite, which are scattered to other leaves where they begin to grow and penetrate the leaf, living on the sap and food materials of the plant.

Brown or Rust Stage (rapid summer spread). During the first part of July the parasite, which has been growing and developing inside the leaf, grows to the surface and breaks out as a brown spot or pustule. This soon begins to shed the brown or rust-colored dust, which is again composed of thousands of tiny spores that are carried about by the wind and eventually settle on the bean leaves. These spores begin to grow and develop in the same manner as the white spores and soon produce another crop of rust-colored spores. This stage reproduces itself about every two to three weeks and is the chief method of extensive spread and development of the rust during the summer months. For each rust spot on the leaf there is a vast network of the parasite inside the leaf living on the food that was produced to form the flowers and pods. When this development becomes too extensive, there is no food for the plant to develop its flowers and pods, and they wither and die.

Black Stage (winter or resting stage). Late in August or early in September the rust-colored spots on the leaves begin to change to a black color. This is due to the formation of another type of spore which is a thick-walled resting spore capable of withstanding the unfavorable winter conditions and then becoming active

^{1/} Uromyces appendiculatus

again in the spring. This spore falls to the ground or remains on the old plant refuse, or on the stakes, wire, end posts and other equipment used about the bean fields. Many of these spores are destroyed by the normal cultural practices, but some survive and are ready to start the new infections the next year. These spores remain dormant until about the time the bean plants begin to grow; then they begin to grow and produce secondary spores that fall on the leaves of the young plant and the white blister stage develops from these infections.

The Problem of Controlling Bean Rust

Two possible methods of controlling bean rust are: (1) Prevent the fungus from carrying over from one season to the next; (2) Keep the bean plant covered with some fungicide so that infection cannot take place. At the present time it would seem that a combination of the two methods would have the best chance to give satisfactory control.

Preventing the Rust from Overwintering. While it would be impossible to destroy all the spores of the fungus so that the disease could not get started, certain practices should be followed to reduce this spore carry-over to a minimum. This can best be accomplished by observing the following points:

(1) Prevent Formation of Resting Spores. Since the dormant spore or resting stage is not produced until late in the season, the majority being formed after the last picking of beans is made, the green vines should be torn down and the ground disked as soon as the last picking is made. It might be advisable for companies contracting beans in localities where rust is serious to make this a compulsory practice among their growers. If it were not for the fertilizer value of the vines, it would be advisable to burn rusted vines so as to destroy all the spores on them.

(2) The Use of Wire in Preference to Stakes. It has been noted that staked fields often have more rust early in the season than beans trained on wire. Likewise, fields staked with old poles from rusted fields the previous season have much more rust than portions of the same field where new stakes were used. Microscopic examinations of dust from these old stakes show many of the dormant rust spores still clinging to them when they were placed in the field the following season.

(3) Treating Posts and Stakes. Stakes, end posts and wire should be treated with some strong fungicide before they are used each year. Although no tests have been completed so that a definite fungicide can be recommended at this time, it is suggested that a dormant lime sulfur 12-100 might be tried for this purpose. The stakes and other materials should be thoroughly wet and soaked for a few minutes in the solution.

Dusting to Prevent Infection and Subsequent Spread. The use of sulfur dust for the control of bean rust has come into practice in some localities in Oregon during the past few years, and the results obtained from this dust have been variable. During the seasons of 1942 and 1943, observations were made in several different bean fields where the growers had used sulfur dust. From these observations it was concluded that the following points should be observed to get the best results from the use of sulfur:

(1) Time of Applications. Very few of these growers followed a definite dusting schedule. The tendency is to wait until rust becomes serious before starting to dust. The growers who followed this method did not get as good control with sulfur as those growers who started when the beans were a few inches high and continued to dust at one-week intervals regardless of whether they could see the rust or not. Three different growers, who had fields of beans in which there was considerable rust in 1942, started dusting with sulfur when the plants were a few inches high and continued to make weekly applications for 5 to 7 weeks. Very little rust occurred even by the time of the last picking in these three fields in 1943, although the year before these fields had more rust than any other fields in Oregon. Apparently the critical time for applying the sulfur is early in the season to prevent the white spore stage. At this time the plant needs protection only from an occasional spore, but once the brown stage has started, the plant needs constant protection against thousands of spores.

(2) Number of Applications. The minimum number of applications of dust necessary to give satisfactory control has not been determined. If the beans were dusted once a week from the time they were a few inches tall until the small pods begin to form, 7 to 8 applications would be needed. If any of these are to be omitted, it would be better to apply the dust regularly for the first few weeks to delay the formation of the rapidly spreading brown stage as long as possible. The interval between dusts should not be much longer than 7 days, since the bean plant produces considerable new growth in 7 days' time.

(3) Amount of Sulfur Needed. The first applications of dust should take about 20 pounds per acre, while the last few dusts may take as much as 50 pounds per acre. This would take 300-350 pounds per acre for the season. At present prices, \$15 to \$20 per acre would be a fair estimate for cost of materials. It readily can be seen that it would not take much of an increase in yield to pay for this dust.

(4) Type of Sulfur. As only one type of sulfur is being used to any extent for the control of bean rust in the fields observed, we have no way of comparing the different types as to effectiveness. A commercial product sold under the trade name of Kolodust has been used almost exclusively for bean rust in Oregon. This or similarly prepared sulfur dust should be used until other types of sulfur have been found to be as effective. These types of sulfur are very fine and cling to the leaf hairs and settle in the leaf depressions so that even if it rains soon after the dust is applied, a considerable amount of the sulfur will still remain on the plant and protect it from rust infection. It is during these wet rainy periods, or periods of heavy dew, that the rust spores begin to grow and cause infection unless the plant is protected by the sulfur.

S U M M A R Y

The following points should be remembered in controlling bean rust:

- (1) Destroy Living Vines. Cut down and disk in bean plants as soon as the last picking is made, to destroy and prevent excessive formation of the dormant spores. In some cases where the vines are not needed for their fertilizer value, they should be burned.
- (2) Use Wire in Preference to Stakes. As rust spores cling to the wooden stakes and are carried over from one season to the next and from one field to another field, it is preferable to use wire whenever possible.
- (3) Treat Stakes to Kill Spores. Stakes, end posts, wire, pipes and other materials from diseased fields should be treated with some fungicide to kill spores. Dormant lime-sulfur 12-100 is suggested for this purpose.
- (4) Dust with Sulfur. Start dusting with a good type of sulfur as soon as the first leaves begin to form. Continue dusting at one-week intervals until a normal crop is insured. Five to seven applications may be necessary.
- (5) Precautions. Since some canneries have experienced difficulty in canning products bearing sulfur it is not advisable to dust beans after any pods have formed. Therefore the last dust should be applied about the time the first blossoms appear.