

" FOLIAR FUNGICIDES FOR IMPROVING SEED QUALITY"

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The biggest problem soybean producers of the Gulf Coast region encounter is the lack of high quality seed. My definition of seed quality includes six items. They are as follows:

1. Varietal Purity
2. Germination and Vigor
3. Mechanical Purity and Inert Matter
4. Weed Seed
5. Other Crops Seed
6. Uniformity of Size

Most plant pathologists are primarily concerned with germination and seedling vigor. There are three primary factors that affect germination and seedling vigor. The first is pathological. This includes fungi, bacteria, and viruses. Pathological organisms attack soybeans during the growing season and infest the seed. They can be carried either externally or internally. The second factor affecting germination and vigor is physiological conditioning. This includes seed moisture, drying and storage temperatures, etc. The third is mechanical handling, including harvesting, but also includes storage and processing.

The primary reason that I, as a plant pathologist, became concerned in the seed quality problem was the result of a request to investigate a problem that occurred in a farmer's field. A sack of one seed lot was dumped into two hoppers of a six row planter. The farmer put seed of a different lot into the other four hoppers and planted them. The seed germinated and from one seed lot he averaged eight plants per foot and from the second seed lot he averaged only three plants per foot. This was extremely dramatic when seen under a field situation. The farmer got upset about it, called us and we examined the plants and the remaining seed and found that plants produced by seed from the poor quality lot were heavily infected with seedling diseases. Upon running germination tests we found that the good seed lot germinated 87%, the poor seed lot germinated less than 40%. In this particular instance, a law suit ensued and the seed company paid damages.

We are concerned with four specific diseases in the south. These include cercospora (purple seed stain), downy mildew, diaporthe pod and stem blight, and anthracnose. All four of these diseases are carried on the seed and affect seedling quality the following year. To solve our problem we made detailed observations of many commercial plantings and reviewed the research conducted in several other states.

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University of Florida researchers had found that when harvest was delayed approximately one week, germination of the soybeans fell from 90% to 70% with some varieties. They also reported that soybeans had a 50% greater infection with fungal organisms when harvest was delayed and that yield and grade decreased as disease level increased.

We know from our basic plant pathology that several things are required for a disease to become established. There has to be a susceptible host, a parasitic organism, and correct weather conditions. Therefore, to solve our problem we initiated several demonstrations. These included application of pre-planting seed treatment fungicides, hopper-box fungicides, foliar fungicides and untreated plots to rate the various diseases. With the pre-planting seed treatment fungicides we encountered difficulty because the fungicides used to treat the seed were detrimental to the nodulating bacteria. Hopper-box fungicides worked a little better. When we harvested the plots treated with foliar fungicides we found that not only did we increase seed quality but we increased yield, considerably.

For example, at one location in 1971 we found that application of 'Benlate' as recommended by the formulator increased yields by 15 bushels per acre. We also found that germination increased as much as 30% above the seed harvested from the untreated plots. These dramatic results stirred our interest in foliar fungicides and we began looking at numerous materials for control of soybean diseases. In demonstration tests conducted since 1971, we have increased soybean yields an average of six bushels per acre per year by application of foliar fungicides. We also found that we consistently increased quality.

Additional research was initiated by researchers in many other states. For example, Dr. Norman Horn in Louisiana found that when diseases were present in the field, he increased the yield of 'Bragg' soybeans from 36 to 48 bushels per acre. He also reported increases in germination from 15 to 30% above that of the untreated check plots. A research pathologist at Beaumont, Texas found that seed from nontreated plots averaged 80 poor quality seed in 100 grams of seed. Whereas, plants treated with a foliar fungicide averaged only 45 poor quality seed in 100 grams of seed. Foliar fungicides reduced infection by fungi up to 50%. In this Texas test the control plots had 18.81 seed per 100 grams infected with cercospora (purple seed stain) but the seed from the foliar fungicide treated plots had 0.69 infected seed per 100 grams.

During the past several years we have applied foliar fungicides aerially to demonstrations in many different locations in Texas. Our yields averaged six bushels per acre increase when 'Benlate' was applied at one-half pound per acre. Other fungicides such as 'Mertect', 'Bravo' and 'Du-Ter' also increased yields. Dr. Barry Jacobsen, University of Illinois, had ten large aerial application plots during 1975. He found that with 'Benlate' applied at one-half pound per acre at early pod set and again 14 to 21 days later, yields increased up to 10 bushels per acre. However, Illinois this past year received an above normal amount of rainfall. Dr Jacobsen is of the opinion that it would pay all seed producers in the state of Illinois to treat with a foliar fungicide to

increase seed quality.

The use of foliar fungicides brought several facts to light. When a foliar fungicide is applied to a soybean plant the plant retains its leaves from seven to ten days longer. Several researchers believed that foliar fungicides delayed maturity. Others were of the opinion that the fungicide allowed the beans to mature at their normal rate. It was found that untreated soybean plants were defoliated prematurely by cercospora organisms and the use of a fungicide suppressed these organisms allowing the soybeans to retain their leaves and mature at a normal rate of growth.

University of Maryland researchers have shown that when soybeans defoliate prematurely due to diseases, yields are decreased. The most important stage of growth for soybeans is the last two weeks before maturity. This the time beans obtain their full size. The use of foliar fungicides delays leaf senescence up to one week thus allowing the beans to mature at a normal rate and produce maximum yields.

In Texas our recommendations are as follows: Apply one-half pound of 'Benlate'/A during each of two applications. The first application should be made at early pod set. Early pod set is defined as, "that stage of growth when approximately 60% of the pods have been set on the plant." At this time the pods are from one-eighth to one inch long but will not have begun filling. There will also be some flowers on the plant. The second application should be applied fourteen to twenty-one days after the first application.

We have found that the method of application of the fungicide to soybeans is critical. Because soybean plants are too big to effectively use ground equipment for spray application, aerial applications are suggested. Since aerial application of fungicide is relatively new, work on application of fungicide to crops was necessary. It was found that the height of the plane during application had to be no more than five to eight feet above the crop to obtain proper penetration of the plant canopy. Also, a minimum of five to seven and one-half gallons of water per acre should be used to obtain proper coverage. Keep in mind that when diseases were not a problem foliar fungicides did not increase yields, however, where there was a severe disease problem yields were increased considerably by the application of foliar fungicides.

In conclusion, let's review some germination test data. During 1974, thirty-eight fields of soybeans in Arkansas were treated with 'Benlate'. Fields treated with split applications of one-half pound of Benlate each averaged 89.63% germination. Check fields averaged 80.13% germination, an increase of 9.5% germination. A summary of data from all states reporting during 1974 reveals that forty-four large plots were treated with 'Benlate' and the seed averaged 88.64% germination. Seed from the check plots averaged 79.27% germination, an increase of nearly 10%.

Finally, I suggest that you as a seed producer treat a portion of

your fields as previously indicated and leave a portion untreated. Harvest both portions separately, determine yields, quality and germination of the seed. I think you can prove for yourself whether a fungicide is worth the effort.

The use of foliar fungicides during the growing season is a common practice. It is usually applied to a crop at a certain stage of its growth. The most common time for application is just before or just after the crop has emerged from the soil. The purpose of the application is to protect the crop from fungal diseases that may be present in the soil or on the plant itself. The use of foliar fungicides is also common in the case of certain diseases that are not soil-borne. The use of foliar fungicides is also common in the case of certain diseases that are not soil-borne.

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In fact, our recommendations are as follows: Apply one-half pound of fungicide during each of two applications. The first application should be made at early bud set. Fungicide should be applied at the stage of growth when approximately 50% of the pods have been set on the plant. At this time the pods are firm and slightly so on one side but will not have begun filling. There will also be some flowers on the plant. The second application should be applied between 10 and 15 days after the first application.

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In conclusion, this review has indicated that during 1955, fungicide-treated fields in soybean production were treated with fungicide. Fungicide-treated fields with foliar application of one-half pound of fungicide per acre during the growing season. A variety of other fungicides were also used. The use of foliar fungicides is also common in the case of certain diseases that are not soil-borne.

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