IT TAKES MORE THAN TENDER LOVING CARE TO PREVENT BLACKSPOT (BRUISING) IN POTATOES

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To the average spud grower, the term "blackspot" sounds strange. He's heard of blackleg and blackheart, but now potato growers have two new words to add to their vocabulary -- BLACKSPOT -- and its closely related cohort -- STIB. These are related like brothers. You might say the father potato industry has two wayward sons, STIB and blackspot. In the past two years these two problem boys have cost the old man five million dollars.

WHAT IS BLACKSPOT?

It's very simple -- blackspot is just another word for potato bruise. It can also refer collectively to all the bruises on a single tuber, all the bruises in a sack, in a field, in a cellar, in a carload, etc.

STIB is a word coined by Dr. R. Kunkel to mean "Susceptibility to Internal Bruising." This means that some lots of potatoes are more susceptible to bruising blows than others.

Potato buyers are well aware of this fact. From costly experience they have learned that some potato lots are relatively free of blackspot -- while other spud lots may be seriously affected.

Potato processing plant managers have taken their lumps, too, when they get into a "bad lot" of potatoes. They have a motto which says -- "The finished product is no better than the raw product we start with" -- and they stand by it. So when the finished product is "out of grade" there are a lot of people in the plant who want to know why! The answer can usually be supplied by the head of the field department who keeps a record of the management practices of his contract growers. Through his fieldmen he is influential in regulating the date of the last irrigation -- a factor that determines mightily whether potatoes are STIB or not STIB.

SO WHY CHANGE?

If blackspot is merely a synonym, why change? In Idaho, growers seem to have been treating the symptom rather than the cause. Let's take a closer look at this problem.

Processors can't use that portion of the tuber affected by blackspot. They

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have to hire women on the trim table to trim, pare, peel or speck each tuber. This cuts the processor two ways. First, it costs extra money to hire labor. Second, for French fries, it makes too many "short cuts" which sell at a lower price, and it also lowers the number of pounds of finished product per 100 pounds of raw product processed. This drops the operating efficiency of the plant.

IT ALSO HURTS THE POTATO GROWER!

Blackspot causes internal discoloration just under the skin of the potato. This is scored against the farmer by state and federal inspectors when they grade his product for the fresh market or when under contract to processors. Therefore blackspot may increase the "tare factor" and could reduce a grower's take-home pay.

HISTORY OF POTATO BRUISING

Bruising, or blackspot, in potatoes was cited as an agricultural problem as early as 1912 when the first known report was published in England. Since then blackspot has been reported from all major potato growing areas in the world.

WHAT CAUSES BLACKSPOT?

The basics of the problem involve the plumbing system of the entire potato plant and whether or not the roots can supply water fast enough to prevent tuber dehydration. Let's take a look at some basic plant physiology. (Fig. 1).

A plant on a functional basis has roots for water pumps. The tubers are food and water storages (75-83% water) and the stems are conveyor systems intimately connected with all plant parts. The leaves are manufacturing centers equipped with evaporators.

When the water pumps cannot obtain enough water from the soil, the manufacturing plant draws water from its tuber storage. Thus the tubers attached to growing plants can become slightly or partially dehydrated. The idea of tuber dehydration is logical, but has it been proved? Yes. Laboratory balances were set up in a potato field. Tubers were actually weighed while still attached to the growing plant.

This research showed that potato tubers gain weight in staggered steps -- two forward and one backward. Growing tubers will dehydrate if the plant wilts in the heat of the day due to lack of moisture. Irrigation will rehydrate the tubers again.

BLACKSPOT CAN "BEGIN" RIGHT ON THE VINE

Potato tubers can become STIB while attached to a green growing vine if the volume of water leaving the plant exceeds the amount of water

entering the plant.

The University of Idaho recommends that Eastern Idaho growers stop irrigating the last week in August and in Western Idaho, the first week in September. This is based on the average use of irrigation water as shown by the university's water curves for consumptive use of water by spuds and established in connection with the average mean temperature at Aberdeen, Idaho.

If weather conditions are average, the recommendation is good. But if the growing season is unusually long, the recommendation could be detrimental in terms of blackspot.

Suppose there is a long warm fall with no frost and the farmer leaves the vines on to get maximum yield. If he stops irrigating early "to set the skins," and especially if he is on sandy soil, these potatoes will become STIB. Under these conditions, this one factor -- date of last irrigation -- will nearly always explain why one lot of potatoes will show more bruises or blackspot than another.

IF POTATOES ARE STIB, CAN A GROWER USE ENOUGH TENDER LOVING CARE AT HARVEST TIME TO PREVENT BLACKSPOT?

Potato growers in Idaho have been wisely advised to "slow your digger chain down to 1-1/2 miles an hour" and handle potatoes gently.

Even though "tender loving care" is used at harvest time, potatoes that are STIB will probably develop blackspot or bruises simply due to standard harvesting procedures. Yet farmers will be judged guilty of mishandling their spud crop. You've heard the comment, "A farmer will spend four months to grow the crop and ruin it in four hours." But wait a minute! Think back. Isn't it true that in Idaho, when there has been an early frost, growers rarely have had a bad blackspot year? The past two seasons in Idaho prove that point. There was a long, warm fall both years. In 1966, the killing frost occurred around Oct. 12; in 1967, about Sept. 28. Both years were severe from the standpoint of bruising, and a study of the problem indicates this was because farmers stopped irrigating too soon and the ground dried out. The potatoes were STIB when they were dug.

The blackspot was so severe, in fact, that the Idaho Potato and Onion Commission appropriated funds for an advertising campaign to emphasize the need to handle spuds gently. It has done so again this year. This idea is good so far as it goes, but it places the blame only on rough handling, whereas current research indicates that the weatherman, together with the percentages of soil moisture, may be as guilty as the grower who harvests his crop too fast.

No one knows why a dehydrated tuber is more susceptible to forming

blackspot. It appears that during dehydration the cell walls become more likely to rupture and the enzyme "polyphenol oxydase" reacts with other materials. This results in the black pigment we call a bruise, or blackspot. On the other hand, fat, well-hydrated, turgid tubers may tend to split around the ends, but they are much more resistant to bruising or blackspot than their dehydrated counterparts.

BLACKSPOT MAY RESULT DURING STORAGE

Potato tubers may be resistant to bruising when first put into storage. If they lose moisture in storage, they will become STIB and will develop blackspot upon being handled out of storage. In New York, blackspot historically has been a serious storage problem rather than a field problem, because natural rainfall conditions at harvest time keep the ground from drying out.

Research work at Cornell University demonstrated that the storage blackspot problem could be eliminated commercially simply by adding humidity to the air used to cool the stored potatoes, thus preventing tuber shrinkage.

THERE ARE OTHER FACTORS WHICH INFLUENCE POTATO BLACKSPOT

1. Balanced nutrition, especially K_2O and N
2. Disease
3. Insects
4. Mechanical injury during handling
5. Handling out of storage when pulp temperature is below 45^{o}

These factors are of importance only to the degree in which they affect the turgor pressure of the tuber. For example, one of the effects of potash deficiency is that it causes the roots of the potatoes to sluff off and restricts the intake of water. In the Columbia Basin of Washington, where there is a great deal of potash deficiency, potato plants showing symptoms of K_2O deficiency can be pulled out of the ground easier than normal plants. It has been found that when adequate amounts of potash have been supplied to potassium-deficient potatoes, the amount of blackspot was reduced by 30 percent.

The same argument holds true for root rot diseases which affect the roots of potato plants. Diseases which affect the water-conducting tissues of a plant also can lead to blackspot. This means that if a farmer has a field of potatoes where a spot or area is suffering from Verticillium wilt, chances are good that potatoes coming from that area will be STIB.

SUMMARY

The Idaho potato industry calls it "bruising". The Washington potato industry calles it "blackspot." The two terms are synonymous. In an attempt to simplify matters, Dr. R. Kunkel in 1962 proposed calling blackspot "internal bruise" and coined the word STIB to mean "Susceptibility to Internal Bruising," because it would emphasize the basic cause of blackspot rather

than describe the after-effects.

The main thrust of this report is that healthy potatoes can become susceptible to blackspot the same as healthy people can become susceptible to a cold when they are exposed to certain conditions. A growing body of research indicates that potato plants should be kept alive and healthy until the frost kills the vine or until the vines are removed. This includes, among other things, supplying liquid nitrogen through the irrigation water during the growing season and application of potash at pre-planting or planting time.

It is also advised that growers keep the roots of their potato plants healthy and well supplied with water to prevent tuber dehydration, STIB and blackspot. Careful handling at all stages of harvesting, storage and marketing is also considered a must if growers and processors alike expect more money from the potato crop.

In summary then, anything which restricts the uptake of water through the roots of potato plants, be it lack of moisture, insects, disease, lack of fertilization, or mechanical injury, has been found to be responsible for making potato tubers STIB or susceptible to internal bruising.

(Information partially based on report entitled, "Factors Known to Affect Blackspot in Potatoes," by R. Kunkel, Sixth Annual Washington State Potato Conference.)

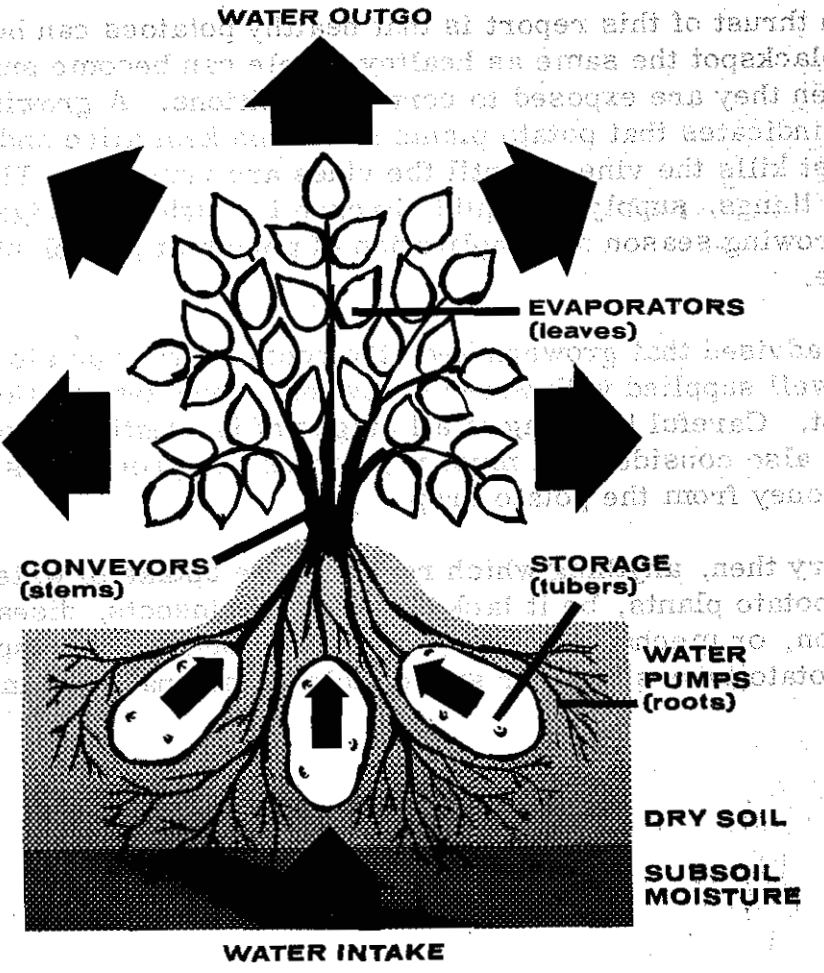

Figure 1 Basics of a potato plant's "plumbing system." In a STIB-prone plant, evaporation from leaves draws on water stored in tubers. In a STIB-resistant plant, evaporated moisture is balanced by moisture drawn from soil, but not from tubers.