

POTATO EYES



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CSS Farms: Frito-Lay's Supplier of the Year

Frito-Lay announced its 1997 "North American Potato Supplier of the Year" award winner this



Randy Spevak (left), and Milt Carter (right)

Spring. The selection is based on performance, cost, quality, and service, and on a mutual business philosophy. The supplier's impact on

the industry is considered. This award symbolizes credit for the winner's partnership with Frito-Lay. This award is given each year to the supplier who is the "best of the best" among Frito-Lay's North American potato suppliers.

And the winner this year is **Randy Spevak** and **Milt Carter** of **CSS Farms**.

Formed in 1986 in South Dakota when two family operations merged under Randy and Milt, starting with dry-land crops and a few hundred acres of irrigated potatoes. During 1993 and 1994, CSS Farms expanded into Nebraska starting at Kearney. Storage facilities were constructed there in 1995 to supply Frito-Lay's chip plant in Topeka, KS. Expansion has continued and CSS Farms now supplies raw chipping material to this plant from July to May. Meticulous attention to detail has significantly reduced defects; in 1996-97 storage season, total defects averaged 6.7%. More than ¾ of all storage loads met the 65 color, 8 defect measurement.

And, recently, CSS Farms has hosted a "Best Practice Seminar" so all suppliers could achieve improved performance.

Congratulations! Randy and Milt!

New Insects in Nebraska

FALSE CHINCH BUG

The FALSE CHINCH BUG (*Nysius raphanus*) and/or its damage to potato plants has now been seen across Nebraska including the Panhandle. It's current high populations this year is unusual.

Appearance — The false chinch bug adult is 1/8 inch and brownish-gray with silvery-gray wings. It congregates on the leaves where it sucks the sap. As many as 100 adults may be on a single leaf often crawling inside the curl. The adults crawl or fly to other plants after killing the plant top. The adults seem to be the primary concern on potatoes. The nymphs have a brownish-gray head and thorax with a light-tan longitudinal stripe and light tan abdomen with some tiny reddish spots. Nymphs are smaller than adults and are wingless.

Life Cycle — False chinch bugs overwinter as nymphs and adults under debris near winter annuals especially mustards which also act as hosts. Eggs are laid in loose soils or in soil cracks. They hatch in four (4) days. Nymphs feed for about three weeks and reach adulthood. Adults live for several weeks congregating on hosts. There are three or four generations per season with peak populations in July and early August. Crop hosts besides potatoes include small grains (1996 in wheat in Kansas), alfalfa (1983, Nebraska), etc. The bugs were recently seen damaging sugar beets in the Panhandle. Wild hosts include mustards, kochia, Russian thistle, and sagebrush. Heavy populations build up in these hosts.

Damage — Symptoms seen in fields look like wind burn to upper young leaves. The young top leaves first appear wilting and possibly slightly curled while the rest of the plant appears normal. These leaves rapidly turn brown along the edges and curl. This rapidly progresses with the leaves turning darker and curling tighter until they dry out and are dead. This can occur in a matter of a few days. Affected areas can be along field's edge, spots in the field, strips or swathes through the field and in weedy areas.

Habit & Treatment — Adults prefer cooler temperatures and are seen on leaves during late evening, 6-8 pm, and somewhat in the early morning. During daytime temperatures, they crawl on the ground under the canopy and are difficult to see because of their brown coloring against the ground. This suggests that the best application of a chemical treatment is by air in the evening. Little is known about chemical efficacy for control. However, the only product with this insect on the label is Thiodan. A number of Nebraska growers have given it high marks for its effectiveness. The EC formulation would be applied at 1 1/3 qt/acre, the highest rate for Col. potato beetle, aphids or leafhoppers. Dimethoate and Monitor have been reported effective as well. Pyrethroids were suggested in Colorado and work on (true) chinch bugs. A few growers reported poor to fair results.

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Alexander D. Pavlista

SAND CHAFER

On occasion over the years, white grub damage to potato tubers was reported in Nebraska and northeast Colorado. Causal identification was evasive. Recently, entomologists at UNL and CSU, have identified one of the causal insects, the sand chafer (*Strigoderma arboricola*).

Appearance — These insects have only one generation per year. Adults look similar to Japanese beetles, a relative. They're large, about a 3/8 inch long. Their bodies are black with rusty-red wing covers. The top seems a shiny black with a brassy or coppery reflection.

Life Cycle — They emerge from the soil as adults in June with a population peak in early-mid July. These bugs like decaying organic matter, e.g., manure. The adults live 11-31 days and may do a little foliar damage. They burrow into the ground and eggs are deposited singly in the soil. The egg stage is 11-25 days after which the larvae (white grubs) emerge and live in the soil five to ten months. It's the larval, white grub stage that is economically important by damaging tubers as they feed late in the season.

Treatment — Furadan (4F) is suggested to kill larvae as they hatch in the soil. This treatment will also be effective against adults. Provado is reported as excellent against larvae but plant-back restrictions exist. Pyrethroids were reported to be good.

Irrigation and Common Scab

There is still much discussion on the role of irrigation scheduling on the incidence of common scab on potato tubers. This past year, I've reviewed highlights from the scientific literature with grower groups in Montana and Texas. It's time to revisit this topic and present the conclusions.

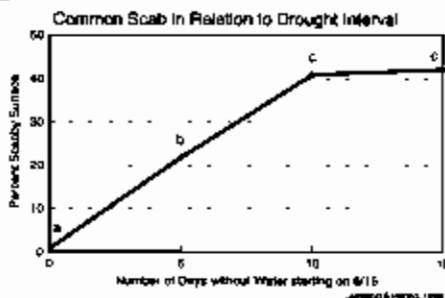
Infection — Common scab, *Streptomyces scabies*, infects lenticels or pores of growing potato tubers. Lenticels are found in the internodes, the area between bands of eyes. Eyes mark the nodes on the potato tuber. The scab forms as a wounding response to infection by common scab, a bacteria with some fungal properties. The susceptibility of the tuber and severity of the scab, surface to pitted, depends on the variety since there is a genetic resistance component in many varieties. Research reviewed here was conducted on Russet Burbank, Irish Cobbler, Majestic, Maris Piper, and Kufri Chandramukhi.

During the course of tuber diagnostics, many times tubers were observed with scab areas that matched drought periods and pictures of scabby tubers in these published research papers suggesting an irrigation scheduling problem.

Drought

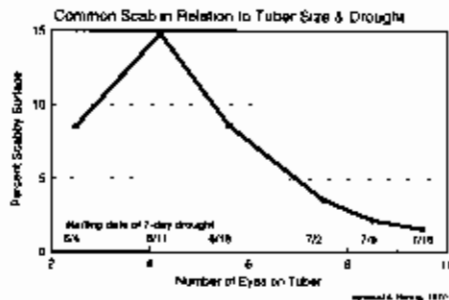
The amount of scab on a tuber's surface is directly related to the length of time that potatoes are deprived of irrigation. Figure 1 (modified from Lapwood & Hering, 1968) shows the percent of tuber surface with scab in relation to the length of a drought period beginning on June 15. With a drought period from 6/15 to 6/20, five days, the amount of scabby surface increased from zero to over 20% making tubers unmarketable. A 10-day drought period caused over 40% of the surface area to be scabby. (Dates are based on a 5/1 planting).

Figure 1



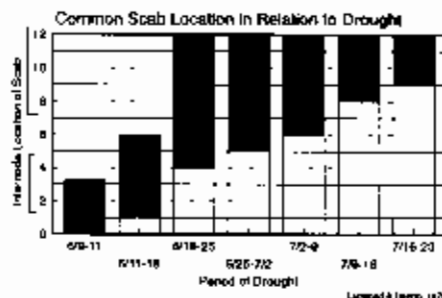
When a drought period starts also affects the amount of surface that's scabby. Figure 2 (modified from Lapwood & Hering, 1970) shows the effect of a 7-day drought period started on different days in June and July (based on a 4/30 planting). Drought periods started in June caused the largest amount of scabby surface on tubers. Only when the drought period started after tubers had more than 6 nodes (eye number) was the infected surface area less than 5%. Note later internodes are shorter than ones formed early in the tuber growth.

Figure 2



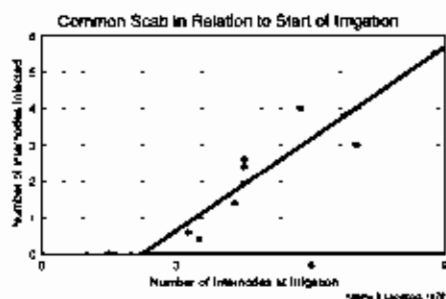
Early drought periods affect the first internodes while later periods affect the later-formed internodes. This is demonstrated in Figure 3 (also modified from Lapwood & Hering, 1970). It is key to note that earlier formed internodes (solid bracket) are longer than later ones (dashed bracket). This couldn't be depicted on the figure. Infection of the second to the fifth internode (stolon end) occupies most of the tuber surface while infection of the last five internodes (bud end) results in less than 15% of the tuber surface to be scabby. The amount of surface that's scabby is directly related to drought periods in relation to tuber growth and internode development.

Figure 3



If irrigation starts by the time the number of internodes on tubers is less than three, then there is little scab-infected area. But, if irrigation doesn't start until there are 4-5 internodes, then the first two internodes will be scabby (Figure 4, modified from Adams & Lapwood, 1978). If there are seven internodes present at the start on irrigation, then the first four internodes are scabby resulting in over half the tuber's surface area to be scabby.

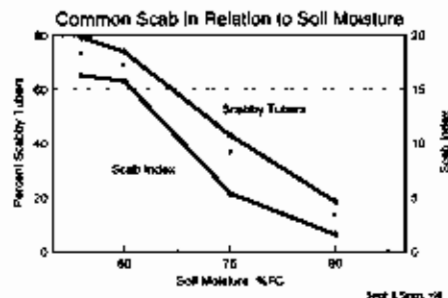
Figure 4



Soil Moisture

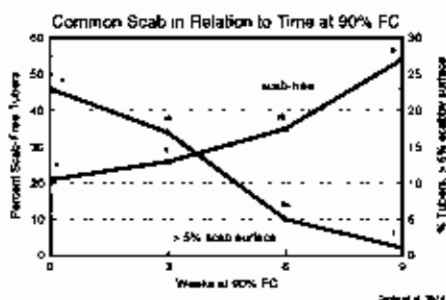
So the period of greatest scab damage in terms of surface area is during the early bulking period, around and shortly after flowering. How much soil moisture is needed to keep the number of scabby tubers and the degree of scab low? Looking at Figure 5 (modified from Singh & Singh, 1981), one can see that 90% field capacity is needed to decrease the percent of scabby tubers to below 20 and at least 75% to lower the scab index to 5. [Scab index is based on infected surface area and scab type, see Erickson, H.T. 1960. *Am. Potato J.* 37:18-22.]

Figure 5



How long does the soil moisture have to be at 90% field capacity to reduce scab? Figure 6 (modified from Davis et al. 1974) shows that a minimum of six weeks is required to reduce the number of tubers with less than 5% scabby surface to 5%, US grade A standard marketable level. To achieve more than half the Russet Burbank tubers to be scab-free, nine weeks at 90% field capacity was needed. Six weeks corresponds to the start of the tuber bulking period to past the mid-point.

Figure 6



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Lab to Label

Advanced Screening

This is the second part of this series on taking a compound from the laboratory to the crop. Advanced screening is commonly referred to as secondary and tertiary screening and are considered still part of Phase I Discovery.

Secondary Screen

About 100 to 300 compound per year are retested in the laboratory and greenhouse. These tests are designed to determine active rates and application timings, and determine the target pest and crop. Compound may be tested several times before going to the field for testing. Compounds that look promising are re-synthesized in slightly large quantities, 1 to 5 ounces.

Tertiary Screen

This is the first field screening of compounds. Of the compounds tested in the secondary screen, 10 to 50 compounds will undergo small scale field tests. These tests are conducted initially on company research farms and are conducted in small plots. Application timing and method, rates, and some structure/activity tests are conducted. Analogs of active compounds are synthesized and tested in the secondary screens for activity and patent purposes. All of these analogs are also tested in the mutagenicity test and active ones are further put through the eye irritation, dermal toxicity and oral toxicity tests. From the initial field test, a few compounds, less than 10, are sent for testing by a few University researchers around the country in small plot evaluations to confirm the company's research and to determine activity in a wider range of situation.

At this time, the selected compounds undergo formulation testing. Formulation testing looks at different carriers and physical properties of the compounds. University researchers get test compounds in a preliminary formulation, usually a liquid flowable (LF), emulsifiable concentrate (EC) or wettable powder (WP). This is quite different than the form in the primary and secondary screens in which the compound is unformulated and tested in a solvent such as acetone.

At the same time, environmental impact testing begins on compounds going into tertiary screening. The compound's persistence in different soils and breakdown by soil microbes are key tests. Its volatilization and solar effects are measured. How it is metabolized by both the target crops and pests are determined using radio labeled tagging. The method of uptake, for instance root or foliar, and percent penetration and translocation are determined.

Toxicological testing is expanded to determine speed and amount mice excrete the compound, urine and feces. The metabolic breakdown of the compound in mice is determined, and all metabolic products are identified. These are called the "7-day toxicology studies" and a problem here, such as the formation of a dangerous by-product in the mouse, would eliminate the compound and possibly the whole chemistry from further testing.

In summary Phase II testing involves field efficacy trials, preliminary formulation studies, environmental persistence determinations, plant and/or pest metabolism, and rodent excretion and metabolism.

Of the 10,000 compounds that are screened each year (Phase I), only one to five go into Phase II Development. This will be covered in the third part of this series.



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Irrigation and Common Scab Summary Highlights

1. Early-bulking, low soil moisture results in scab near the stolon end and a greater tuber surface area infected by scab.
2. Later-bulking, low soil moisture results in scab near the bud end and less surface area is affected by scab.
3. New internodes, the area in between eye bands, get scabby during low soil moisture periods.
4. On sandy soils, the critical period starts 2-3 weeks after tuber initiation. This corresponds to about row closure or early flowering for most varieties.
5. Every 5-day drought period corresponds to 2-4 internodes infected by scab.
6. The sensitivity of an internode to scab infection is its second week after formation.
7. Soil needs to be at 90% field capacity during early and mid bulking to effectively suppress common scab.

Data References:

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[A complete list of references is available.]

Check out the Nebraska Potato Eyes on the WWW at: <http://lanrwww.unl.edu/lanr/phrec/Peyes.htm>



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