PHREC 98-05b

NEBRASKA

POTATO EYES

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Updates

Late Blight

The Section 18 request has been approved and is in effect for Nebraska, Colorado and Wyoming. It is in the process for Kansas after a late start. The products approved are:

Acrobat MZ, dimethomorph mixed with mancozeb by Amer. Cyanamid, Curzate DF, unmixed cymoxanil by DuPont, Manex C8, cymoxanil mixed with mancozeb by Griffin, Tattoo C, propamocarb-OH mixed with chlorothalonil by AgrEvo.

Last year about 7,600 lb Acrobat MZ, 25,700 lb Curzate M8 (no longer available from DuPont), 6,400 lb Manex C8 (same active ingredients as Curzate M8), and 3,700 lb Tattoo C were used in Nebraska for late blight control.

Acrobat MZ and Manex C8 are expected to get full registration by next year. Quadris (5504), a new product for early and late blight control, by Zeneca may also receive full registration by then. Some potential products being studied are fluazinam, RH7281, and SuperTin pre-mixes.

SuperTin received a Section 24c in Nebraska extending the duration of its use. Its pre-harvest interval was reduced to seven days.

Vine Kill

Unfortunately, it seems Gramoxone Plus will not be available for the summer crop. Product with the 1997 label may still be legally used. Inferno, an organic copper by Griffin, may be available for desiccation in July or August. This material worked well, better than diquat, last year on fall cropped Atlantic. This year, it will be tested on summer and fall crop Russet Norkotah. Tests will also combine a copper hydroxide treatment for tuber late blight control.

Alexander D. Pavlista

Lab to Label

People in general have a poor concept of what it takes to bring an agricultural product to the farm. Many have misconceptions concerning toxicological and environmental testing, and government regulations and requirements. Only about one in 20,000 compounds pass testing from synthesis to field use. It undergoes some 120 separate toxicological and environmental tests, ensuring that the compound poses no health or environmental concerns when used properly. Product development, testing and approval by the EPA takes from eight to 10 years and costs about $50 million. This also leaves only about seven to nine years on the patent for the developer to recoup the costs.

Because of the importance for people to understand this process, this is the first part of a multi-part article on the general scheme for taking a compound out of a test tube to the crop. The article is based on my decade-long experience as a researcher in a chemical company and a brochure called "from Lab to Label" published by the American Crop Protection Association.

Phase I. Screening (Discovery)

Primary Screening - Small quantities, as little as an ounce, of a compound is synthesized. The compound may be a derivative of another compound, an analog, or a foray into a new chemical sequence, or a by-product of a methodology used for something else, commonly a fermentation by-product. (The latter is the reason why most large ag-chemical manufacturers are closely related to a pharmaceutical manufacturer, such as American Cyanamid and Lederle, Elanco and Eli Lilly, Bayer, just to name a few.) In a large ag-chemical company about 10,000 compounds are made each year; exact numbers are kept confidential.

These compounds are tested routinely in special laboratory and greenhouse tests developed by the company's researchers. They are tested in these mini-screens for activity. The protocols for these tests are kept under trade secrets and change according to market development and interest.

After this initial screening, 100 to 300 of the 10,000 show some interesting activity warranting further testing in the greenhouse or insectary, etc. At this point, the first toxicological tests kick in. The most important and immediate test is the Ames mutagenicity test. This laboratory test on bacteria looks to see if the compound can alter DNA, normally by base substitution, and results are back in a few days. If it does, it's finished and will never leave the lab. The only testing permitted is by company researchers under highly protective conditions in the lab. This limited testing may be done by the researcher for various reasons, usually to define structure-activity relationships and look for non-mutagenic analogs.

If the compound passes this test, it will undergo an eye irritation test with a rabbit. This is a mild test and used as a guide for applicators. If the compounds might be tested other than locally at the research and development center, it must go through both oral and dermal toxicity tests on mice. This will determine the compounds LD_{50} or what is the dose for 50% mouse mortality when the compound is ingested or in skin contact. If the LD_{50}s are acceptable, it is cleared for shipping in sealed packages.

The next part in this series will deal with the second half of Phase I, secondary and tertiary screening of compounds.

Inside this issue...

Russet Norkotah: Field Management Profile

Table 1. Summary of Characteristics and Defects

Growth Type	determinate, growth abruptly stops at flowering, hail sensitive with little to no re-growth
Maturity	early to medium
Emergence	rapid, sensitive to cold soil at planting
Dormancy	medium, 3-4 months
Eyes	many, well-distributed, shallow
Vine	small-medium, upright
Leaves	open, average-sized, medium green
Flowers	few, small and white
Tubers	oblong to long, well-shaped (most marketable quality)
Set	light to medium (8-12), high on hill, (greens easily with oversizing)
Yield	potential for over 400 cwt/acre, slightly better than Norgold Russet under good conditions.
Gravity	low to medium (1.070-80)
Sugars	medium (fry only out of field)
Storage	short-term, market by mid-March
Bruising	dehydrates in storage resulting in blackspot and pressure bruises
External Defects	none (# 1 strength for fresh market)
Internal Defects	occasional hollow heart (oversizing)
Disease Susceptibility	all common viruses, early dying, black dot, both blights, blackleg/ soft rot, dry rot, pink rot, leak, seedpiece decay, silver scurf
Disease Resistance	common scab
Insect Attractiveness	aphids
Weed Control	competes poorly with weeds, herbicide use needed
Herbicide Sensitivity	none, very resistant to metribuzin

Table 2. Yield and specific gravity range in Nebraska as reported by growers.

Nebraska Region	Yield cwt/acre	Specific Gravity
North-Central (fall crop)	350-475	1.075-80
South-Central (summer-fall crop)	250-400	1.075-80
Panhandle (fall crop)	250-450	1.070-75

Since its release in 1987 by North Dakota St. Univ., Russet Norkotah has replaced Norgold Russet in the fresh market. It has become the major russet potato variety now grown in Nebraska. With many growers requesting management information in the past year or so, it's time to review Rus. Norkotah's profile as recommended in Colorado, Idaho, Maine, and North Dakota.

Characteristics

Russet Norkotah is an early to medium maturing (95-110 days from planting), determinate potato variety. Some key management characteristics are: medium-sized upright vine resulting in about 85% row closure, poor drought tolerance due to a small root system, and tendency to oversize. It's very susceptible to blights and often to early dying. Care is needed to harvest under cool dry conditions because of its susceptibility to *Pythium* leak and *Erwinia* soft rot (and blackleg). Russet Norkotah is also susceptible to silver scurf.

Seed and Planting

Due to its tendency to oversize, Russet Norkotah should be planted 9 to 11 inches apart within rows. Plant six inches deep due to a high set. Cut seed pieces are preferred over single drops in order for the plant to have more stem. Avoid physiologically ageing seed. Don't warm seed at 60 F for more than two weeks before planting. Don't hold pre-cut seed for more than a month. Don't plant in cold soil, less than 50 F, or stem cankers, *Rhizoctonia*, develop resulting in poor roots and poor nutrient uptake.

Early planting does not increase yields but will allow early harvest with full yield potential. This makes Russet Norkotah a good summer crop. Also, this variety grows better in acidic soils than alkaline soils.

Toxic Seedpiece-Decay Syndrom

This is an unusual disorder that is observed in very few varieties. However, it is often seen in Russet Norkotah. A noticable wilting of the vine occurs just before tuberization about 3 weeks after emergence and is associated with the plant switching its nutrient flow from the seedpiece to the root system. The root system about this time has reached its maximum growth (12 inches root length) and the canopy is about midway (10 inches stem height) in its growth (Pavlista, 1995, UNL Cooperative Extension Circular 95-1249 "Potato Production Stages: Scheduling Key Practices").

Leaf margins in the upper canopy, the new leaves, dehydrate and turn brownish as if windburned. Brown streaks may be visible along the lower part of the stems. The seedpiece rots leaving a light-brown, jelly-like residue. The cause is not known but the syndrom occurs when early season weather conditions were wet and warm. Plants normally recover in two weeks from this. I have not found any data relating this to yield or quality loss in the crop and I have only seen this syndrom occur occasionally in the summer crop south of the North Platte River.

Fertilization

Russet Norkotah requires 20-30% less nitrogen than recommended for Russet Burbank. Colorado recommendations are 200-230 lb N/acre, 120-200 lb P/acre and 0-40 lb K/acre. Apply most nitrogen before tuber set (first flowering). Early pre-plant nitrogen should be above 100 lb N/acre to get maximum rapid growth, 110-140 lb N/acre is usually recommended. The remaining 75-100 lb may be applied through the sprinkler in 10-25 lb increments. High early-season application of nitrogen does not delay tuberization, but mid-season application can slow tuber bulking which normally is rapid. Russet Norkotah grows well after alfalfa and clover.

In most Nebraska soils, adding potassium is usually not recommended.

Petiole Nitrate-Nitrogen

Unlike most potato varieties, Russet Norkotah shows little, if any, yield response to split nitrogen application. When all nitrogen is added pre-plant, nitrate-N levels were 16-18,000 ppm at 55 days after planting (DAP) and dropped to about 6-8,000 ppm at tuber maturation (Figure 1). Higher nitrate-N levels were associated with yield decreases in Idaho. Russet Norkotah matures earlier than Shepody and requires less nitrogen uptake for best yield, grade and quality compared to Shepody (see NPE, April, 1996).

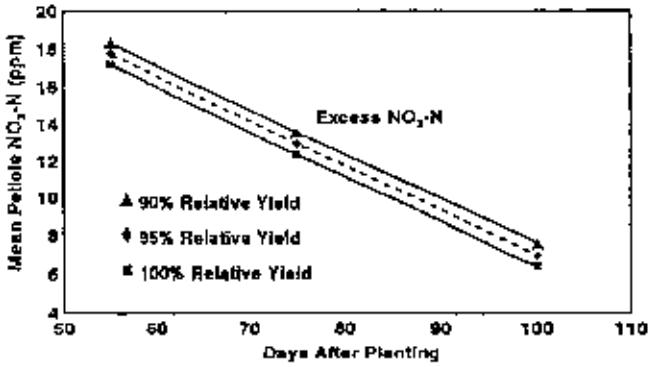

Figure 1. Petiole nitrate-N sufficiency nutrient range for Russet Norkotah preplant N, Idaho.

Irrigation

Since the rooting system is very shallow, about 12 inches deep, Russet Norkotah is sensitive to drought stress. The recommended irrigation interval at maximum ET early in the season is 2½ days. Early season drought stress must be avoided. On the other hand, because of its rapid tuber bulking and early senescence, over-watering during the later part of the season must be avoided. Late-season over-watering may result in leak, blackleg/soft rot and pink rot especially during warm day-time temperatures.

Insect Note

Aphids are notably attracted to Russet Norkotah.

Senescence/Desiccation

Due to its early maturity, Russet Norkotah usually undergoes natural senescence about mid-August. As a fall crop, it should be allowed to die naturally unless field sampling shows a large number of tubers are oversizing. This variety is easily desiccated and desiccants may be applied 95-110 days from planting or 70-80 days after emergence depending on planting date. Skin set can occur as early as 12 days after desiccation but needs to be checked before harvest.

Harvest/Disease Notes

Harvesting of Russet Norkotah needs to be done under cool temperatures and dry soil conditions, usually in the morning. This is because of this variety's propensity for *Pythium* leak and *Erwinia* soft rot/blackleg. Metalaxyl with a blight protectant treatment, applied when tubers are about "marble sized" and when they are about "golf ball sized" are highly recommended to assist controlling soft rot and pink rot. After harvest, tubers need to be kept cool, dry and well ventilated. Neither *Pythium* nor *Erwinia* like air. If lenticels are swollen due to excess soil moisture, these diseases readily enter the tuber and a wet barrier over lenticels inhibiting air passage into tubers promotes growth of these diseases inside.

Storage/Disease Notes

Storage of fall crop Russet Norkotah is not recommended past March. About 3-4 months storage is maximum for best results. It's lack of storability is due to its disease susceptibility, tendency to dehydrate and bruising in storage. Besides leak, soft rot and pink rot, this variety is prone to silver scurf, tuber early blight, dry rot, and moderately to black scurf. During long storage, it dehydrates and develops pressure bruising and internal blackspot.

Table 3. Key Management Points for Russet Norkotah

canopy maturity	95-110 DAP
canopy size	compact
planting (tablestock)	10 in. apart, 6 in. deep
irrigation	early season high, late season little
fertilization	pre-plant, pre-emergence
	before tuber bulking
nitrogen	200-230 lb/acre
petiole nitrate-N	16-18,000 ppm @ 55 DAP
	6-8,000 ppm @ tuber maturity
potassium	little if any
foliar diseases	early and late blights, blackleg, *Verticillium* wilt, viruses
tuber bulking	rapid
tuber diseases	leak, soft rot, pink rot, dry rot, tuber blight, silver scurf
tuber defects	oversizes
desiccation	natural, readily killed
harvest	cool, dry, aerated
storage	short-term
	pressure and blackspot bruising

Russet Norkotah - Field Management Profile

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Check out the Nebraska Potato Eyes on the WWW at:

http://ianrwww.unl.edu/ianr/phrec/Peyes.htm