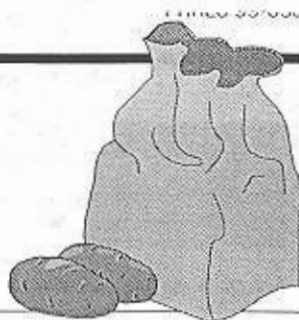


# POTATO EYES



Vol. 11, Issue 3, June-July 1999 • Alexander D. Pavlista, Extension Potato Specialist

## Nebraska-Wyoming Builder

Lloyd May died on May 23, 1999 at his home outside Pine Bluffs, WY, when it burned down Sunday night. Lloyd was 63, born in Kimball, NE. He began farming wheat and corn with his father in Banner Co., NE, and Laramie Co., WY. In 1970, Lloyd took over the family business, May Farms, Inc., and, in 1975, began growing seed potatoes in Wyoming. In 1984, Lloyd moved to Imperial, NE, formed Frenchman Valley Produce and began growing potatoes for the fresh market.



After an operation in 1991, he moved back to Banner County. Frenchman Valley Produce today is in the able hands of Tim May, his son. Lloyd was a member of the Elks Lodge and Eagles. Funeral services were held at the Albin (WY) community center on Friday, May 28 and interment at the Albin Cemetery.

He is survived by Shirley, his wife of 44 years; his children and their spouses -- Tom and Bobbie May (Banner Co.), Tim and Tamy May (Imperial), Randy and Tracy May (Harrisburg), LeAnn and Daryl Streeks (Gering), and Lana and Don Gray (Avondale, AZ) -- 16 grandchildren and one great-grand child.

• "He cut a large swath and brought a bumper crop."

*Alexander D. Pavlista*

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## Herbicides and Injury on Potato

With planting near completion and emergence under way, it is worth reviewing the type of injuries which can be caused by herbicides used on potatoes, or can be carried over from the previous year's crop, or may be used on the crop across the road. Injury descriptions are organized based on the most likely use of herbicides. Following these descriptions, injuries due to non-potato labeled herbicide are described.

### Potato Labeled Herbicides

Most herbicide injury is first observed as a general stunting of the canopy and/or distorted growth of the leaves and stems. Potato plants can be injured even by herbicide to which they are tolerant if they are under stress such as from temperature extremes or damaged by hail. Stress decreases the plant's ability to reduce uptake or deactivate the herbicide. The herbicides covered, in order of general application, are

**ROUNDUP - DUAL - PROWL and TREFLAN - LEXONE/SENCOR - LOROX - MATRIX - EPTAM/GENEP - POAST.**

#### ROUNDUP (glyphosate)

mode of action: amino acid synthesis inhibition

specific mode: inhibits EPSP synthetase (stops production of phenylalanine, tryptophan and tyrosine)

chemical family: amino acid derivative

uptake: foliar only

movement: systemic throughout plant

common application: pre-plant

weed control: non-selective, "TVC" total vegetation control

weed stage: emerged

potato injury: Growing cells (meristems) are affected and plant growth stops due to lack of protein. Injury appears in less than a week after exposure and starts with new, young leaves. Symptoms start with leaf yellowing (chlorosis) and progresses to browning (necrosis) until plants wilt and die. The process takes 10 to 14 days from exposure. There is no recovery. Sub-lethal doses cause parallel veining on leaves and an over-production of vegetative buds (similar to symptoms caused by phenoxy compounds such as 2,4D).



Injury from ROUNDUP

#### DUAL (metolachlor)

mode of action: seedling growth inhibition

specific mode: shoot inhibitor

chemical family: chloroacetamide (acetanilide)

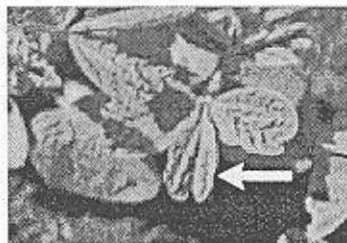
uptake: stem primarily and root

movement: systemic throughout plant

common application: pre-emergence

weed control: annual grasses and some annual broadleaves

[for Nebraska, grasses as foxtails, sandbur, crabgrass, fall panicum, and



Injury from DUAL

Continued on page 2

# Herbicides and Injury on Potato (continued)

broadleaves as Eastern black nightshade and pigweeds, and partial control of hairy nightshade]

weed stage: pre-emerged (germinating seed)

potato injury: Protein synthesis at the shoot and root tips (meristem cells) is inhibited resulting in poor growth. The first symptom of severe exposure is no emergence of potato sprouts due to stunting of underground shoot. If severely affected plants emerge, the stem will not recover and new stem growth must occur from below ground. With mild exposure, affected leaves have a shortened mid-vein resulting in a "heart-shaped" appearance from the "draw-string" effect. Leaf "crinkling" is usually associated with the draw-string effect. Leaves are often very small and may be downwardly cupped before forming the heart shape. Injury results from post-emergence application or application at cracking followed by rain or irrigation which pushes Dual down the soil crack to the sprout.

## **PROWL (pendimethalin) and TREFLAN (trifluralin)**

mode of action: seedling growth inhibition

specific mode: inhibits root growth

chemical family: dinitroaniline (dna)

uptake: root primarily and shoot

movement: remain at site of absorption

common application: pre-emergence

weed control: annual grasses

[for Nebraska, grasses as foxtails, sandbur, crabgrass and fall panicum, and broadleaves as kochia, lambsquarter and pigweed]

weed stage: pre-emerged (germinating seed)

potato injury: Dinitroanilines inhibit tubule formation thereby stop cell division at the root tips. With no cell division, cells enlarge. Lateral root development is halted causing short, stubby roots with enlarged tips. Root hairs don't form along affected portions of root. Note that root must grow into soil area containing the dinitroaniline. Short thick underground shoots may be seen if they were in direct contact with herbicide. Plants become stunted. Injury appears within a week of exposure. Injury may result from an early post-emergence application. Mildly injured plants show dark-green areas on leaves with some crinkling. Mature plants with leaf symptoms often have brittle stems which can be snapped by wind. Seldom is injury severe enough to cause death since un-affected roots can make up for loss. Some varieties seem more prone to injury than others.

## **LEXONE and SENCOR (metribuzin) and LOROX (linuron)**

mode of action: Photosynthesis inhibition

specific mode: C<sub>1</sub> class (metribuzin), C<sub>2</sub> class (linuron)

chemical family: triazinone (metribuzin), phenylurea (linuron)

uptake: root and foliar

movement: move from roots to vine, no movement from leaves

common application: pre-emergence

weed control: annual grasses, annual broadleaves, perennials

[for Nebraska, grasses as foxtails, crabgrass and fall panicum, and broadleaves as kochia, lambsquarter, pigweed, common ragweed and wild mustard, and thistles]

weed stage: pre-emerged and early post-emerged broadleaves

potato injury: Photosynthesis inhibitors result in the production of

free radicals which disrupt cell membranes. Because of compounds upwardly movement in plant's xylem, symptoms appear in the leaves. These compounds do not prevent emergence but become effective when the plants are exposed to sunlight, form leaves and begin photosynthesis. Initial symptoms are a yellowing (chlorosis) of leaf margins and tips especially of older leaves. Yellowing first occurs between the veins and moves inward to the mid-vein. As injury progresses, leaves turn brown (necrotic) and die. Younger leaves are more affected as they enlarge. Plant death is not common but loss of yield and quality is. Symptoms are more pronounced in soils with pHs above 7.2 (alkaline). Varieties vary considerably in their sensitivity to injury. As a general rule with many exceptions, white and red-skinned varieties are more sensitive than russet-skinned ones. Russet Norkotah is one of the least sensitive and metribuzin has been successfully used early post-emergence on this variety.

## **MATRIX (rimsulfuron)**

mode of action: amino acid synthesis inhibition

specific mode: inhibits ALS-AHAS enzyme

(stops production of isoleucine, leucine and valine)

chemical family: sulfonylurea

uptake: foliar and root

movement: systemic throughout plant

common application: early post-emergence

weed control: grasses and broadleaves

(Major use is control of triazine-resistant weeds as pigweeds.)

[for Nebraska, grasses as foxtails, volunteer cereals and corn, crabgrass and fall panicum, and broadleaves as kochia, mustards, pigweeds, and partial control of hairy nightshade, common ragweed and common lambsquarter]

weed stage: pre-emerged and early post-emerged

potato injury: Growing cells (meristems) slowly stop growing as amino acid reservoir depletes and proteins aren't synthesized. This is the newest of the potato herbicides in use, so injury information is scarce. Symptoms should be similar to other sulfonylureas such as Accent and to imidazolinones such as Pursuit. Plants may become stunted, and both leaves and stems may turn yellow (chlorosis) and/or purple. Severe injury may result in death of terminal growing points. Growth stops shortly after application but discolorations appear gradually, one to two weeks.

## **EPTAM/GENEP (EPTC)**

mode of action: seedling growth inhibition

specific mode: lipid synthesis (non-ACCase) inhibitor

chemical family: thiocarbamate

uptake: stem and root

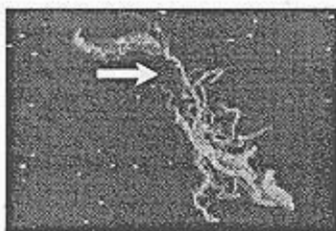
movement: systemic throughout plant

common application: post-emergence and pre-emergence

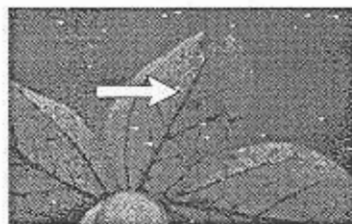
weed control: grasses and broadleaves

[for Nebraska, grasses as foxtails, sandbur, crabgrass, fall panicum, cereals and broadleaves as black, hairy and cutleaf nightshades, pigweeds, and common lambsquarter]

weed stage: pre-emerged and newly emerged



**Injury from PROWL**



**Injury from MATRIX**



**Injury from EPTAM/GENEP**



# Herbicides and Injury on Potato (continued)

potato injury: Method of inhibiting lipid synthesis is not well understood. Compound causes crinkling or puckering of leaves which also appear thick and dark-green. Leaf buds may not open. Emergence is delayed and plants may be stunted. Symptoms appear one to several weeks after exposure and are similar to those by dinitroanilines except for stem brittleness. Sensitive varieties are uncommon.

## POAST(sethoxydim)

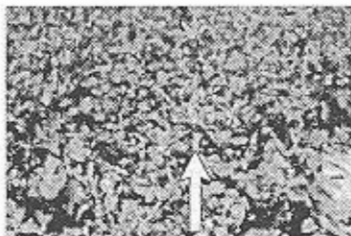
mode of action: lipid synthesis inhibition  
specific mode: ACCase inhibition  
chemical family: cyclohexanediones  
uptake: foliar only  
movement: throughout plant  
common application: post-emergence  
weed control: nearly all annual and perennial grasses  
weed stage: post-emerged  
potato injury: None, but may get some burn of leaf tips ("fire blight") due to the crop oil additive when applied on a warm day.

## Potato Injury Due to Drift

In Nebraska, three major herbicidal families have caused injury due to drift from nearby fields. Phenoxyacetic and benzoic acids are plant growth regulators, and bipyridiliums are vine desiccants.

## Synthetic auxin growth regulators

family: phenoxyacetic acid  
example: 2,4D (many product names)  
family: benzoic acid  
example: dicamba (Banvel, Clarity)  
crop uses: small grains, corn, pasture  
movement: downward through plant (phloem)



Injury due to PGRs

potato injury: As auxins, these promote cell enlargement in the vascular tissue resulting in clogging and inhibition of translocation. Plants exposed to phenoxyacetic acids exhibit twisting stems (epinasty) due to asymmetrical growth. Leaves will malform appearing cup-shaped, crinkled, strapped, and having parallel veins. Leaves of dicamba-exposed plants have a "fiddle-neck" appearance, or a folded or hooded appearance. Curling of some petioles and leaves may occur along with the puckered appearance. Symptoms may occur within a few hours to several days. Yields are reduced. Tubers may have creases and appear with elephant-hide.

## Cell membrane disrupters

family: bipyridilium  
example: diquat (Diquat) and paraquat (Gramoxone)  
crop use: potato vine desiccation  
movement: none, contact herbicide  
potato injury: By diverting electrons from photosynthesis, these compounds cause the formation of hydrogen peroxide which disrupts cell membranes. Drift injury of these potato vine desiccants appears as leaf speckling or necrotic spots on leaves.

## Potato Injury Due to Carryover

In Nebraska, carryover injury on potatoes has been observed from four major herbicidal families. Carboxylic acids are plant growth regulators, imidazolinones and sulfonyleureas are both inhibitors of ALS/AHAS enzyme, and triazines are photosynthesis inhibitors.

## Synthetic auxin growth regulator

family: carboxylic acid or pyridine or picolinic acid  
example: clopyralid (Stinger) and picloram (Tordon)  
crop use: small grains, corn, sugar beets, grass pastures  
movement: downward through plant  
potato injury: Potato injury is similar to that from phenoxyacetic acids such as 2,4D. Typical symptoms are curling of young leaves, "fiddle-neck" leaf appearance. Tuber yields are greatly reduced. In addition, exposure may carry over into seed tubers and affect the following year's crop.

## Photosynthesis inhibitors

family: triazine  
example: atrazine (several product names), cyanazine (Bladex), simazine (Princep), hexazinone (Velpar)  
crop use: corn and alfalfa  
movement: upward from root to vine  
potato injury: Carry-over injury has generally occurred in Nebraska when metribuzin at its high, labeled rates is also used on a field after triazine-treated corn in Nebraska. Recommendations are to use metribuzin at half rate under this circumstance or to plant a variety that is resistant to triazine injury such as Russet Norkotah. Symptoms are the same as those described for metribuzin (Lexone, Sencor). The most notable early symptom is veinal chlorosis.

## Amino acid inhibitors

family: imidazolinone  
example: imazethapyr (Pursuit), imazaquin (Scepter) and imazamox (Rapture)  
family: sulfonyleurea  
example: chlorimuron (Classic), chlorsulfuron (Glean), metsulfuron (Ally), nicosulfuron (Accent), and triasulfuron (Amber)  
crop use: corn, soybean, small grains, grass pasture, and CRP  
movement: throughout plant  
potato injury: Foliar symptoms include a light green appearance of leaves especially new ones. Leaves are cupped upward giving a "boat-shaped" appearance. There may be a loss of leaf blade integrity; leaf disintegrates leaving the mid-rib and about 10% of a normal leaf. Rolling of the leaves may occur resembling drought stress. Severe injury results in stunting and purpling. Tuber yield and quality are greatly reduced.

## TUBER SYMPTOMS ASSOCIATED WITH HERBICIDE INJURY

Tuber mis-shaping include longitudinal cracks, "dumb-bells," curved or folded tubers, indentations, and knobs, bumps or protrusions. Tubers are often under-sized. The skin may develop "alligator" and formation of "popcorn" tubers. Aerial tubers have also been observed.



## Potato Injury Symptoms from Herbicides

	<u>Leaves</u>	<u>Stems</u>	<u>Roots</u>
glyphosate	yellow, brown, die	die	die
metolachlor	heart-shape, crinkle, downward cup	delayed emergence, stunting	—
pendimethalin trifluralin	dark-green blotches some crinkling	delayed emergence short thick sprout, stunting, brittle	knobby tips missing hairs, growth stopped
metribuzin linuron [triazines]	yellow margins & tips interveinal yellowing to browning	—	—
rimsulfuron [imidazolinones] [sulfonylureas]	yellow blades purple veins (NOTE: tubers mis-shape.)	stunting purpling	—
EPTC	crinkled, puckered thicken, dark-green closed leaf buds	delayed emergence stunting	—
PGRs	cupped, crinkled, strapped, curled parallel veining, fiddle-necking	twisted, bent	—
diquat paraquat	speckling (drift)	—	—

## References

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