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NEBRASKA

POTATO EYES

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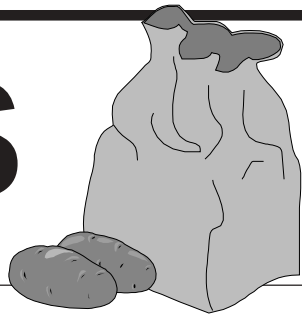

Potato Pricing and Production

There is much discussion on the relation of price per cwt and potato production. Potato prices in 2000 were very poor but prices the past two years have been favorable. This has been attributed to production and harvest acreage.

To look into this, I went through NASS (National Agricultural Statistics Service) records for the past 20 years (1982-2001). Figure 1 shows U.S. production and price of potatoes for each year. The inverse relation between price and production is clear; when production goes up, prices go down. The only exception was in 1993, one out of 20 years.

I then took the last eight years (1994-2001) and graphed price versus production (Figure 2). There is a striking linear and negative correlation between these two data sets with 1995 and 2001 having the highest price and lowest production while 1996 and 2000 having the reverse.

The linear equation is price (US$/cwt) = 17.5 - 0.025 production (million cwt) with an R-square = 0.84 (or 84% probable correlation). This means that, for every production increase of 25,000 cwt, the price per cwt goes down by $1. There is also much discussion that price is related to harvested acres.

For the same period, I graphed price against million acres (Figure 3). With the exception of 1995 (high $) and 2000 (low $), again there is a linear and negative relation. When harvested acres go up, price goes down. In 1995, yields dropped 5% lower than 1994 and 8% below 1996 yields.

In 2000, yields were above normal, 6% higher than 1999 and 2001. When I remove these two years, then the linear relation shows that the price reduction is correlated with increased harvested acres at the 95% level. Although yield plays an important role, under normal conditions, harvested acres is the major cause of price changes.

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Figure 1. U.S. Production and Price by Year

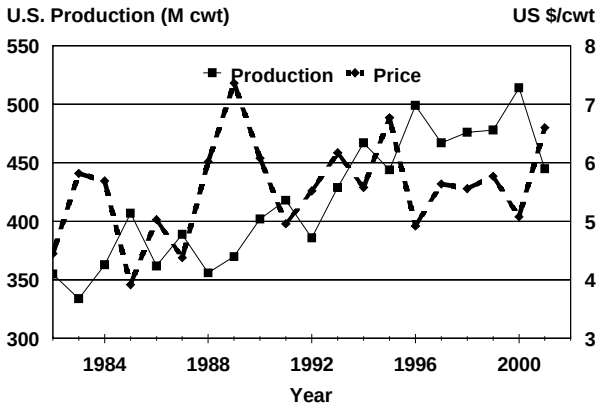


Figure 2. U.S. Production vs Price

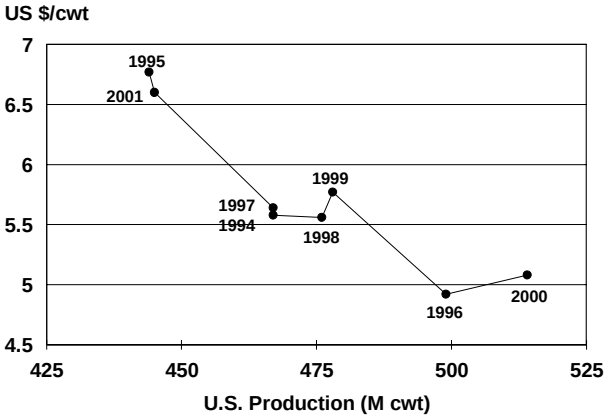
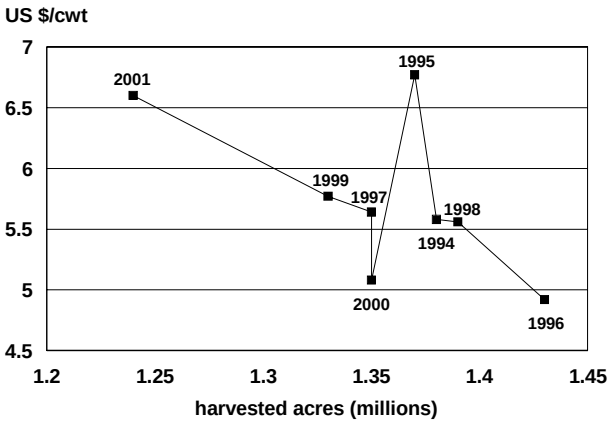


Figure 3. Price versus harvested acres, 1994-2001



Spartan, a New Herbicide

Background

One of the most commonly used herbicide on potatoes in Nebraska is Sencor / Lexone (AI= metribuzin, a triazine). It is applied primarily pre-emergence but is not an excellent herbicide against the nightshades. Some potato varieties are sensitive to it such as Atlantic, Snowden and Shepody while others are quite tolerant such as Russet Norkotah. An additional factor is that, if potatoes are planted after corn that had been treated with another triazine, especially atrazine, the herbicidal effect would be cumulative and the metribuzine rate would need to be reduced. When metribuzin is mixed with metolaclor (Dual), weed control is usually greatly improved. But, in the mid 1990s, it was evident that redroot pigweed and other weeds were developing triazine-resistance.

In 1996, Matrix (AI=rimsulfuron, an ALS-inhibitor) was registered for potatoes in Nebraska under a Section 18 to control triazine-resistant weeds that were now unaffected by metribuzin. Matrix had a good advantage in that it could be applied pre or post-emergence or both. It was the first new herbicide in the previous two decades. Although it has a good spectrum in broad-weed control, it is inconsistent in controlling nightshades and common lambsquarter. In recent years, resistance to ALS-inhibitors has been detected starting with resistant kochia due to the herbicide program used in small grain production. This resistance has spread to other weeds. Now, in this region (NE, CO, KS, ND), important weeds such as the pigweeds and waterhemp have developed dual resistance, to both triazines and ALS-inhibitors.

Last year, the situation was bad enough that Nebraska received a 'crisis' Section 18 to test phytotoxicity of Spartan (AI=sulfentrazone). About 300 potato acres planted to several varieties were treated with this new herbicide. No phytotoxicity (plant injury) was observed. Research with potatoes on this new herbicide was extensively done in 1999 and 2000 at Colorado State Univ and recent published (Weed Technology 16:567-574. 2002.). Last year, two trials were conducted at the Panhandle Research and Extension Center, one on weed control efficacy and the other on phytotoxicity of major potato varieties in Nebraska. A Section 18 on Spartan has been reissued for 2003 and expanded to cover many more treated acres; treatment for 12,000 acres has been petitioned to the EPA.

General Chemical Characteristics

Spartan is an aryl triazinone. Its mode of action is to inhibit an enzyme (PPO-inhibitor) that is part of the chlorophyll biosynthesis pathway. One result is cell membrane disruption. The half-life of Spartan in soil is between 110 to 280 days depending on soil type, organic matter, temperature, moisture, etc. It can leach in the soil and its mobility is considered moderate, more than alachlor (Lasso) but less than metribuzin (Lexone or Sencor). Product label characteristics are discussed at the end.

Colorado State University Research

[Reference: Wilson, D.E., S.J. Nissen and A. Thompson. 2002. Potato (*Solanum tuberosum*) variety and weed response to sulfentrazone and flumioxazin. Weed Technology 16:567-574.

Spartan was applied pre-emergence at various rates, 2.7 to 8 oz product (75% AI)/acre. It was also tested mixed with Dual Magnum (AI=*s*-metolaclor). These treatments were compared to Matrix DF (25% AI) + Dual Magnum (7.62 lb AI/gal), Lexone DF (75% AI) + Dual Magnum, and Dual Magnum (Dual Mag.) alone. Checks were untreated (weedy) and hand-weeded. Spartan gave excellent control of broadleaf weeds even at 2.7 oz P/a (Table 1). But, higher rates were needed to control grasses, in other words, a rate-response was observed. When mixed with Dual Magnum, grass control greatly improved. Spartan was very successful (reducing biomass by >90% at the lowest rate) in controlling nightshades (black, hairy and cutleaf), redroot pigweed, kochia, and common lambsquarter. There was less of an effect on barnyardgrass and wild proso millet. Russet Norkotah and Russet Nugget were little affected by Spartan applied pre-emergence (Figure 1). Chipeta showed some injury, 13% of plants, when exposed to the highest rate. Of the four potato varieties tested, it was the red-skinned Sangre that showed considerable injury (phytotoxicity). Early injury was characterized four weeks after treatment as small dark lesions and minor stunting.

Figure 1. Sensitivity of four potato varieties to Spartan applied pre-emergence at 2.7, 4 and 5.3 oz/a

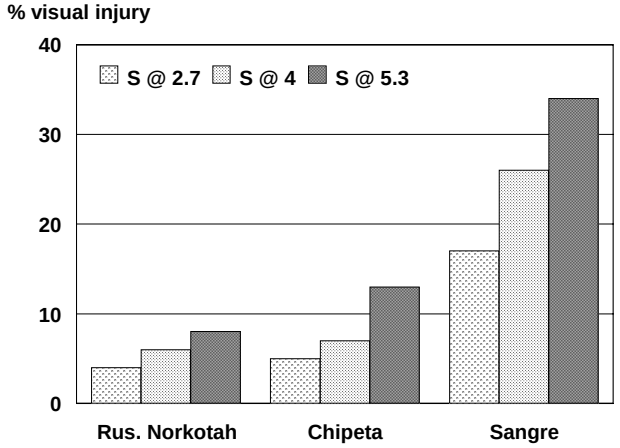


Table 1. Weed control efficacy of Spartan, combined data from 1999 and 2000 in Russet Norkotah at Gilcrest, CO (modified from article).

Product in oz/a or fl oz/a	Hairy Nightshade	Redroot Pigweed	Barnyard grass
	% weed control		
Spartan @ 2.7	97	98	69
Spartan @ 4.0	100	98	78
Spartan @ 5.3	100	100	81
Spartan @ 8.0	100	100	84
Spartan @ 2.7 + Dual Mag. @ 16.8	98	100	98
Matrix @ 1.0 + Dual Mag. @ 22.5	93	100	98
Lexone DF @ 6.4 + Dual Mag. @ 22.5	86	96	88
Dual Mag. @ 22.5	83	96	94

Continued on page 3

Spartan, a New Herbicide, (continued)

University of Nebraska Research

A weed control efficacy trial was conducted in 2002 at the Panhandle Research & Extension Center (PREC) in Scottsbluff on the potato variety Atlantic. The trial was conducted by Dr. Robert Wilson. The purpose of this trial was to evaluate efficacy for weed control of Spartan applied with Matrix compared to other common pre-emergence herbicide treatments. In addition to hairy nightshade, control of common lambsquarter, common purslane, redroot pigweed, wild proso millet, and common mallow was determined (Table 2). Weed competition in non-treated plots reduced potato yields by over 50% compared with plots where weeds were controlled by herbicides. There was a positive relationship between herbicides that controlled hairy nightshade and tuber yields (Figure 2). About three-quarters of the variation in yield could be explained by a linearity between yields and hairy nightshade control, that is, as hairy nightshade control increased so did tuber yields.

Figure 2. Relation of hairy nightshade control versus yield

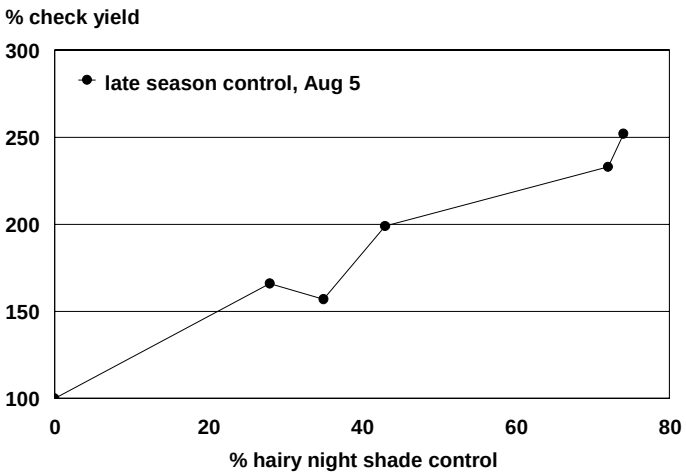


Table 2. Weed control efficacy on July 2, 32 days after pre-emergence applications of Spartan in 2002 in Atlantic at Scottsbluff, NE.

Product in oz/a or fl oz/a	Hairy Nightshade	Redroot Pigweed	Common Lambsquarter
	% weed control		
Matrix 25DF @ 1.5	19	98	94
Spartan 75DF @ 2 + Matrix @ 1.5	94	93	99
Sencor 4F @ 16 + Matrix @ 1.5	24	99	99
Sencor @ 16 + Dual Magnum 7.6F @ 16	32	99	99
Sencor @ 16 + Eptam 7EC @ 55	50	99	99

A Phytotoxicity trial was also conducted at the PREC. Eight varieties — Atlantic and Snowden, Ranger Russet, Russet Burbank and Russet Norkotah, Red Norland and Red Pontiac, and Yukon Gold. Half the plots were treated with Spartan at 2.5 oz/a applied 16 days after planting (9-10 days before emergence) and half were not. For maximum weed control, all plots were treated with Sencor, Dual, Matrix, and Eptam. There were no symptoms of injury to either the vines or the tubers due to Spartan for any of the varieties. There was no reduction in yields.

Figure 3. Mid-season application of Spartan to Russet Burbank, injury observed two weeks later.

In order to characterize post-emergence application injury, in mid-season (mid Aug), fully grown Russet Burbank plants were treated with Spartan at 2.5 oz/a and observed two and four weeks later. Figure 3 (photograph) was taken on 27 Aug, two weeks after treatment. Two weeks later, the plants were nearly dead while untreated ones were still green and healthy.

Label Characteristics

Before applying Spartan, check the label which is good from 10 April to 30 June, 2003. Spartan is a solid containing 75% sulfentazone as the active ingredient (AI). It may cause moderate irritation to the eyes if exposure occurs. Personal protection equipment is listed as long-sleeved shirt, long pants, waterproof gloves, and shoes and socks; there is no requirement for a respirator listed. Sulfentrazone can leach through the soil and should not be used on coarse soils (sand) containing less than 1% organic matter. Spartan cannot be applied aerially or chemigated and can be applied only once per season. Its re-entry interval is 12 hrs.

The Nebraska Section 18 specifies Spartan's use in potatoes for the control of ALS-inhibitor and triazine resistant pigweeds. Spartan is to be applied pre-emergence and can be applied after drag-off prior to emergence. It works best if moved into the soil by rain or irrigation. Avoid mechanical incorporation. Rates depend on soil texture and organic matter content (Table 3). Be wary of plant injury if soil has less than 1.5% organic matter and pH is above 7.8. Rotational crop guidelines state that soybean may be planted anytime after potato; small grains need a four month re-cropping interval; for corn and sorghum, it's 10 months, and for sugar beets, it's two years due to crop injury concerns.

Table 3. Rate of Spartan with regard to soil and organic matter.

Organic Matter	Coarse Soils (sand (sand, loamy sand and sandy loam) *	Medium Soils (loam, silt loam and silt) **
< 1.5%	2.0-2.67 oz/a	2.67-3.0 oz/a
1.5-3%	2.67-3.0 oz/a	3.0-4.0 oz/a
> 3%	3.0-4.0 oz/a	4.0-5.33 oz/a

* Not recommended for coarse soils with less than 1% organic matter.
** Same rates are for Fine Soils (clay types).

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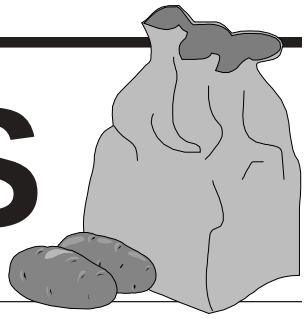

The Nebraska Potato Eyes is on the WWW at:
www.panhandle.unl.edu/peyes.htm