NEBRASKA POTATO EYES

Technical News Reports for the Nebraska & Wyoming Potato Industry

Vol. 7
Issue 1
Spring 1995

Alexander D. Pavlista, Editor, Extension Potatoe Specialist, NE
Gary D. Franc, Contributing Editor, Research Plant Pathologist, WY
Jerry Allen, Typesetting & Design, Altek Ltd., NE

Editor's Note

This issue of NPE reviews some potato research conducted in Nebraska (Pavlista) and Wyoming (Franc) in 1994. Covered are variety, sulfur, fungicide and disease (common scab, early blight and seed treatments), insecticide (wireworm and C. potato beetle), herbicide and vine desiccation trials.

Late Blight Forecasting: The Nebraska Potato Development Board has contracted OK Consultants (Dr. Robert O'Keefe), Scottsbluff, NE, to forecast late blight in Nebraska and eastern Wyoming. This service is available to potato growers who pay the potato check-off and the forecast information is sent via FAX.

No Pesticides: The article, "No Pesticides: A Boon?" in last Spring's issue of "Nebraska Potato Eyes" on reduced pesticide use received some notoriety, even reprinted in Australia. Joe Schon (Lockwood Corp.) passed along something which he heard at the World Potato Congress. In the Netherlands, several potato growers reduced their chemical usage by 50%. One of results was a 25% loss in income. Do you think that this explains why "organic" potato production accounts for much less than 1% of the European market? Dutch researchers have reported that for all their efforts to date, they have been totally unable to reduce the devastation of late blight without the use of fungicides.

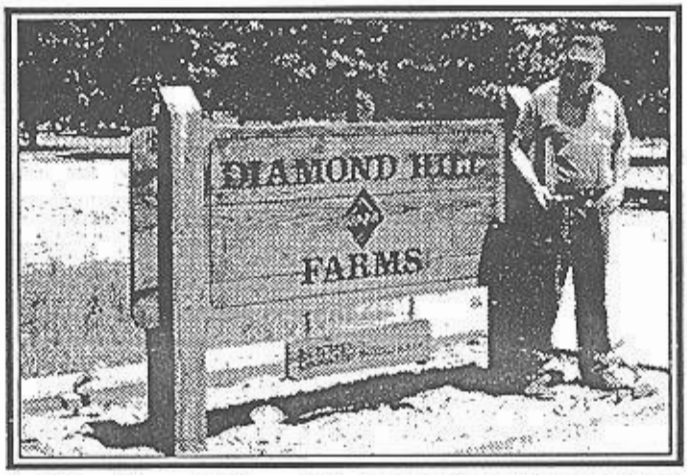
New Leaf: The Russet Burbank clone resulting from the genetic transfer of an anti-Colorado Potato Beetle gene from a bacillus ("Bt") is undergoing seed increase this year. The name is 'New Leaf' and may be commercially available in 1996. A group called the "Union of Concerned Scientists" is urging delay of EPA approval for New Leaf due to possible resistance to the Bt gene which they claim would be a threat to organic and low-input potato, corn and cotton growers.

Disease Notes: Black dot has been observed in a few tuber lots this spring. Most of these were first generation tubers originating from the Red River Valley. Silver scurf has also been observed on a couple of samples. Growers might be cautious about these diseases in seed from the Red River Valley. These diseases may not appear until the second season.

National Representation: Dale Moore of Western Potatoes, NE was newly appointed by the Acting USDA Secretaty to the National Potato Promotion Board and Don Brown of Brown Enterprises WY was reappointed. Kathy Shaver of Nationwide Seed Sales, NE has been appointed to the National Potato Council's Board of Directors.

Alexander D. Pavlista

Awards To Nebraska Growers



Jack Nielsen, Diamond Hill Farms, holding trophy for Storage Potato Supplier of the Year for Frito-Lay, Inc.

Frito-Lay, Inc., the largest potato chip producer in North America, awarded Diamond Hill Farms, Alliance, Nebr., their Storage Potato Supplier of the Year (trophy) and Central Storage Supplier of the Year (plaque) for 1994. "I'm holding this trophy for the personnel at Diamond Hill Farms -- They're all in the fields working and could not be in this picture, but they are the ones who earned the awards" (Jack Nielsen). Jack Nielsen established Diamond Hill Farms in 1979. His family has been growing potatoes in western Nebraska since 1916.

At the same ceremony last April at Orlando, FL, Western Potatoes, Inc., Alliance, Nebr., recieved the award for Best of the National Potato Seed Grower of the Year (1994). Thirty Frito-Lay seed suppliers throughout the USA and Canada compete for this award. The employees of Western Potatoes, Inc. have previously earned this National award in 1990 and 1991.

In This Issue...

Nebraska Potato Variety Trials

Alexander D. Pavlista
Extension Potato Specialist
University of Nebraska, Scottsbluff, NE

The 1993 Nebraska Potato Variety Trials were conducted at four locations – Alliance (two chipstock, one tablestock and North Central Regional Trial), Central City (table and chipstock) and Madrid (tablestock). The trial at Central City was partially washed out. There were four red, 10 russet, three long-white, and 14 round-white entries in the Nebraska trials, and 15 entries in the NCR trial. Days from planting to harvest ranged from 100 to 128 and, from emergence to desiccation, it was 70 to 93 days. Cultural practices were according to the cooperating growers. All seed pieces were cut and treated with TOPS 2.5 D. All but the NCR trial were planted by the cooperator. All trials were under center-pivot irrigation. Rainfall was about average except for a wet spring in eastern Nebraska. Hail was below normal.

Observations (1994): As in 1993, Red LaSoda and ND1871-3R had good yields and percent of US #1 tubers among red-skinned potatoes. Both entries tended to oversize. Fontenot (LA12-59) had the highest specific gravity. Red LaSoda and W1100R had above average common scab in west Alliance and the former had more black scurf in Central City. Few defects occurred in Madrid. The best yields of a russet-skinned potato were obtained with A82611-7. Specific gravity was above 1.090 at both Alliance and Madrid with Ranger Russet, A82611-7 and W1005. The latter, W1005, tended to have small, long and thin tubers. In the Nebraska Panhandle, Ranger Russet had above average common scab; Russet Burbank had black scurf, and Shepody, a long white, had both. Ranger Russet remains among the best russet varieties. Good yielding chipping entries in the Nebraska Panhandle were Atlantic, Chipeta, Coastal Chip, Monona, Norchip, and ND2471-8. The highest specific gravities were obtained from Atlantic, Mainechip, A80659-2, A83306-1, MS700-70 and ND2471-8. The lightest chips came from Mainechip and Snowden. Kennebec and A83306-1 had the darkest chip color after harvest (one month preconditioning/curing period at 60F). Chipeta, Norchip and Portage had a lower chip color rating than the rest. Chipeta tended to oversize. Overall the best numbered entry seemed to be ND2471-8. Common scab was high in Atlantic, Coastal Chip, Kennebec, Monona, Portage, Snowden, A80559-2, A83306-1, and ND2471-8. Entries in these trials were: Red – Red LaSoda, Fontenot, ND1871-3R, and W1100R; Russet – Century R., Krantz, R. Norkotah, Ranger R., R. Burbank, A7961-1, A82611-7, CO083008-1, W1005, and W1099; Long-White – Kennebec, Itasca and Shepody, and Round-White – Atlantic, Chipeta, Coastal Chip, Mainechip, Monona, Norchip, Portage, Snowden, A80559-2, AC83306-1, MS700-70, ND2417-6, ND2471-8, and NYE55-35.

North Central Trials (1994): Yields were higher than last year. Among russet entries, Russet Norkotah and W1099 Russ outyielded Russet Burbank. The russet entries had the severest common scab. The highest yielding red/purple entries were MN15220 (purple) and Red Pontiac, both tended to oversize. Red Pontiac had the most scabby tubers and MN15220 was very knobby. The highest yielding white entries were MN13540, MN12823 and Norchip. The highest specific gravities were obtained from ND2471-8 and W1149, and the best chip color ratings were from Norchip, P84-9-8 and ND2471-8. Nearly half the tubers of P84-9-8 had common scab. Many tubers of Norchip and W1149 had growth cracks.

[Trials were funded by the Nebraska Potato Development Board.]

Chip Color of chipping varieties

Entry Number	After Harvest*	After 6 mo. at 50 F*	After 6 mo. at 40 F*
Atlantic	66	48	48
Chipeta	58	55	50
Coastal C.	67	48	51
Kennebec	46	45	42
Mainechip	70	49	58
Monona	59	56	53
Norchip	60	49	51
Portage	59	21	19
Snowden	70	54	57
A80559-2	70	55	57
AC83306-1	53	42	42
MS700-70	67	36	36
ND2417-6	64	50	44
ND2471-8	63	49	49
NYE55-35	63	60	50
mean	62	48	47

Chip color was determined after two weeks curing at 60 F with an Agtron E-10.

Summary of yield and process data of the 1994 NCR Trial in Nebraska.

Entry	Yield cwt/ac	Specific Gravity	Chip Color
Red Norland	354	1.072	56
Red Pontiac	626	1.085	43
MN15220	750	1.074	39
W1100R	455	1.077	60
R. Burbank	327	1.095	52
R. Norkotah	387	1.079	52
W1099 Russ	382	1.087	57
Norchip	499	1.095	67
MN12823	577	1.089	59
MN13540	527	1.089	60
ND2417-6	480	1.074	58
ND2471-8	383	1.104	64
P83-11-5	246	1.095	61
P84-9-8	203	1.097	66
W1149	463	1.104	62
means:	444	1.088	57

Chip color was determined after two weeks curing at 60 F with an Agtron E-10.

NEBRASKA RESEARCH (1994)

Alexander D. Pavlista, Extension Potato Specialist
University of Nebraska, Scottsbluff

Ammonium Sulfate and Thiosulfate Trials

Research on yield enhancement and common scab suppression by sulfur-containing compounds was continued in 1994.

Ammonium Thiosulfate (ATS) -- Thiosul (60% ATS) was tested at 11.5, 23.1 and 46.1 gal/ac (equivalent to 33, 67 and 133 lb S/ac). Applications were in-furrow at planting, early postemergence (11 days after emergence) and tuber initiation (21 days after emergence). In a separate trial at Alliance, Thiosul (35 gal/ac equivalent to 100 lb S/ac) was applied through the center pivot at 11 and 21 days after emergence and plots were harvest within treated wedges. A urea-treatment was the nitrogen check and an untreated wedge was included.

Observations (1994): Yields of US#1 tubers were significantly increased by 20% with 23.1 gal Thiosul/acre applied either at planting (in-furrow below seed piece) or at 11 days after emergence (foliar). At tuber initiation, yields were not significantly increased; the 46.1 gal/ac rate significantly lowered yields. Application of Thiosul through the center-pivot did not significantly increase yield over the nitrogen check (urea). The number of tubers with pitted common scab and the amount of tuber-surface area covered with common scab were significantly lowered by 23.1 and 46.1 gal Thiosul/acre when applied either at planting (in-furrow below seed piece) or at early post-emergence (foliar). At tuber initiation, the decrease in common scab was associated with a yield decrease by 46.1 gal Thiosul/acre. Thiosul applied at 35 gal/ac through the center pivot had little effect compared to the nitrogen check (urea). There were significant decreases in the number of tubers with severe black scurf associated with 23.1 and 46.1 gal Thiosul/acre applied at planting and at early post-emergence. There was no significant effect with center-pivot applications.

Ammonium Sulfate (AS) -- AS was applied to Atlantic potatoes grown in Alliance and Scottsbluff. Granular AS at 208 and 416 lb/ac (equivalent to 50 and 100 lb S/ac) was applied in-furrow at planting and early postemergence (foliar), 11 days after emergence. Degradable sulfur at 100 lb S/ac was used as a standard. Soluble AS was applied in water (100 gpa) around tuber initiation (21 days after emergence) at 208 and 312 lb AS/ac (50 and 75 lb S/ac).

Observations (1994): In-Furrow applications showed a significant increase (12%) in the yields of 'US#1' tubers by 416 lb AS/ac. The number of tubers with common scab was decreased. With early postemergence application, yield of 'US#1' tubers was significant increased (9%) by 416 lb AS/ac. The number of tubers with common scab or black scurf was signficantly decreased by over 35%. At tuber-initiation, there was no significant effect on yield by the liquid AS application. Ammonium sulfate at 208 lb/ac significantly decreased the incidence of common scab and black scurf by 40 and 55%, respectively.

[Trials were funded by the Nebraska Potato Development Board, the Colorado Potato Administrative Committee and Cominco Fertilizers (U.S.) Inc.]

Summary of 1991-94 trials -- Thiosul at 23.1 and 46.1 gal/ac significantly increased yields 15 to 24% when applied in-furrow below the seed pieces or foliar at 11 days after emergence. No deleterious effects were observed on tuber specific gravity nor chip color. The number of tubers with pitted common scab was significantly reduced by half. Foliar application of the lower rate significantly decreased the incidence of black scurf on tubers; other treatments showed a trend in reduction. Foliar application of Thiosul also reduced vine height. The effect is rate related and transient; the greatest difference from checks was observed 1 to 3 weeks after treatment. Ammonium sulfate at 208 and 416 lb/ac significantly increased yields 13 to 23% when applied as granular in-furrow below the seed pieces or foliar at 11 days after emergence. No deleterious effects were observed on tuber specific gravity nor chip color. Pitted scab was significantly reduced by 50% (in-furrow application) and 33% (foliar application). There was no significant effect by ammonium sulfate on the incidence of severe black scurf.

Yield and tuber-disease incidence after applications of Thiosul to Atlantic Potatoes, 1994.

Thiosul gal/acre	Yield cwt/a	% Pitted Scab	% Severe Black Scurf
a. In-Furrow/At-Planting: (Scottsbluff, NE)			
0	277	25	40
23.1	336 *	8 *‡	18 *
46.1	319	8 *‡	26 *
b. Post-Emergence/11 DAE: (Alliance, NE)			
0	225	25	38
23.1	275 *	4 *‡	19 *
46.1	270 *	1 *‡	29 *
c. Tuber-Initiation/21 DAE: (Alliance, NE)			
0	260	20	41
23.1	272	19	23 *
46.1	194 *	9 *‡	31

* Number was significantly different from check at 95% level.
‡ The surface area of tubers covered with scab was significantly reduced by 49-52% (in furrow) and 60-69% (foliar applications).

Yield and tuber-disease incidence after applications of ammonium sulfate to Atlantic Potatoes, 1994.

lb S/acre	Yield cwt/a	% Common Scab	% Severe Black Scurf
a. In-Furrow/At-Planting: (Scottsbluff, NE)			
0	285	20	28
208	307	11 *	25
416	319 *	15 *	21
b. Post-Emergence/11 DAE: (Alliance, NE)			
0	307	51	31
208	327	41	8 *
416	335 *	28 *	16 *
c. Tuber-Initiation/21 DAE: (Alliance, NE)			
0	250	41	31
208	255	24 *‡	14 *
312	252	23 *‡	17 *

* Number was significantly different from check at 95% level.
‡ The surface area covered by scab was significantly reduced by 44-47%.

Fungicide/Seed Treatment Trial

Tests on thiophanate-methyl (TOPS) in various formulations and with different additives began in 1989. The 1994 test was conducted on Russet Norkotah at the Panhandle Research & Extension Center, Scottsbluff, NE.

Observations (1994): Yield of US#1 tubers was significantly increased by TOPS 2.5E over check and mancozeb. This treatment increased yield over the other treatments as well but the increase was not significant. TOPS 5D + Captan 10 had about the same yield as the check. The effects on tuber diseases were similar to past trials. The number of tubers with black scurf (*Rhizoctonia solani*) and all disease defects combined were significantly less with all the TOPS treatments than check or mancozeb alone. There were no significant effects on common scab, rot or vascular discoloration.

TOPS trials were conducted from 1989 to 1992 on various formulations and mixes on Atlantic and Norgold Russet potatoes. In 1993, trials were conducted on these varieties as well as four other russets and three other white varieities. In summary, TOPS treatments increased yields and decreased the number of tubers with disease defects with russet varieties. But, there was no effect on round white varieties.

Yield and Disease Occurrence on Russet Norkotah after seed treatments with TOPS, Scottsbluff, NE, 1994.

Treatment	Yield, US#1 cwt/acre	% Tubers with Disease	% Tubers with Black Scurf
check	229	22	17
mancozeb	240	20	16
TOPS 2.5	258	10 *	4 *
TOPS 2.5 exp	290 *	4 *	2 *
TOPS 5	260	6 *	6 *
TOPS 5 + Captan 10	224	6 *	3 *

** Numbers are significantly different from check.*

Fungicide/Early Blight Trial

The main purpose of the early blight trials since 1991 was to determine the duration of effectivenessof test compounds. A single treatment of each test material is foliarly applied and early blight infection is monitored weekly. The percent infection of each plant (0, 1, 5, 10, 25, 50, 75, and 100%-dead) is recorded. These individual readings are combined to calculate the percent of the plot that is infected.

Observations (1994): Two Penncozeb formulations (DF, WP) were the best treatments. Effective control lasted for three weeks. At 4 weeks after treatment, there was still a significant amount of plants still surviving even though both early and late blight killed at least three-quarters of the plants in other plots. The 1994 trial was conducted at McGrew.

Observations (1991-1994): Penncozeb DF and WP were not significantly different but DF-treated plants had less early blight over the years. They were effective for 3 weeks and were the best control treatments. Bravo was good for 2 weeks. Maneb, Maneb+zinc, Microthiol Special, and Rovral were effective for the first week before the early blight pressure increased.

Varietal Comparison Over Four Years -- In 1992 and 1994, Russet Norkotah was used in the trial; Goldrush was used in 1993 and the early blight trial was conducted on Norgold Russet in 1991. Goldrush was the most resistant to early blight infection and Norgold Russet may be a little less susceptible than Russet Norkotah.

Four-year Averages of plot infection with early blight disregarding variety.

Treatment @ lb ai/ac	weeks after treatment percent plot infected		
	1 week	2 weeks	3 weeks
check, X-77	4.2^{A}	18.0^{A}	58^{A}
Maneb+Zn 4F @1.5	2.1^{BC}	14.2^{A}	44^{AB}
Maneb 75D @1.5	2.8^{B}	13.2^{AB}	44^{AB}
Microthiol 80D @4.8	1.3^{C}	10.1^{ABC}	40^{B}
Rovral 4F @0.75	2.5^{BC}	10.2^{ABC}	45^{AB}
Bravo 500 @1.0	2.4^{BC}	6.4^{BCD}	38^{B}
Penncozeb 80D @1.5	1.9^{BC}	4.9^{CD}	22^{C}
Penncozeb 75W @1.5	1.8^{BC}	2.3^{D}	16^{C}

Numbers in column followed by the same letter are not significantly different using least significant differences (LSD) at P<0.05.

Pesticide Updates

Bayer formerly Miles Lab recently received EPA registration for two products from a new class of insecticides, the chloronicotinyls. These substances attack the insect nervous system causing muscle paralysis and they are affected only through insect feeding on the vine. The products are systemic. ADMIRE 2F is applied as a band to the soil in-furrow at planting; PROVADO 1.6F is foliar applied and currently registered on cotton and apple. (Admire was tested at Scottsbluff last year (see "Insecticide/Admire Trial" in this issue) and Provado will be tested at Scottsbluff in 1995.) The active ingredient is named imidacloprid which binds to the soil or enters the leaf depending on application. The target pests are Colorado potato beetle, green peach aphid, leafhoppers and fleabeetle.

Ciba received EPA approval for their new combo product, RIDOMIL MZ72, for late blight control on potato as well as onion, tomato, and other fruits and vegetables. This material is sold in premeasured water-soluble bags.

TEMIK and MOCAP, both from Rhone-Poulenc, will be sold in American Cyanamid's new Lock'n Load closed handling system. The primary target crops are potato, cotton and peanut.

Herbicide/Turbo Trial

Most potato herbicides are used pre-emergence and need to control weeds until the plants grow sufficiently to cover the area between the rows, row closure. Row closure usually occurs between 6 and 8 weeks after emergence. After the Nebraska Potato Focus was held on weed control (1993), several growers have asked about the timing and rate of application of metribuzin (Sencor/Lexone) to sensitive potato varieties such as Atlantic. The interest is primarily in the use of Turbo, a metribuzin and metolaclor tank mix. In 1994, the first trial on Turbo management was conducted at Scottsbluff measuring weed control, phytotoxicity and yield.

Observations (1994):

Weed control at 3, 5 and 8 weeks after emergence was influenced by the timing of Turbo application and not significantly affected by the rate of product between 1.5 and 3 lb/acre. Applications 3 weeks after planting had a significantly lower weed population, determined at three and five weeks after emergence, compared to 1 week applications, and 2 week application was intermediate. At row closure (8 weeks after emergence), application timings of 2 and 3 weeks after planting both significantly reduced the weed population to nearly zero compared to 1 week applications. Also at row closure, there was a trend to longer weed control by 2.25 and 3 lb Turbo/ac compared to 1.5 lb/ac. More effective weed control occurs with later applications of Turbo. Plant injury was estimated. There were no effects on percent stand or yield; no pytotoxic symptoms were visible, and no differences in canopy height or width, or flowering were observed with respect to treatments.

Turbo application timing effects on weed control (scale is 0 = no weeds to 5 = heavy infestation) observed 3, 5 and 8 weeks after emergence of Atlantic potatoes, Scottsbluff, 1994.

Application Weeks after Planting	Weeks After Emergence — 3	5	8
	weed control scale, 0 to 5		
1 *	1.6[A]	1.4[A]	0.9[A]
2 *	1.1[A]	0.8[AB]	0.1[B]
3 *	0.4[B]	0.3[B]	0.1[B]

** There was no significant difference between rates (1.5-3 pt/ac) of urbo applied; therefore, all three rates were combined.*
Numbers in columns followed by different letter are significantly different at the 95% level using least significant differences (LSD 0.05).

Vine Desiccation/Diquat Trial

Diquat was tested at different rates and application timings in 1994. Leaf and stem desiccation, regrowth and skinning were measured during the period after initial desiccant application.

Observations (1994): Upto 7 days after treatment (DAT), before a second application, the higher rate of Diquat (2 pt product/ac) shows significanly more desiccation of leaves and stems than the lower rate (1 pt/ac). At 14 DAT, leaf desiccation was about the same for the two rates. However, stem desiccation at 14 DAT was still greater with a single 2 pt/ac application than two applications of 1 pt/ac. At 21 DAT, only the single 1 pt/ac application of Diquat showed significantly less stem desiccation that the best treatments. Regrowth did not play a significant role in Diquat efficacy in 1994. Most regrowth was observed at 14 DAT. Tubers from treated plants started to show a greater degree of skin set at 14 DAT as indicated by a decline in the percent of the surface skinned. At 21 DAT, the single dose applications showed significantly less skinning than the check. The multiple application treatments further lowered skinning. There was no significant effect on harvested yield (21 DAT) nor on specific gravity.

Conclusions (1994): Compared to the lower rate (1 pt Diquat/ac) and the check, the higher rate (2 pt Diquat/ac) gave greater leaf and stem desiccation, and lower regrowth at the time of harvest (21 days after treatment). There was no difference between rates with regard to surface skinning. With regard to leaf desiccation and regrowth, multiple applications showed no difference compared to single applications. However, multiple applications of the lower rate showed more stem desiccation especially at harvest than the single application. There was no difference with the higher rate. Tubers from all multiple applications of either rate showed less skinning at harvest than tubers from the single applications.

Desiccation efficacy and Skinning after Diquat treatments, Scottsbluff, 1994.

Diquat pt/ac	Percents, days after treatment 7 days	14 days	21 days
a: Leaf Desiccation			
0	21[A]	36[A]	83[A]
1	68[B]	90[B]	100[B]
1+1	71[B]	90[B]	100[B]
1+1+1	71[B]	98[B]	100[B]
2	91[C]	98[B]	100[B]
2+1	89[C]	100[B]	100[B]
2+2	90[C]	100[B]	100[B]
b: Stem Desiccation			
0	0[A]	4[A]	13[A]
1	13[A]	45[B]	73[B]
1+1	18[A]	49[B]	88[C]
1+1+1	15[A]	53[B]	94[C]
2	46[B]	80[C]	91[C]
2+1	48[B]	83[C]	98[C]
2+2	43[B]	90[C]	98[C]
c: Skinning			
0	67[A]	51[A]	40[A]
1	62[A]	43[AB]	24[B]
1+1	59[A]	35[B]	11[C]
1+1+1	57[A]	39[B]	13[C]
2	53[A]	38[B]	26[B]
2+1	54[A]	41[B]	13[C]
2+2	61[A]	35[B]	6[C]

Numbers in columns in each section not followed by the same letter are different at the 95% probability level using least significant differences.

Insecticide/Aztec Trial

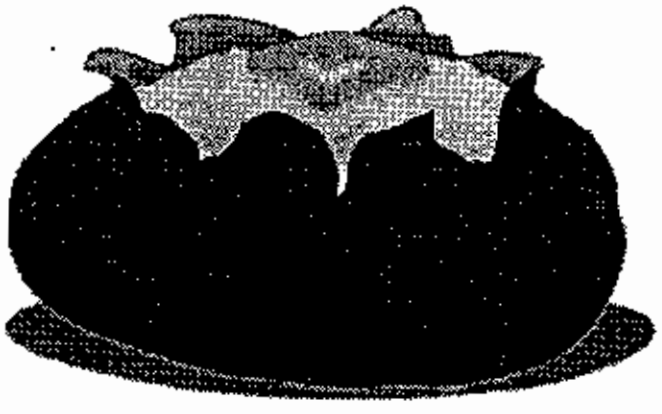
Wireworm has been repeatedly reported in potato fields south of the Platte River. They seem to be especially attracted to the russet potato variety Krantz. Due to this problem and the anticipated release of Aztec for wireworm control, a trial was established in Madrid.

Observations (1994): In this trial, 48% of the Krantz tuber from untreated plants were affected by wireworms and 24% of the check tubers had more than 3 wireworm holes. Aztec applied below the seed piece increased yields (12-29%) of tubers not graded out for wireworms; so other factors were also involved. When applied onto the seed pieces, Aztec depressed yield by 16%. The number of tubers with wireworm holes at harvest was greatly decreased. Assuming tubers with one or two holes would still be marketable, less than 5% of the yield would have more than 2 holes with AZTEC treatments. The checks, on the other hand, would have 24% grade-outs, tubers with more than 2 holes. Mocap also increased yield 22% and the number of tubers with wireworm holes at harvest was also significantly decreased. Six percent of the tubers would have more than 2 holes with Mocap treatment.

Effect of AZTEC and MOCAP on the incidence of wireworm holes in Krantz potatoes, Madrid, NE, 1994.

lb product / 1000 ft	Yield cwt/ac	% Yield with Wireworm Holes	% Tubers with More Than 3 Holes
untreated	240	53	24
Mocap @2.1	292	16 **	6 **
Aztec @.48	270	19 **	4 **
Aztec @.64	296 *	17 **	4 **
Aztec @.96	310 *	11 **	4 **
Aztec @.64^	202	15 **	5 **

^This treatment was placed atop the seed piece; all other treatments were place below seed piece.
** These data were different from check at the 90% probability level.*
*** These data were different from check at the 95% probability level.*



Insecticide/Admire Trial

With Admire's recent registration on potato, it was tested for its effects on Colorado potato beetle population and foliar damage.

Observations (1994): Both Admire treatments and the Thimet treatment significantly lowered the number of beetles observed on the plants in the plots. The higher rate of Admire was the best treatment; there were significantly less beetles at this rate than in Thimet-treated plots. The plants in the plots treated with this Admire rate were the only ones to have significantly less leaf defoliation compared to the check, and the leaf defoliation was also significantly less than Thimet and the lower Admire rate.

Effect of Admire on Colorado potato beetles population on a scale of 0 (none) to 5 (highest) and the percent of leaf defoliation on Atlantic potatoes on 8/12/94, Scottsbluff, NE.

	Col. Pot. Beetle Population Scale 0-5	Percent Leaf Defoliation Scale 0-100%
No Treatment	2.25 A	19 A
Thimet 20G @ 1.0 lb/1000'	1.25 B	16 A
Admire 2F @ 0.9 fl oz/1000'	1.50 B	16 A
Admire 2F @ 1.2 fl oz/1000'	0.63 C	6 B

Numbers in columns followed by different letter are significantly different at the 95% level using least significant difference (LSD 0.66).

Insecticide/Mocap Trials

Starting in 1993, Mocap has been tested for control of common scab. The mode of action is presumed to be through the control of springtails (see Nebraska Potato Focus, 1991). In 1993, Mocap had no effect on common scab, black scurf, hollow heart, yield, specific gravity nor chip color. However, in 1994, Mocap decreased the number of tubers with common scab or black scurf on Atlantic potatoes grown in Alliance. Mocap also tended to decrease the amount of tuber surface infected by either of these diseases. There was no effect on bulk yield. Could the difference between this trial and last year's be the wet, cold condition of 1993?

Effect of Mocap on the incidence of common scab and black scurf on Atlantic potatoes, Alliance, 1994.

Product	Common Scab % of Tubers	Common Scab % Surface	Black Scurf % of Tubers	Black Scurf % Surface
untreated	22 A	18 A	36 A	35 A
THIMET	17 B	18 A	35 AB	30 A
MOCAP	15 B	10 B	26 B	20 A

Numbers in columns followed by different letter are significantly different at the 90% level using least significant difference (LSD 6.10).

WYOMING RESEARCH (1994)

Gary D. Franc, Research Plant Pathologist
University of Wyoming, Laramie

Tuber Injury and Early Blight

The relationship of tuber injury to dry rot decay caused by early blight, *Alternaria solani*, and the storage environment that minimizes storage loss has not been determined. The goal of this research is to increase tuber market quality by reducing bruise related losses caused by the early blight fungus. This is a preliminary report of data summarized to date.

Potato tubers (cv. Gemchip) were harvested by hand to minimize bruising injury and three different bruising levels were established. Bruising levels are designated in the Table as B1, B2 and B3 and indicate progressively increasing levels of injury. Fungus spores were applied in known concentrations to tubers immediately after injury. Four inoculum levels (0, 10, 100 and 1000 spores/gram soil) were used. After wound healing at 55 F for approximately 1 week, tubers were stored at two temperatures (40 F and 50 F) and were rated for tuber decay. The number of lesions per tuber and the average volume of tuber decayed per lesion was measured.

More lesions resulted as tuber injury increased for tubers stored at 40 F. This trend was not evident for tubers stored at 50 F. Approximately twice as many early blight lesions developed on tubers stored at 50 F than tubers stored at 40 F. The average volume of tuber flesh decayed was approximately 3 times greater for tubers stored at the warmer temperature. Data also show a general increase in the number of lesions per tuber as early blight spore concentration increased in soil. The volume of tuber flesh decayed per lesion did not appear to be related to inoculum concentration in soil. Complete data analysis will be done after all tubers are evaluated. This study is being repeated using cv. Monona.

Incidence of early blight tuber decay associated with each level of tuber injury at each storage temperature. Data are averaged over inoculum levels.

Temperature degrees F	Bruising Level	Lesions per Tuber	Volume per Lesion
40	B1	0.29	58.54
	B2	0.34	67.28
	B3	0.39	90.19
mean:		0.34	72.00
50	B1	0.66	258.28
	B2	0.76	227.37
	B3	0.68	220.08
mean:		.70	235.24

The incidence of early blight tuber decay associated with each inoculum level at each storage temperature. Data are averaged over bruising levels.

Temperature degrees F	Inoculum Level	Lesions per Tuber	Volume per Lesion
40	0	0.33	40.49
	10	0.43	98.62
	100	0.80	51.43
	1000	3.40	54.26
mean:		1.24	61.20
50	0	0.78	256.62
	10	0.71	226.19
	100	1.72	204.60
	1000	7.01	195.67
mean:		2.56	220.77

Early Blight Fungicides

Early blight is an annual disease problem in our production region. The alternating wet and dry conditions associated with overhead irrigation and/or dew is ideal for fungus sporulation and early blight spread. Research shows that properly timed fungicide applications effectively reduce early blight severity, and increases tuber yield and quality. Labeled fungicides must be tested to determine their efficacy under our growing conditions. Also, field-testing is needed to identify new, alternative compounds for early blight control.

Early blight field trials were conducted at the University of Wyoming Research and Extension Center at Torrington, WY in 1994. Twenty-two fungicide treatments were compared to an untreated check for early blight control on cv. Snowden. All disease resulted from naturally occurring inoculum. Results showed that by August 17, all fungicide treatments significantly reduced the number of early blight lesions per leaflet when compared to the untreated check ($P<0.05$). Also, treatment 10 (Bravo Zn) had significantly fewer lesions per leaflet than treatments 2 (TD-2350, low rate) and 18 (EXP10386B, low rate) but was not significantly different from the remaining fungicide treatments ($P<0.05$). Treatments 2 and 18 were statistically equivalent to all other fungicide treatments, as well ($P<0.05$).

By September 16, 24 days after the last fungicide application, none of the treatments had significantly less disease than the untreated check ($P<0.05$). However, treatment 11 (ASC-67098-Z) had significantly fewer lesions per leaflet than did treatments 2 (TD-2350, low rate), 3 (TD-2350, high rate), 16 (Rovral) and 19 (EXP10386B, high rate) ($P<0.05$). The low rate of EXP10386B (treatment 18) was not significantly different from treatment 11 ($P<0.05$). Therefore, the differences measured between treatments 11, 18 and/or 19 may not be real. None of the fungicide treatments significantly affected total tuber yield and grade ($P<0.05$).

Although early blight lesions first appeared approximately July 11, and the disease was found throughout the plot by July 26, disease pressure remained relatively low during the 1994 season. This made it difficult to determine

treatment effects. However, several of the new formulations showed promise for early blight control in our production area. Additional fungicide studies are planned for 1995. Growers will be able to visit the research plots at the Torrington R/E Center field day, currently scheduled for July 28, 1995.

The effect of foliar fungicides on potato early blight disease severity, Torrington, WY.

Number and Treatment	Lesions per leaflet August 17	Sep 16
1 Untreated check[1]	1.69A[2]	25.72ABC
2 TD-2350 50DF (0.5 lb ai/A)	0.90 B	27.83AB
3 TD-2350 50DF (1.0 lb ai/A)	0.60 BC	27.73AB
4 TD-2343 33.6F (1.125 lb ai/A)	0.21 BC	16.26 BC
5 TD-2343 33.6F (1.5 lb ai/A)	0.16 BC	16.62 BC
6 Maneb 75DF (1.5 lb ai/A)	0.11 BC	25.81ABC
7 Penncozeb 75DF (1.5 lb ai/A)	0.34 BC	18.99 BC
8 Bravo 720 (1.5 pt/A)	0.12 BC	21.45ABC
9 Bravo Ultrex 82S (1.4 lb/A)	0.13 BC	19.03 BC
10 Bravo ZN (2.125 pt/A)	0.02 C	16.84 BC
11 ASC-67098-Z (1.275 lb/A)	0.11 BC	11.55 C
12 ASC-66897 SDG (1.875 lb/A)	0.23 BC	14.40 BC
13 Terranil 6L (1.5 pt/A)	0.16 BC	20.36 BC
14 Zeneca 504 (0.1 lb ai/A)	0.16 BC	15.15 BC
15 Kocide 50DF (4.0 lb/A)	0.35 BC	17.35 BC
16 Rovral (0.75 lb ai/A) + Triton (0.25% V:V)	0.69 BC	28.44AB
17 EXP1037A (0.75 lbs ai/A) + Triton (0.25% V:V)	0.50 BC	21.93ABC
18 EXP10386B 4.5 SC (42.7 fl oz/A) + Triton (0.25% V:V)	0.89 B	26.13ABC
19 EXP10386B 4.5 SC (64.0 fl oz/A) + Triton (0.25% V:V)	0.33 BC	36.14A
20 EXP10566A (43.6 fl oz/A)	0.22 BC	22.67ABC
21 EXP10554A (53.3 fl oz/A)	0.19 BC	17.12 BC
22 Rovral (0.5 lbs ai/A) + Penncozeb (1.0 lbs ai/A) + Triton (0.25% V:V)	0.14 BC	15.77 BC
23 Bravo 720 (0.56 lbs ai/A pre-vine closure + 1.125 lb ai/A post-closure)	0.25 BC	18.21 BC

[1] Treatments were applied in a total volume of 30 gallons per acre at 30 psi boom pressure.
[2] Treatment means followed by different letters differ significantly (P=0.05). Duncan's multiple range test was used for mean separation.

Snowden and Ranger Russet: Cultural Profile

David Curwen
Extension Specialist
University of Wisconsin, Madison, WI

In 1994, cultural profile trials were conducted with two recently released varieties, Snowden and Ranger Russet. Cultural profile trials are designed to gain more information about the cultural practices needed for newly released varieties. In-row spacings and supplemental nitrogen rates were investigated. The varieities were harvested in September.

In-Row Spacing Treatments

In-row plant spacings were 9, 12 and 15 inches. The row spacing was kept 36 inches. Snowden and Ranger Russet were planted on May 2.

Supplemental Nitrogen Treatments

Five rates of supplemental nitrogen: 0, 80, 160, 240 and 320 lbs N/ac were tested. Each rate was split; the half was applied at emergence on May 31, and the second half was applied at about tuberization (June 16 for Snowden and June 20 for Ranger Rus.). Each variety received 30 lbs N/ac preplanting.

Observations (1994): In general, total yields were lower and hollow heart greater than expected. The reason(s) for this are unknown. Basic fertility of the field was very good and all pest problems (including late blight) were controlled. Overall vine growth seemed good but slightly less vigorous.

Ranger Russet is primarily used for early processing. Increasing the in-row spacing from either 9 or 12 inches to 15 inches significantly increased both the % US#1 and the % of 10-13 oz tubers. The 12 and 15 inch spacings also were associated with more hollow heart although this was not significant. Increasing the supplemental nitrogen rate to 160 lbs N/ac significantly increased total yield, the % US#1 and the % of 10-13 oz tubers. Further increases in supplemental nitrogen had no positive effects on yield or tuber size. Increased tuber size was associated with hollow heart. The higher supplemental nitrogen rates did significantly reduce specific gravity compared to the 0 and 80 lbs rates.

Snowden's acreage is rapidly increasing. While some information is available on spacing and nitrogen requirements, more data is needed and thus Snowden was included in the cultural profile trial. Increasing the in-row spacing significantly affected only tuber size. Both the 12 and 15 inch spacings increased the % of tubers greater than 3.5 inches in diameter compared to the 9 inch spacing.

Effects of in-row spacing and supplemental nitrogen rate on yield, tuber size, hollow heart and specific gravity of Snowden, Hancock, WI, 1994.

Treatment	Total Yield (cwt/A)	US1As (%)	>3.5"Dia (%)	Hollow (% of As)	Gravity
Spacing:					
9 inch	338	92	2	19	1.084
12 inch	330	91	2	26	1.085
15 inch	314	92	5	27	1.084
	ns	ns	*	ns	ns
Nitrogen:					
0 lb/A	205	86	1	2	1.080
80 lb/A	327	91	1	12	1.085
160 lb/A	363	94	3	20	1.086
240 lb/A	377	93	5	37	1.085
360 lb/A	362	94	5	49	1.085
	*	*	*	*	*

*ns = not significant; * = significance @ 95% probability level*

There was no significant spacing effects on total yield, US#1 and hollow heart. Increasing the rate of supplemental nitrogen did, however, significantly affect all these parameters. Increasing the rate to 160 lbs/ac significantly increased total yield and the % US#1. Further increases in supplemental nitrogen rate did not increase either total yield or % US#1. Compared to 0 and 80 lbs N/ac, the highest nitrogen rates, 240 and 360 lbs/A, significant increased the % of tubers over 3.5 inches in diameter. These rates also significantly increased hollow heart. All rates were associated with significant increases in specific gravity compared to checks.

Summary: The data for Ranger Russet and Snowden suggest that the optimum spacing for each is about 12 inches which is the best compromise considering total yield, tuber size and hollow heart incidence. Supplemental application of 160 lb N/ac gave the best yield, tuber size and specific gravity. Higher rates tended to give larger tuber size,but this didn't always give larger yields. These tubers also tended to have more hollow heart.

Effects of in-row spacing and supplemental nitrogen rate on yield, tuber size, hollow heart and specific gravity of Ranger Russet, Hancock, WI, 1994.

Treatment	Total Yield (cwt/A)	US1As (%)	10-13oz (%)	Hollow (% of As)	Gravity
Spacings:					
9 inch	256	84	7	18	1.090
12 inch	275	85	9	24	1.090
15 inch	216	79	15	29	1.090
	ns	*	*	ns	ns
Nitrogen:					
0 lb/A	165	78	4	17	1.091
80 lb/A	245	86	8	19	1.091
160 lb/A	299	87	15	28	1.090
240 lb/A	273	81	10	26	1.089
320 lb/A	263	81	15	27	1.089
	*	*	*	ns	*

*ns = not significant; * = significance @ 95% probability level*

A survey reported by Potato Business World showed that 66% of the U.S. public wanted the government to fund biotechnology research. Those supporting biotechnology funding believed that it would improve food quality and productivity, and also have environmental and economic benefits. In a national telephone survey conducted by Colorado State University, consumers were asked about their willingness to buy genetically-engineered food. Seventy-one percent of the consumers felt that biotechnology can benefit them and 64% supported the use of biotechnology to produce food.

Percent of people finding biotechnology acceptable or not for selected areas.

Area	% Acceptable*	% Unacceptable*
Herbicide-Resistance Crops	64	18
Insect Resistance Crops	63	19
Ice-Minus Bacteria	56	21
Disease-Resistance Animals	53	27
Leaner Meat (PST)	44	31
Increased Meat (BST)	37	42
Food Flavorings	33	43
Sport Fish	31	49

**The remaining percent were undecided or neutral.*

Consumer willingness to buy food produced using biotechnology.

Biotech provides	More Willing*	Less Willing*
same quality, 10% cheaper	59%	31%
better quality, 10% more expensive	43%	48%

**The remaining percent indicated no difference.*

Biotechnology ranking by consumer focus groups.
The scale was 1 (strongly oppose) and 5 (strongly support).

Insect-resistant crops	– 4.6
Medicine-producing bacteria	– 4.5
Waste-cleaning bacteria*	– 4.2
Herbicide-resistant crops	– 4.0
Medine-producing cows	– 3.2

**oil spills and toxic waste*

Genetic Engineering Pot Pouri

Alexander D. Pavlista
Extension Potato Specialist
University of Nebraska, Scottsbluff

The Flavr Savr tomato is genetically altered to prolong shelf-life, i.e., delay ripening. With its recent release, it was time to review some surveys on public opinion. This is even more important to our industry with the upcoming releases of genetically altered potatoes. Besides the work being done by Hybri Tech, researchers at Leicester University in the U.K. are looking at altering potatoes to produce antibodies against human diseases. In other words, eating a potato will not only give nutrition but will immunize.

To return to the Flavr Savr tomato, did you know that its release is estimated to cost $67,000,000. "That's no cheap tomato!" According to this estimate of Calgene's costs released by the Harvard Business School, the projected costs over five years are $20 million for research and development, $10 million for corporate overhead and $37 million for marketing and sales. However, the rewards can be much bigger. Estimated by the Harvard Business School, the fresh tomato market is valued at $3.5 billion. If Flavr Savr achieves a 25% penetration into the premium market in five years, it will have sales of $380 million. These figures may be optimistic but this market will sure be interesting to watch.

Luther Burbank, the developer of the "Burbank" variety,once said in 1906 -- "We will manipulate life in a way never intended by nature."

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