PHREC 98-05e

NEBRASKA

POTATO EYES

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Lab to Label

Phase II. Development

The third part of this series concerns the transfer of chemical testing from Research (or Discovery) to Development. Phase II determines the feasibility of a compound to become a product.

Field Testing

One to five compounds per year get into the early development stage. Compounds are synthesized in larger quantities, several pounds, and sent to university researchers throughout the country to test for a specific affect and on a specific crop. These tests are done at many locations to determine broad efficacy data and to collect data for potential registration. Efficacy is evaluated in different climatic conditions and soil characteristics.

"Material Safety Data Sheets" (MSDS) are prepared and accompany test samples. MSDSs identify the compound and indicate the proper protective clothing to be worn by the researcher. Physical data are included such as volatility, solubility, and melting and freezing points. Flammable limits and explosiveness data are given. Toxicity data included are acute oral (rat) and dermal (rabbit) LD_{50}s, acute inhalation LC_{50}, eye and dermal irritation and sensitivity. Also included on the sheets are first aid information and disposal procedures.

Manufacturing technology for these compounds are studied for less expensive synthesis pathways and methods that may be used in large scale production. Preliminary cost of production estimates are made and a pilot plant may be built.

Safety Testing

Environmental tests on these compounds are conducted to determine their volatility, breakdown by light and microbes, leaching and adsorption properties, soil dissipation, and flammability and explodability. Formulations are tested for compound and storage stability.

Residue studies on environmental persistence and fate are initiated. As testing progresses, residue studies are expanded to include to livestock, fish, drinking water, milk and eggs, other foods, processed foods and feed, and crops. Data are collected to determine tolerance limits. Ground water monitoring studies are conducted.

Metabolic studies continue on plant and animal metabolism of test compounds. Metabolic breakdown products of test compounds are studied to determine their safety in animals. Mode of action(s) is determined.

Toxicology testing continues. Studies gradually move from acute (short-term, 7-day) toxicity to 21-day studies and later to chronic toxicity (long-term, 90-days to two years). Chronic toxicity studies include feeding, inhaling and neurological effects. As Phase II progresses and compounds show commercial efficacy, tests are conducted on cancer risk potential, oncogenicity and teratogenicity studies. The potential for chromosome or gene damage is determined.

As compounds advance, toxicity data are required to determine any potential effects on wildlife. Toxicity tests are conducted on birds, usually quails and ducks, fish such as sunfish and trout, fresh water invertebrates, estuarine and marine animals such as clams and shrimp, and wild mammals. A key study is determining any bio-accumulation potential through food chains. A potential would immediately eliminate a potential product.

Only about one compound every two to three years gets through Phase II and advances to Phase III Registration. This will be covered in part four of this series.

Inside this issue...

Testing for Late Blight and Silver Scurf

As the potato storage season begins, there's concern on checking tubers for late blight and silver scurf. The following is a testing protocol suggested by pathologists at Colo. and Wash. State Universities.

1. Collect 100-400 unwashed tubers randomly from about two feet below the pile's surface. Ideally, tubers should be medium sized, 4-10 oz. or 2½-4 inches diameter. This is may done after 2-4 months storage.

2. Place subsamples, e.g., 10 tubers, in plastic bags with rolled up moist paper towels in the bottom and a few small holes punched at the top

3. Close bag. Store samples in the dark at room temperature, 65-70°F for three weeks. Do not let the bags dry out.

4. After this period, remove soil from tubers. Silver scurf may be observed on the skin with a strong hand lens or stereoscope at a magnification of 60X. Silver scurf appear like tiny, translucent, Christmas trees (conidiophores) on the surface. Scoring is the percentage of tubers with silver scurf.

5. Wash tubers and examine for late blight lesions. Lesions are irregular-shaped, brown to purple areas. It may expend a half-inch below the surface, and have a reddish brown coloring and an irregular border. With time, these lesions get darker and sink deeper into the tuber. Tuber breakdown is due to secondary organisms invading through the lesions. True identification requires slicing and incubating tubers, or removing tissue from lesions and incubating it on potato dextrose agar. Following incubation, spores are identified with a high-powered microscope.

Samples may be sent to the Panhandle R&E Center for identification and rating.

Alexander D. Pavlista

CULTIVARS: NorValley

The release of NorValley (ND2417-6) was announced in Summer, 1996, by North Dakota State University. NorValley is a white-skinned variety for both the chip and fresh markets. This selection is expected to replace acreage of Norchip and possibly Snowden. It was selected in 1985 from a cross of Norchip and ND860-2 at NDSU by Dr. Robert Johansen. This variety was tested for three years (1993-95) in the North Central Regional Trials conducted at Alliance and, during the same period, in the Nebraska trials around Alliance and Central City, and in the Snack Foods Assoc. chip trials, 1994-96.

The following summarizes its properties and some of the field data.

Summary of Properties:

Purpose – multi-purpose: chipping, tablestock and flake market
Maturity – mid-season, about like Atlantic
Vine – semi-erect and medium height
Flowers – white
Leaves – medium green with semi-closed silhouette
Eyes – shallow, intermediate in number, evenly distributed
Tubers – round to oval, smooth white skin with yellow undertones
Specific Gravity – similar to Norchip, lower than Atlantic and Snowden
Dormancy – medium
Yield – higher than Norchip and Snowden, similar to Atlantic
Storage – reported to have cold-chipping properties
Sugars – very low levels
Glycoalkaloids – low (4.3mg/100g fresh weight)
Cooking Quality – comparable to Red Norland and Russet Burbank
Bruising – resistant to blackspot
External Defects – none reported
Internal Defects – resistant to hollow heart; lower internal defects than Atlantic and Snowden
Disease – resistant to common scab, no problem with seed decay, no unusual problems with early blight, dry rot, soft rot, PVX nor early dying; some susceptibility to PVY reported
Herbicide Sensitivity – none reported

Conclusions and Comments

NorValley's principle reason for release is its ability to produce color-acceptable potato chips after storage at 43°F without reconditioning. Three-year averages of Agtron readings of potato chips following 7 months storage at 43°F were 61 for NorValley, 54 for Snowden and 48 for Norchip. (Agtron readings of 55 and higher are considered sufficiently light for chipping.) NorValley was also reported to maintain glucose levels below 2 micromoles/gram fresh weight at 43°F. (This glucose level is needed to produce acceptably light-colored chips.)

Yields of NorValley tend to be similar to Atlantic and Snowden (Tables 1-4). Specific gravity (and % solids) are lower than Atlantic and Snowden, more like Norchip (Tables 1-4). Chip color after curing is like Atlantic, Snowden and Norchip (Tables 3 and 4). In the No. Central Regional Trial of 1995, the Agtron chip readings after curing from three irrigated sites were 54 for NorValley, 56 for Atlantic and 58 for Snowden. In 1994, NorValley's readings were similar to Norchip's. In Nebraska, NorValley may be less susceptible to common scab than Atlantic and Snowden but more so than Norchip (Table 4).

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CULTIVARS: NorDonna

The release of NorDonna (ND1871-3R) was announced in Spring, 1995, by North Dakota State University. NorDonna is a red-skinned variety for the fresh market. This selection is expected to replace acreage of Red Norland and Red LaSoda. It was selected in 1982 from a cross of two other experimental lines at NDSU by Dr. Robert Johansen and named after his wife, Donna. This variety was tested for three years (1991-93) in the North Central Regional Trials conducted at Alliance and Scottsbluff and for four years (1992-95) in the Nebraska trials around Alliance, Bridgeport, Central City, Imperial, Kearney, and North Platte.

The following summarizes its properties and some of the field data

Summary of Properties:

Purpose – fresh market; baking, boiling and micro- waving; soups and salads; excellent flavor, texture and appearance, no after-cooking discoloring
Maturity – medium-late; later than Red Norland, earlier than Red Pontiac, similar to Red LaSoda
Emergence – normal
Vine – medium-large; spreading type
Flowers – reddish-purple
Leaves – medium green with semi-open silhouette
Eyes – shallow, well-distributed
Tuber – bright-red-skinned, darker than Dark Red Norland and white-fleshed **Tuber Shape**– oval to round
Set – greater than Dark Red Norland and Red LaSoda
Dormancy – medium-long
Yield – slightly greater than Red Norland and slightly less than Red LaSoda
Storage – reported to hold red skin color in storage
Sugars – high, doesn't process well
Glycoalkaloids – extremely low (0.2mg/100g)
Bruising – susceptible to blackspot
External Defects – not observed
Internal Defects – no hollow heart
Disease – problems with seed decay, tolerant of common scab, may be susceptible to early blight, early dying, dry rot, soft rot, PVX and PVY.
Herbicide Sensitivity – none reported

Conclusions and Comments

NorDonna's principle strength is its bright red skin color (Table 2) and its ability to hold that color in storage. Other strengths include its cooking qualities, lack of hollow heart, and very low glycoalkaloids. Weaknesses include a susceptibility to dry and wet rots, early blight, and seed decay.

Yields of NorDonna under irrigated conditions tend to be higher than Red Norland and Dark Red Norland, and Fontenot, but lower than Red LaSoda and Red Pontiac (Tables 1, 3 and 4). Percent US#1 tubers is similar to that of the Norlands.

The percent of NorDonna tubers with common scab (*Streptomyces scabies*) is slightly higher than the Norlands but slightly lower than Red Pontiac and Red LaSoda (Tables 3 and 4). In the 1991 and 1993 No. Central trials, NorDonna tubers had 50% of their surface with common scab. Scab lesions were reported as large and rough. The percent of NorDonna tubers with black scurf (*Rhizoctonia solani*) is like Red LaSoda, less than Dark Red Norland, and more than Fontenot (Table 4).

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CULTIVARS: NorValley, Continued from page 2

Table 1. Performance of NorValley in irrigated trials in North Dakota, 1993-96, averages of eight trials.

	US#1 Yield cwt/ac	US#1 %	Specific Gravity
NorValley	330	88	1.082
Norchip	294	86	1.084
Atlantic	321	92	1.093
Snowden	312	91	1.095

Table 2. Performance of NorValley in the North Central Regional Trials, 1993-1995; irrigated sites averaged (Alberta, Indiana, Iowa, Michigan, Minnesota, Nebraska, Ontario, South Dakota, and Wisconsin)

	Yield of US#1 (cwt/ac)			
	1993	1994	1995	means
NorValley	277	330	375	330
Norchip	330	294	294	303
Atlantic	.	.	357	
Snowden	.	.	339	
	Percent Solids			
	1993	1994	1995	means
NorValley	20.2	19.8	18 6	19.5
Norchip	20.2	20.7	19 0	20.0
Atlantic	.	.	21.0	
Snowden	.	.	20.5	

Table 3. Performance of NorValley in the Snack Foods Assoc. Trials, 1994-1996

	US#1 Yield cwt/ac	Specific Gravity	Chip Color (Agtron)
NorValley [1]	313	1.078	60
Atlantic [1]	340	1.090	58
Snowden [2]	336	1.093	60
Norchip [3]	269	1.080	59

[1] mean of 1994-96, [2] mean of 1995-96, [3] mean of 1994-95

Table 4. Performance of NorValley in Nebraska, 1993-1995.

	US#1 Yield cwt/ac	Specific Gravity	Percent C. Scab [2]	Percent Bl. Scurf [2]
NorValley [1]	275 a [3]	1.076 C [4]	14 BC	18 a
Atlantic [1]	325 a	1.090 A	32 A	16 a
Snowden [1]	280 a	1.084 B	25 AB	12 a
Norchip [2]	302 a	1.079 C	5 C	9 a

	Chip Color (Agtron Readings)		
	1 Month [5] @ 60°F	+5 Mons. [5] @ 50°F	+5 Mons.[5] @ 40°F
NorValley [1]	59 AB	62 a	57 a
Atlantic [1]	61 A	62 a	58 a
Snowden [1]	62 A	64 a	62 a
Norchip [2]	57 B	61 a	57 a

[1] mean of 8 trials, [2] mean of 5 trials

[3] Numbers followed by lower case letters are not significantly different at the 90% level.

[4] Numbers followed by upper case letters are not significantly different at the 95% level.

[5] Potato tubers were cured for one month at 60°F. One-third was chipped (mean of 8 trials). One-third was stored for 5 months at 50°F then reconditioned and chipped and the other third was stored for 5 months at 40°F then reconditioned and chipped. The storage data are means of two trials.

CULTIVARS: NorDonna, Continued from page 2

Table 1. Performance of NorDonna in irrigated trials in North Dakota, 1993-95, averages of six trials.

	US#1 Yield cwt/ac	US#1 %	Hollow Heart %
NorDonna	303	93	0.4
Red Norland	312	91	0.8
Red Pontiac	330	92	1.8
Red LaSoda	375	89	2.8
Fontenot	285	89	0 1

Table 2. Skin color intensity of red varieties in North Dakota, 1994-95; visual rating scale = 1 (white), 3 (pink), 5 (red), 7 (dark red)

	4-site average
NorDonna	5.9
Red Norland	4.2
Red Pontiac	3.9
Red LaSoda	4.6
Fontenot	5.8
Viking	3.8

Table 3. Performance of NorDonna in the North Central Regional Trials, 1991-1993; irrigated sites averaged (Alberta, Indiana, Iowa, Michigan, Minnesota, Nebraska, Ontario, South Dakota, and Wisconsin)

	Yield of US#1 (cwt/ac)			
	1991	1992	1993	means
NorDonna	375	339	392	369
Red Norland	303	294	330	309
Red Pontiac	455	357	392	401
	Percent Tubers with Common Scab			
	1991	1992	1993	means
NorDonna	12	5	20	12
Red Norland	6	4	16	9
Red Pontiac	12	14	22	16

Table 4. Performance of NorDonna in Nebraska, 1992-1995.

	Yield cwt/ac	Percent US#1	Specific Gravity	Percent C. Scab	Percent Bl. Scurf
NorDonna [1]	290 B [4]	92 B	1.068 B	6 ab [5]	12 b
Red LaSoda [1]	345 A	97 A	1.069 B	16 a	14 ab
Dk Red Norland [2]	266 B	91 B	1.064 C	0 b	23 a
Fontenot [3]	245 B	96 A	1.076 A	1 b	5 b

[1] mean of 9 trials, [2] mean of 7 trials, [3] mean of 4 trials

[4] Numbers followed by upper case letters are not significantly different at the 95% level.

[5] Numbers followed by lower case letters are not significantly different at the 90% level.

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Updates

Risk Assessments

The EPA has released requests for risk data on several active ingredients. With this release, anyone can submit data on products containing these ingredients. Sixteen ingredients were released in Aug and Sep, and 24 will be in the coming months. Of the first 16, products used in potato production are: Thimet/Phorate, Mocap, Cygon/Dimethoate, and Guthion.

Book Available

Just published is "Processing Vegetables: Science and Technology" published by Technomics, Lancaster, PA (800-233-9936). Chapter 10 is "Potatoes: Chip and French Fry Processing" by A.D. Pavlista and J.C. Ojala, pages 237-284. The book also includes chapters on onion, sweet corn, tomato, pepper, canning, freeze drying, *et* al. It's available for US$99.95 + $4 S/H.

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