Performance of

Red and Russet Potato Varieties

Grown in the Red River Valley

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Potatoes, by far the most important commercial horticultural crop grown in North Dakota, now have an on-the-farm value to the state of around $25-30 million. Production of potatoes in Minnesota and North Dakota has jumped from 31.5 million hundredweight in 1969 to 35.5 million hundredweight in 1971. Most of the four million hundredweight increase in the two states during the three years has been in growing processing potatoes used mainly for chips, dehydrated products and frozen French fries.

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The most popular red varieties produced for the fresh or the washed trade in the Red River Valley are Norland, Red Pontiac and, to some extent, Chieftain. For chips Kennebec, Norchip and Monona are important varieties and for frozen French fries Kennebec and, to a certain degree, Norchip are the two principal varieties. For flakes and other forms of dehydration, Norchip, Irish Cobbler, Kennebec, Red Pontiac, Norgold Russet and Norland are the main varieties used. In certified seed production Kennebec, Norland, Norchip, Norgold Russet, Red Pontiac and Red LaSoda were the top six varieties produced in 1971.

Table 1. U.S. No. 1 yield (cwt/A) potato varieties grown at Grand Forks and Park River, North Dakota, 1961-1971.

Grand Forks	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	Average
Norland	144	164	214	111	130	142	115	207	166	209	201	164
Viking	142	241	214	189	197	185	147	278	177	310	261	213
Red Pontiac	192	216	251	210	219	222	172	253	231	162	291	220
Chieftain	—	—	213	161	—	227	150	283	208	268	281	—
Norgold Russet	111	188	207	160	124	123	110	231	163	184	213	165
Russet Burbank	89	115	157	109	170	54	98	128	102	77	179	116
Park River												
Norland	151	156	105	163	166	264	122	246	87	221	326	182
Viking	154	167	127	181	228	275	135	313	157	206	283	202
Red Pontiac	202	196	117	252	270	258	137	353	187	171	415	233
Chieftain	—	—	—	—	—	257	129	304	133	238	308	—
Norgold Russet	152	126	117	177	203	284	93	260	99	174	323	183
Russet Burbank	93	101	84	137	198	155	56	193	70	132	260	134

Table 2. Per cent total solids of potato varieties grown at Grand Forks and Park River, North Dakota, 1961-1971.

Grand Forks	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	Average
Norland	20.5	21.2	18.8	18.6	18.6	19.0	21.4	19.2	19.4	18.6	19.4	19.5
Viking	20.9	22.2	20.5	20.9	20.1	20.3	23.3	19.2	19.4	19.4	19.9	20.6
Red Pontiac	19.4	21.4	19.2	19.2	19.9	18.8	21.4	18.6	17.7	16.5	19.9	19.3
Chieftain	—	—	20.3	19.9	—	18.2	23.1	20.1	18.6	20.1	19.2	—
Norgold Russet	21.4	22.2	21.6	21.4	20.9	20.7	23.1	20.5	20.7	20.3	21.4	21.3
Russet Burbank	21.4	22.7	21.4	21.8	19.9	19.4	24.2	19.7	19.2	18.8	20.9	20.9
Park River												
Norland	19.9	20.4	19.7	18.4	20.3	20.7	21.4	18.8	18.2	19.0	19.7	19.7
Viking	20.1	21.9	21.1	19.4	19.4	22.7	21.6	18.6	19.7	19.4	20.3	20.4
Red Pontiac	19.0	20.1	19.2	18.0	19.9	21.8	19.0	18.0	17.5	17.3	20.3	19.1
Chieftain	—	—	—	—	—	20.1	20.9	19.7	19.9	19.2	20.5	—
Norgold Russet	20.7	22.4	22.0	20.1	21.2	22.4	22.7	20.5	20.3	20.1	20.9	21.2
Russet Burbank	20.1	22.1	22.0	20.9	22.2	21.6	20.7	20.3	19.7	18.8	22.7	21.0

Data taken on the varieties Norland, Viking, Red Pontiac, Chieftain, Norgold Russet and Russet Burbank grown at Grand Forks and Park River from 1961 to 1971 are summarized in this report. Varieties are shown in Figure 1.

Norland, Viking, Red Pontiac and Chieftain

Norland, an early-maturing, red-skinned variety was released by North Dakota State University in 1957. Norland originated from a cross between Redkote and ND626, and has the distinction of being the first variety released by North Dakota State University that became economically important. Production of this variety now extends throughout the Red River Valley and to many other producing areas in the United States and Canada. Norland thus has achieved wide acceptance, becoming the top early-maturing, red-skinned variety grown in the U. S. It has replaced such varieties as Red Warba, Waseca and other early-maturing, red varieties.

Although the variety was released principally as an early variety, it is now the main red-skinned table stock variety produced in the Red River Valley, and is sold for fresh use in grocery stores all over the U. S. and Canada. In 1971, Norland ranked fifth in total U. S. certified seed production and seventh in certified seed production in Canada. The tubers are smooth, shallow-eyed and seldom oversized. Like most early-maturing varieties, it is susceptible to silver scurf. Also the variety is slightly susceptible to pressure bruising, and will occasionally darken after cooking following a long storage period.

Table 1 shows the yield of U. S. No. 1 tubers at two locations over an 11-year period (1961-1971). The yield of Norland has always been somewhat below that of Red Pontiac; however, this can be expected as Norland matures around August 15 and Red Pontiac in late September. During most years Red Pontiac has had from 15 to 20 days more growing days than Norland.

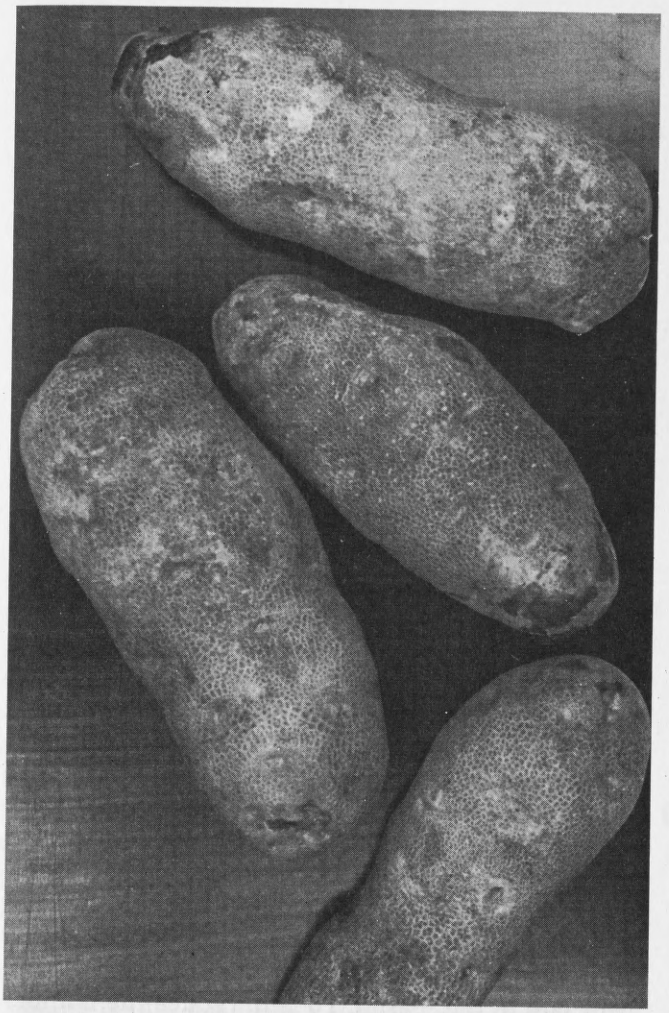
Per cent total solids are found in Table 2. Norland usually has a total solid content equal to or slightly higher than Red Pontiac, but lower than Viking. The total solids content of Norland has made it an excellent boiling potato and in most cases a fair baker. The Norland variety is not extremely dry and mealy when cooked.

The per cent U. S. No. 1 of Norland and several other varieties is found in Table 3, and grade defects of Norland are compared with two other varieties in Tables 4 and 5. Norland has a great deal more resistance to scab than Irish Cobbler and better scab resistance than the common red varieties grown in the Red River Valley. Norland has average resistance to growth cracking but is resistant to second growth, hollow heart, internal necrosis and vascular discoloration.

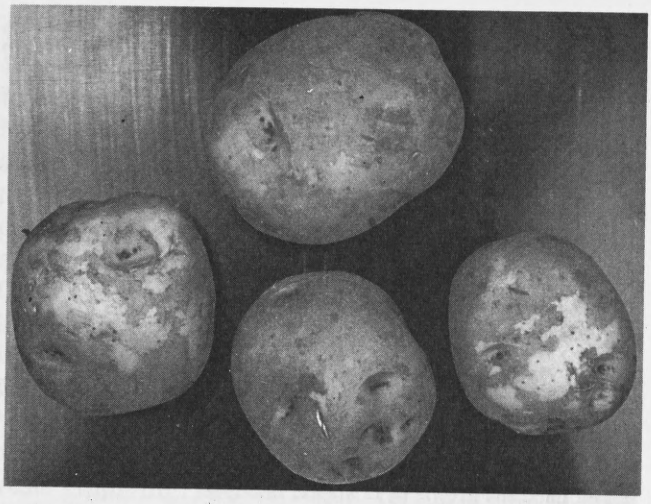
Late planting of Norland has appreciably reduced tuber skin discoloration from silver scurf.

Table 3 Per cent U.S. No. 1 of potato varieties grown at Grand Forks and Park River, North Dakota, 1966-1971.

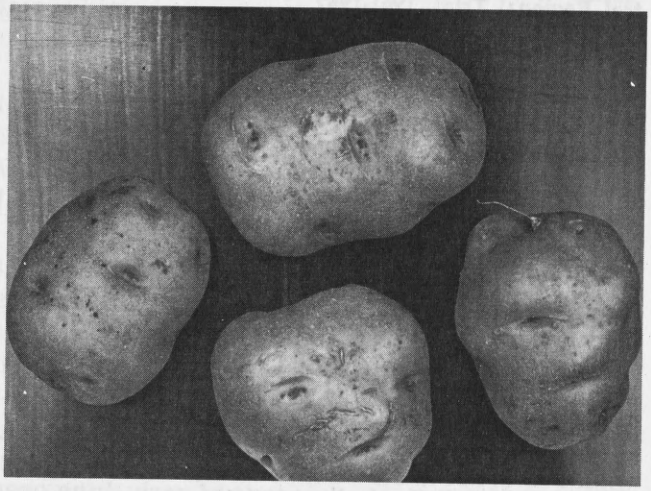
Grand Forks	1966	1967	1968	1969	1970	1971	Ave.
	%	%	%	%	%	%	%
Norland	92	94	96	93	95	92	94
Viking	98	92	96	94	93	86	93
Red Pontiac	96	98	94	96	91	95	95
Chieftain	93	83	96	94	94	95	93
Norgold Russet	88	87	92	90	89	88	89
Russet Burbank	76	87	83	82	78	81	81
Park River							
Norland	94	86	96	68	91	91	88
Viking	95	98	97	94	93	79	93
Red Pontiac	96	86	97	92	85	92	91
Chieftain	97	83	95	78	87	88	88
Norgold Russet	98	81	96	73	82	92	87
Russet Burbank	81	49	85	54	77	81	71



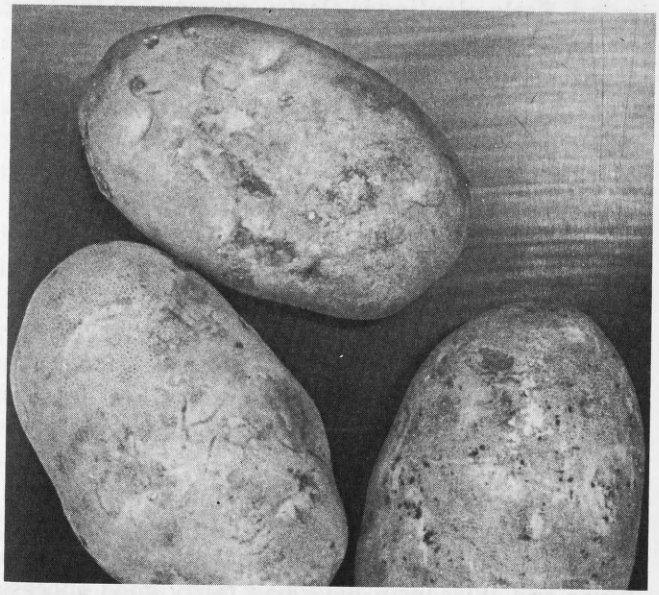
Russet Burbank



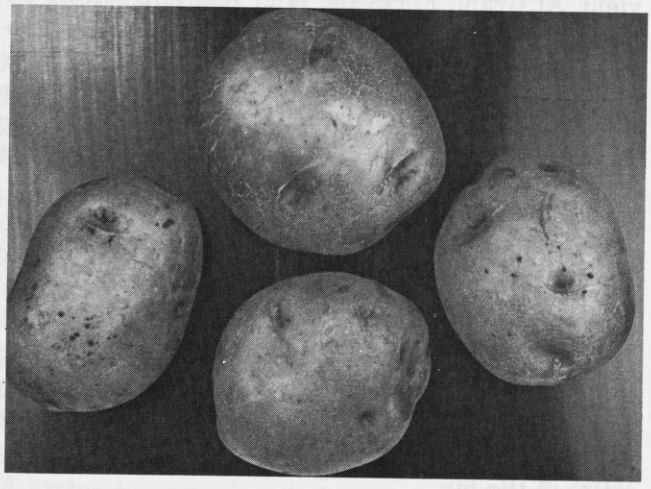
Chieftain



Red Pontiac



Norgold Russet



Norland

Fig. 1. Red and Russet potato varieties grown in the Red River Valley.

Table 4. External and internal grade defects for Norland, Chieftain and Red Pontiac varieties grown in the North Central Regional Trial, 1963-1964.

	Per Cent of Tubers With A Grade Defect[1]					
	External				Internal	
	Scab	Growth Cracks	Second Growth	Hollow Heart	Internal Necrosis	Vascular Discoloration
Norland	23.4	3.9	2.0	0.8	3.0	6.7
Chieftain	25.1	1.6	4.3	0.5	5.3	7.7
Red Pontiac	34.8	3.7	8.2	2.4	1.8	8.7

[1]Based on trials grown in 12 states, 1963-1964.

Table 5. External and Internal Grade Defects of Norland, Viking and Red Pontiac varieties grown in the North Central Regional Trial, 1961-1962.

	Per Cent of Tubers With A Grade Defect[1]					
	External				Internal	
	Scab	Growth Cracks	Second Growth	Hollow Heart	Internal Necrosis	Vascular Discoloration
Norland	31.2	2.8	1.8	0.6	1.2	6.7
Viking	32.2	7.0	6.7	0.1	0.7	11.8
Red Pontiac	35.6	2.0	6.2	2.9	1.3	11.6

[1]Based on trials grown in 12 states, 1961-1962.

However, the distinct advantage of early June over early May planting for controlling silver scurf has been balanced with the effect of late planting on yield. At Grand Forks the later planting can be expected to yield 15 to 20 per cent less. Planting toward the end of the third week or beginning of the fourth week in May should minimize skin color loss from silver scurf without significantly affecting yield. Suggested spacing with Norland is 12 to 14 inches in the row.

Observations over the years have shown certain other characteristics or aspects pertaining to Norland. First is a good spray program to control potato flea beetles and early blight. Yield and quality can be adversely affected if a spray program is not followed. Secondly, Norlands can be easily bruised by deep piling. To prevent this, growers are cautioned not to pile Norland as deep as other varieties in the bin.

Viking, a cross between Redskin and Nordak, was released by North Dakota State University in 1964. It is an extremely white-fleshed variety being particularly good for boiling, and when grown in the Midwest as a late fall potato, it is also a good baker. It is not a chipping variety but has been used for frozen French fries and flakes. Viking is midseason in maturity. However, it has developed a good marketable crop in 85 days. The variety is drought resistant and has a great deal of tolerance to adverse weather conditions. Tubers are medium red to bright red.

Yields, per cent U. S. No. 1 tubers, and total solids of Viking are shown in Tables 1-3. Yield data in Table 1 shows that over an 11-year period the average yield of Viking was almost identical to Red Pontiac, but averaged about 50 hundredweight more per acre than Norland. Total solids content of Viking is better than the other more common red varieties. The relatively high solids content of Viking makes it a good mealy potato that is good for baking and boiling.

Viking has some resistance to scab and vascular discoloration (Table 5). It has less hollow heart and internal necrosis than most varieties but does growth crack more than other varieties.

Tubers of Viking tend to be larger than those of other red varieties, with very few small tubers and a larger yield of jumbo tubers. Traditionally, tuber size is controlled by varying the spacing between hills; closer spacing results in more small and fewer jumbo tubers. This is particularly true when tuber set is poor or plants are permitted to grow late in the season. To help reduce the number of jumbo tubers, Viking should be spaced closer than other varieties. An 8- to 10-inch spacing is suggested. Early planting is also recommended for Viking.

Generally, sprays and dusts containing 2,4-D have increased tuber set in other varieties, and Viking probably would respond similarly. Growers considering the use of sprays or dusts containing 2,4-D are cautioned to check on the current label clearance status of these materials.

Under most conditions in North Dakota, growers should not expect satisfactory yields of Viking before September 1. However, growers should exercise special care with this variety near harvest, checking on tuber development every few days so they can kill vines before tubers become excessively large.

In the past few years, Viking has been tested and found to be a variety adapted to potato growing areas other than the Red River Valley. Growers in Texas and Wisconsin have had fairly good success producing the variety. However, Viking production will always be limited, partly because of the intensive management control excercised by those grow-

ers who have the know-how concerning the time of planting, harvesting and spacing that is necessary to grow it economically.

Red Pontiac is a mutation or a sport of Pontiac that was discovered in a Florida test plot by James W. Weston. In the spring of 1945, Weston found a single tuber with dark red color on about one-third of the surface and replanted those eyes with dark red color in the field during the summer of 1945. This became the initial source of Red Pontiac. The original Pontiac resulted from a cross between Triumph and Katahdin, and was first grown in 1931 by the Michigan Agricultural Experiment Station and the United States Department of Agriculture. Pontiac was tested and first released to growers in 1938.

In spite of all its faults or poor characteristics, the Red Pontiac has always been a reliable variety to grow. Good yields have been recorded when it has been grown under dry and warm weather conditions. Growers have classified Red Pontiac as an easy variety to grow and have considered it to be a "tough variety" when grown under adverse weather conditions. Table 1 shows the yield of Red Pontiac when grown at Grand Forks and Park River for 11 years. Like Viking, Red Pontiac does not produce many small tubers. The per cent U. S. No. 1 of Red Pontiac is found in Table 3.

The total solids of Red Pontiac are generally quite low. The low total solids resulting in a watery cooking potato has been a serious fault of Red Pontiac. Red Pontiacs grown in the southern states have produced solids as low as 12 to 14 per cent. However, when grown in the Red River Valley, Red Pontiac averages around 19 per cent total solids.

The maturity of Red Pontiac is much like Viking in that it is medium late, but earlier than Kennebec. The skin of Red Pontiac is usually quite firm at harvest time.

During the past few years the fresh market in the Red River Valley has switched more to Norlands at the expense of Red Pontiac. The smoothness and earliness of Norland over Red Pontiac probably have been two of the factors causing the grower to make the change. Ten years ago Red Pontiac was one of the top varieties grown for certified seed in the U. S., but has now slipped to eighth place.

Red Pontiac is susceptible to common and russet scab. Although Red Pontiac has no genetic resistance to late blight, it has some field tolerance to the disease. Red Pontiac is quite drought resistant.

Chieftain variety, named by Iowa State University in 1966, originated from a cross between Ia 1354 and Ia 1017-18. In 1971, Chieftain ranked 15th in U. S. certified seed production with most of the seed produced in North Dakota, Minnesota, Nebraska and Wyoming. Chieftain is a smooth, shallow-eyed variety that resembles Norland in many respects. The maturity of this variety is medium late camparable to Red Pontiac. The late maturity of Chieftain seems to be one of its faults. Growers who have produced Chieftain in fairly large acreages report that obtaining a good skin set is their main concern. It is recommended that the vines of Chieftain be killed as soon as the crop has been developed and that the tubers allowed to remain in the ground as long as possible before harvest. Applying less nitrogen fertilizer might also help in developing a better skin set.

Chieftain yield compares with Red Pontiac and Viking (Table 1). The per cent U. S. No. 1 of Chieftain is high, indicating that it doesn't produce many undersized or deformed tubers.

Total solids of Chieftain are usually around 19 to 20 per cent when grown in the Red River Valley. This is comparable to Norland, but somewhat below Viking (Table 2). Chieftain is a fairly good variety for both boiling and baking.

Table 4 shows that Chieftain is resistant to scab and is not susceptible to any other internal or external defect. It's almost as resistant to common scab as Norland. Chieftain is susceptible to late blight and most other common potato diseases.

The table stock acreage of Chieftain seems to be increasing in North Dakota and Minnesota during the past few years. If growers are able to obtain a good skin set, no doubt they will grow more acres of Chieftain.

Norgold Russet, Russet Burbank

Few, if any, varieties have received the wide acclaim and acceptance immediately after introduction that has been the fortune of the Norgold Russet. This variety, introduced by North Dakota State University in 1964, is excellent for baking and boiling. It produces a cooked product that is white and mealy, and when boiled it does not slough nor darken after cooking. Preliminary tests show Norgold Russet is suited for dehydration and French frying but not chipping. The parents of Norgold Russet are ND 2475-8 and A 119-1.

In the midwest, the maturity of Norgold Russet compares with Irish Cobbler but is slightly later than Early Gem. Certain western areas of the United States have reported that Norgold Russet and Early Gem have the same maturity.

Norgold Russet tubers are long to oblong, smooth and shallow-eyed. The russeting is fairly

heavy netted and well distributed over the surface of the tuber. The russeting ranges from yellow to brown, and becomes especially attractive when grown on sandy or coarse-textured soils.

Norgold Russet is tolerant to damage caused by hot dry winds, is highly resistant to common scab but is susceptible to late blight, verticillium wilt and most potato viruses. Plant recovery from wilting caused by high temperatures has been noted to be quite rapid in this variety.

In tests at Grand Forks and Park River, North Dakota, from 1961-1964, Norgold Russet produced higher marketable yields than Russet Burbank, its major russet competitor (Table 1). Yields of Norgold Russet were comparable with Norland.

In the midwest, the total solids of Norgold Russet compare with Kennebec and Russet Burbank and are much higher than Early Gem. Trials at Grand Forks and Park River for four years showed that this variety will average about 21.0 per cent total solids (Table 2).

Results of spacing trials with Norgold Russet are shown in Tables 6 and 7. There was a trend toward lower yields of No. 1 tubers with the wider spacings, but no large difference in the percentage of No. 1 tubers with the different spacings. However, the spacing affected tuber size with more on all tubers produced with the closer spacings. A major justification for close spacing of Norgold Russet would be to help control hollow heart in years when this is a problem.

Table 6. U.S. No. 1 yield of Norgold Russet and Russet Burbank potatoes grown at different spacings.[1]

Variety	In-row Spacings 8"	12"	16"	21"	Average
1970 - Park River					
Norgold Russet	175	167	165	157	166
Russet Burbank	106	111	97	94	102
1971 - Grand Forks					
Norgold Russet	212	215	210	184	205

[1]Average of 8 replications in each location.

Table 7. Per cent U.S. No. 1 tubers of Norgold Russet and Russet Burbank potatoes grown at different spacings.

Variety	In-row Spacings 8"	12"	16"	21"	Average
1970 - Park River					
Norgold Russet	86	89	90	92	89
Russet Burbank	60	64	68	72	66
1971 - Grand Forks					
Norgold Russet	90	94	91	88	91

Tests conducted in North Central regional trials show how Norgold Russet compares in this respect and in respect to other external and internal defects with some common varieties (Table 8). Hollow heart is almost as common in Norgold Russet as in Irish Cobbler. In the trial, Norgold Russet averaged 3.7 per cent, Red Pontiac 2.5 per cent and Norland 0.8 per cent hollow heart.

Table 8. External and internal grade defects for Norland, Red Pontiac, and Norgold Russet grown in the North Central Regional Trial, 1962-1964.

	Per Cent of Tubers With Following Grade Defects[1]					
	External			Internal		
	Scab	Growth Cracks	Second Growth	Hollow Heart	Internal Necrosis	Vascular Discoloration
Norland	23.2	3.8	1.7	0.8	2.6	6.4
Red Pontiac	32.0	2.9	6.2	2.5	1.5	8.4
Norgold Russet	11.6	2.7	5.7	3.7	1.2	5.3

[1]Based on trials grown in 12 states during 1962-1964.

Part of the past concern and extensive occurrence of hollow heart in Norgold Russet can be attributed to wide spacings of 24 inches or more used by many growers when it was first introduced. These wide spacings helped to obtain maximum seed increase with limited quantities of seed, but at the same time increased the incidence of hollow heart. Eight to 12-inch row spacing is recommended for Norgold Russet to reduce incidence of hollow heart. Early planting and using fertilizer higher in potassium than commonly used on potatoes also helps to control hollow heart.

Table 8 also shows Norgold Russet has resistance to scab, and has a lower incidence of internal necrosis and vascular discoloration than most other varieties.

Norgold Russet has a short rest period and will sprout in storage quicker than other varieties. Special care should be taken to be certain storage temperatures are low enough. Tablestock potatoes should be treated with a good sprout inhibitor in storage or at the time they are washed and packaged.

In spite of the fact that hollow heart can be a serious problem with Norgold Russet when grown in the Red River Valley, several table stock growers in the valley have mastered the situation or partially solved the hollow heart problem and are able to grow Norgold Russet nearly free of the

defect. The premium price for Norgold Russets over Red River Valley reds usually is about $1.00 and up per hundredweight. This seems to be enough of an incentive or challenge to grow the variety. However, most of the Norgold Russets grown in the Red River Valley are produced for seed. The seed demand for Norgold Russet has been good, providing growers don't overplant the variety. Seed from the valley and other areas finds its way into Washington, Oregon, Texas, Oklahoma, Colorado and other western and eastern states. In total U. S. certified seed, Norgold Russet ranked sixth in 1971 with the Red River Valley alone producing about 6,000 acres of the 8,000 acres grown.

Russet Burbank is another important variety that originated as a sport or mutation from the old variety Burbank. The variety Burbank was originated by Luther Burbank in 1878 and at that time it was claimed to be a seedling of Early Rose. Luther Burbank only grew about a dozen seedling tubers or so to select the variety Burbank, while now the combined potato breeding programs in the United States grow about a million seedling tubers each year. The origin of Russet Burbank is unknown.

Russet Burbank, a very late maturing variety, ranks as the number one certified seed variety produced in the United States and most likely is the top table stock variety produced. Russet Burbanks are grown mainly in Idaho where they are commonly called Idaho Russets. In Canada they are grown mainly in the western provinces and are known as Netted Gem. Although Russet Burbanks are grown in many states including North Dakota and Minnesota, the principal areas producing Russet Burbank are the western states and to some extent Maine and New York.

Russet Burbank is susceptible to scab and late blight. The variety is also susceptible to most other potato diseases except rugose mosaic.

The Russet Burbanks grown in the Red River Valley are mainly produced for certified seed. However, in the past few years more table stock growers are attempting to raise the variety. This is generally true for growers on the lighter textured soils. Through brief observations and tests, it appears that Russet Burbanks will do very well in the planned or proposed irrigated area at Oakes, North Dakota. The Oakes area has very light sandy soil that is ideal for irrigation.

The yield of Russet Burbanks grown at Grand Forks and Park River is generally lower than that of Norgold Russet and other common varieties (Tables 1 and 6). However, the U. S. No. 1 yield reported in Tables 1 and 6 does not include culls and small tubers, and generally Russet Burbank has more culls and undersized tubers than other varieties. The greater percentage of culls results in the lower percentage of U. S. No. 1 tubers shown in Tables 3 and 7 compared to other varieties.

The total solids of Russet Burbank is comparable to Norgold Russet (Table 2). Russet Burbank has the reputation of being one of the better baking varieties, and its high percentage total solids make this variety a dry and mealy potato.

Summary

The potato varieties Norland, Red Pontiac and, to some extent, Chieftain are now the principal red varieties grown in the Red River Valley. Each variety has both good and bad characteristics; however, it seems that more Norlands are grown each year at the expense of Red Pontiac. The smoothness and attractiveness of Norland, particularly early in the season, are some of the reasons the variety continues to increase in production. Some Vikings are also produced; however, most of these are grown for certified seed and sold in other potato-producing areas. Several growers like Chieftain but the main complaint of this variety is its ability to set skin prior to harvest.

Norgold Russet and Russet Burbank are now the two most popular russet varieties grown. With the premium in price of russets over reds and whites and the increasing consumer demand for russet varieties, growing these varieties will continue to increase in the Red River Valley. Again, both varieties have their own good and bad characteristics.

Norgold Russet can be grown on slightly heavier soils than Russet Burbank but growers will have to observe all the recommendations known for the prevention of hollow heart. By close spacing and more stems per hill, several growers are able to produce Norgold Russets virtually free of hollow heart. Three years' data on all six varieties revealed that for boiling or baking Norgold Russet was the best. This variety was the mealiest, had the best color before and after cooking, and the best flavor.

Very little difference in cooking quality was found for the red varieties Norland, Red Pontiac and Chieftain. However, Norland and Chieftain were rated better in mealiness and flavor but Norland had more after-cooking darkening. Russet Burbank was about the same as these three reds in boiling but scored higher in baking. Viking also had good boiling and baking quality, but excelled above all varieties in color after cooking and after standing for four hours. This variety was much like Norgold Russet in having snow-white flesh after cooking.