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INFLUENCE OF STRAIN AND GENERATION NUMBER ON PERFORMANCE OF THE POTATO VARIETY RUSSET NORKOTAH

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INTRODUCTION

It is well known that strain and generation number can influence the quality and quantity of tubers produced by varieties of potatoes. However, the effect of strain and generation number on yield may be quite different from one variety to another. Strains are spontaneously occurring variants within a variety that may possess qualitative or quantitative characteristics that are superior to the parent variety. Strain selection is a practice that has been in use with potatoes for many years and examples of successful strain selections include Russet Burbank from Burbank, Dark Red Norland from Norland and Norgold Russet M from Norgold Russet. Some strains are discovered based on chance observations of desirable characteristics while others are the products of systematic searches for superior performance.

Generation number indicates the number of field production cycles a seed lot has completed following passage through an in–vitro, tissue–culture based purification program (these purification programs are designed to rid the seed lot of all contagious disease organisms). For example, if a seed lot has been grown for one year in the field the product of that first years field production is called generation 1 (G1). Similarly, the crop from a seed lot that had been cycled through eight production years in the field would be called G8. Most certified seed potatoes sold today have a generation number as part of the certification description. Potato seed lots with low (i.e. G1, G2) generation numbers are generally considered to be more productive than seed lots with higher (i.e. G7, G8) generation numbers. It is also generally believed that the magnitude of difference in productivity between low and high generation numbers may vary due to variety and also according to geographical location of seed production as well as production and storage practices.

Russet Norkotah was released as a public potato variety in 1987[1] by North Dakota State University. It was described in that release as an early fresh market russet with strengths that included tuber type, early maturity, shallow eyes and low gradeout. A varietal weakness was lack of vine vigor associated with early maturity. Acreage of Russet Norkotah increased rapidly across the United States after its release and it quickly became an important early market russet variety. However, the lack of vine vigor persisted as a weakness, especially in more southerly production areas, and systematic searches for strains with more vigorous vines were begun in Texas in 1989 and in Colorado in 1991. In the Texas program, testing began with 375 strains selected on the basis of vine vigor and by 1992 the best 13 had been identified. Several of these 13 have been tested in regional trials and are reported to out perform the standard Russet Norkotah strain. The Colorado program of strain selection was conducted in a similar way and has produced strains that also are reported to out perform the standard Russet Norkotah strain.

Large differences between yields of Russet Norkotah reported by some Alaska growers and results of AFES trials raised questions about the reasons for these yield differences. The effect of strain and generation number on performance of potato varieties has not been studied in a systematic way in Alaska with any potato varieties, so it was decided to evaluate these variables with Russet Norkotah in replicated trials. The study reported here is a preliminary evaluation of ten different sources of Russet Norkotah, three of which are products of the

strain selection program at Colorado State University (strains from Texas A&M were not available for this study). The remaining seven sources are of different origin and generation number but claim no special distinction from the parent strain.

MATERIALS AND METHODS

Field plots at the Agricultural and Forestry Experiment Station Farm near Palmer were prepared by plowing with a moldboard plow to a depth of 10–12 inches followed by disking and packing. Cut seed pieces weighing approximately 3–4 ounces were planted 2–3 inches deep with an Iron Age assist feed planter. Plants were spaced 11 inches apart in rows 36 inches apart. Treatments were replicated four times in a randomized complete block design. Granular fertilizer (10–20–20) was applied at the rate of 120 pounds N, 240 pounds P_2O_5 and 240 pounds K_2O by the planter in bands two inches to the side and two inches below the seed. The fertilizer was composed of monoammonium phosphate (11–51–0), muriate of potash (0–60–60), urea (45–0–0) and a limestone filler. Water was applied as needed through overhead sprinklers. Weeds were controlled by a pre–emergent application of linuron (Lorox) supplemented by cultivation and hand weeding where necessary. Plants were hilled during the last week of June and the crop was harvested with mechanical harvester on September 4. Weather was excellent for harvest and the crop went into cold storage in excellent condition. Late blight was present in the area during the growing season but none was observed in this field plot. Grading was completed in late November, and no tuber blight was observed.

RESULTS AND DISCUSSION

Overall, the 1998 growing season was dry and cloudy. There were many cloudy, misty days but often only small amounts of rain fell. Plots were irrigated as needed to maintain soil moisture within the optimal range for plant development, so plants were never stressed for water. However, yields in this and other trials with potatoes in the field in 1998 were somewhat less than expected, perhaps in part due to the high number of cool, cloudy days.

The ten seed sources used in this study, along with generation number and a comparative assessment of plant vigor are listed in Table 1. The ten sources are listed according to yield of US#1 tubers in both Tables 1 and 2 with the highest yield at the top of the list and the least at the bottom. Complete yield data is summarized in Table 2. Generally speaking, these data illustrate that more vigorous vines are associated with a higher US#1 yield. The general pattern, with one notable exception (PMC), also shows that seed sources with low generation numbers (Table 1) had more vigorous vines and greater US#1 and total yields.

The less vigorous vines of treatments AFES, PMC and CORN S were clearly smaller than vines of all other treatments throughout the growing season. By August 1, vines of most sources had attained the size required to achieve canopy closure, but the three sources listed above did not. In fact, these three sources failed to achieve canopy closure by seasons end. No symptoms of virus infection were observed in any of the 10 sources, but most AFES and PMC plants, as well as some plants in most CORN plots, developed a yellowish hue in the last weeks of the season.

Total yields among the 10 Russet Norkotah sources ranged from 11.2 to 21.8 tons per acre and US#1 yields from 5.9 to 16.7 tons per acre. Total gradeout ranged from 20–46 percent with the majority of gradeout usually consisting of small tubers. The second most common cause of gradeout was greening, followed by shatter and growth cracking. Composition of gradeout was generally similar across the 10 sources although CORN2 had a much higher percentage of small tubers than any other source. Indeed, CORN2 has been dropped as a strain by the Colorado strain selection program because of this exceedingly high percentage of small tubers.

Nine of the 10 sources of seed used in this study were grown for at least one season in the field in the Matanuska valley, three by a commercial farmer and six by the AFES. The one exception, EAC, was certi-

Table 1. Description, generation and plant vigor of the 10 sources of Russet Norkotah used in field trials at AFES Matanuska Farm in 1998.

Source Description[1]	Generation[2]	Plant Vigor[3]
NYU	1	3.3
NYU	2	3.8
NYU	4	3.0
EAC	5	3.0
CORN 3	6?	2.5
CORN S	6?	2.0
PMC	3	1.5
CORN 8	6?	2.5
AFES	8	1.3
CORN 2	6?	2.8

[1]NYU = New York Uihlein Farm, EAC = Edmonton, Alberta Canada, CORN = Colorado Russet Norkotah, PMC = Alaska Plant Materials Center, AFES = Alaska Agricultural and Forestry Experiment Station.

[2]Number of years seed lot spent in the field prior to this planting. Numbers followed by a question mark are estimates.

[3]An assessment of plant vigor based on relative plant diameter eight weeks after planting where plant diameters ranged from: 1 = <10 inches, 2 = 10–12 inches, 3 = 12–14 inches and 4 = 14–16 inches.

fied seed grown near Edmonton, Alberta and shipped here for use by a commercial grower. Most of the differences observed thus cannot be attributed to location of seed production and probably also not to seed storage conditions or handling procedures. That leaves strain and/or generation number as probable explanations for the generally poor performance of all four CORN sources as well as the AFES source. Somewhat surprising is the relatively poor performance of the PMC source. Its generation number is relatively low, yet its vine vigor and yield are among the poorest, suggesting that the PMC source may be inherently weak. This explanation seems more probable when one considers that the AFES source also is of PMC origin but to be certain, additional evaluations will be required.

It is important to remember that these data is preliminary and that firm judgements should not be drawn about any strain or seed source until additional data (to be generated over the next several years) has been summarized. Although this study shows that differences in yield among a collection of strains and seed sources of Russet Norkotah can exist, what cannot be extracted from these data is the specific reason for these differences. Upcoming studies are designed to permit a more critical analysis of the specific effects of strain and generation number.

SUMMARY

1. Large differences in vine vigor and yield were observed among the ten seed sources of Russet Norkotah evaluated in this study.

2. Higher yield was generally associated with more vigorous vines.

3. Higher yield was generally associated with lower generation number.

4. These and other sources or strains having similar generation numbers should be included in tests conducted in future years.

FUTURE PLANS

Approximately 15 sources of seed will be planted in a continuation of this field study in 1999 including G3 or better seed of strains of Russet Norkotah from the Colorado State University and Texas A&M strain selection programs, as well as other available sources such as NYU and PMC. Comparison of seed with similar generation numbers will permit a more useful analysis of strain as a specific cause of yield difference. Further, multiple generations of the NYU and PMC sources will permit a specific evaluation of generation as a cause of yield difference in Russet Norkotah.

LITERATURE CITED

1. Johansen, R.H., Farnsworth, B., Nelson, D.C., Secor, G.A., Gudmestad, N., and Orr, P.H. 1988. Russet Norkotah: A new russet–skinned potato cultivar with wide adaptation. Am. Potato J. 65: 597–604.

Table 2. Summary of performance of the 10 sources of Russet Norkotah in field plots in 1998.[1]

Source Description[2]	Gen[2]	US#1[3]	Small[4]	Other[5]	Total	Percent US#1	Tuber Wt.[6]	Specific Gravity
NYU	1	16.7	1.3	2.9	20.9	80	7.5	1.085
NYU	2	16.2	2.7	3.0	21.8	74	6.8	1.085
NYU	4	15.2	2.0	2.6	19.8	77	6.8	1.086
EAC	5	14.5	2.3	2.5	19.2	75	6.5	1.084
CORN 3	6?	12.9	1.7	3.0	17.6	73	6.8	1.084
CORN S	6?	11.4	1.5	2.5	15.4	74	6.7	1.082
PMC	3	8.5	1.5	3.2	13.1	65	6.4	1.083
CORN 8	6?	8.4	1.8	3.7	13.9	60	6.8	1.083
AFES	8	6.4	2.7	2.7	11.9	54	6.4	1.078
CORN 2	6?	5.9	4.3	1.1	11.2	52	4.9	1.086
LSD[7]		2.1			2.4			

[1]Yields expressed in tons per acre

[2]Details of description and generation enumerated in Table 1 footnotes

[3]#1 market grade as defined by the USDA

[4]Tubers less than 1.88 inches in diameter

[5]Includes oversize, shatter or growth crack, second growth, green, etc.

[6]Average weight of US #1 tubers in ounces

[7]LSD = Least significant difference

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