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INFLUENCE OF STRAIN OR SOURCE AND GENERATION NUMBER ON PERFORMANCE OF THE POTATO VARIETY RUSSET NORKOTAH 1999

Donald E. Carling, Professor of Horticulture
University of Alaska Fairbanks
533 E. Fireweed, Palmer, AK 99645
Phone: (907) 746–9470
Fax: (907) 746–2677
E–mail: pfdec@uaa.alaska.edu

INTRODUCTION

Strains are spontaneously occurring variants within a potato 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. Strain can influence the quality and quantity of tubers produced by a given variety of potato.

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 (purification programs are designed to rid the seed lot of all microorganisms that cause contagious disease). For example, if a seed lot has been grown for one year in the field the product of that first year's field crop is called generation 1 (G1). Similarly, the crop from a seed lot that has 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 generation numbers (e.g. G1, G2) are generally considered to be more productive than seed lots with higher (e.g. 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 but also according to geographical location of seed production as well as production and storage practices.

Russet Norkotah (Johansen *et al* 1988) is a popular fresh market potato variety known for its excellent tuber type and early maturity. It is also known for a general lack of vine vigor, a weakness that prompted researchers in Texas and Colorado to conduct systematic searches for strains with a more vigorous vine. Both of these programs have selected strains that are reported to have more vigorous vines and produce higher yields than the parent strain. Many other sources of Russet Norkotah seed, (including various state potato seed certification agencies and private producers) also are available to potato farmers. These sources generally do not claim a particular "strain" designation for their seed, nevertheless there may be differences in vine vigor and yield potential among them.

This study is an expanded version of one initiated in 1998 (Carling 1999) wherein strains and other sources of Russet Norkotah seed not designated by strain are compared for vine vigor and yield. In 1998, 10 sources were compared whereas the 1999 study contains 18 sources. The 18 sources include: three strains from Texas, two strains from Colorado and 13 sources that are not designated by strain. Among the 13 non-strain designated sources are four different generations from a New York (NYU) source and five generations from an Alaska (PMC) source. With data generated in this study we can compare strain and source differences as well as differences potentially attributable to generation number.

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 on May 12, 1999. 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. Spot spraying with glyphosate (Roundup) was done to control quackgrass. Plots were irrigated as needed with overhead sprinklers. Plants were hilled during the last week of June and the crop was harvested by mechanical harvester on September 9, 1999. Harvested tubers were placed in cold storage for approximately six weeks prior to grading and grading was completed in late November.

RESULTS AND DISCUSSION

The 1999 version of this study was improved in several ways over 1998: 1) high generation seed was replaced with lower generation seed (for example, all strains and sources except EAC were represented by G2 seed) and 2) multiple generations of two sources, NYU and PMC, were included. Thus it is possible to make more meaningful comparisons of the different strains and sources and also to make a more useful assessment of the effect of generation number on Russet Norkotah seed performance. Unfortunately, seed of all of the strains and several of the sources was produced outside of Alaska. Thus, some of the productivity and vine size differences observed may be due to location and conditions of seed production rather than strain or generation number. The 2000 version of this study will eliminate this last variable.

The 18 seed sources used in this study, along with generation number, are listed alphabetically in Table 1. The 18 sources are listed according to US#1 yield in Table 2. Total yield, several qualitative yield parameters, and vine size measured at six and eight weeks after planting are also included in Table 2. All vines were free of contagious disease symptoms but vine size tended to vary among sources. Generally speaking, larger vines tended to be associated with a higher total yield and, to a lesser extent, higher US#1 yield. Also, where multiple generations of the same source were available for comparison, the trend was toward larger vines and higher yields in the lower numbered generations.

Total yields among the 18 sources ranged from 15.9 to 24.3 tons per acre and US#1 yields from 13.7 to 21.4 tons per acre. These yields were somewhat higher than in 1998, probably due to a combination of factors including differences in source, a more favorable growing season and a generally higher quality of seed. Total gradeout ranged from 11–23 percent compared to a range of 20–48 percent in 1998. As in 1998, the most common type of gradeout was small tubers, but there tended to be smaller quantities in all categories of gradeout than in 1998.

As was true in 1998, these 1999 data are preliminary. It is important to remember that firm judgements should not be drawn about any strain or source until additional data (to be generated over the next several years) has been summarized.

Table 1. Description and plant size of the 18 sources of Russet Norkotah used in field trials at AFES Matanuska Farm in 1999.

Source Description[1]	Generation[2]
CORN 3	2
CORN 8	2
CORN S	2
EAC	4
EAC	5
MSU	2
NYU	1
NYU	2
NYU	3
NYU	5
PMC	0
PMC	1
PMC	2
PMC	3
PMC	4
TXNS 112	2
TXNS 223	2
TXNS 296	2

[1] CORN = Colorado Russet Norkotah, EAC = Edmonton, Alberta Canada, MSU = Montana State University, NYU = New York Uihlein Farm, PMC = Alaska Plant Materials Center, TXNS = Texas Norkotah Strain.

[2] Number of years seed lot spent in the field prior to this planting.

However, it does now seem clear that quantitative and qualitative yield differences among strains of Russet Norkotah are manifested under Alaskan growing conditions.

SUMMARY

1. Measurable differences in vine vigor and significant differences in yield were observed among the 18 seed sources of Russet Norkotah evaluated in this study.
2. Higher yield was generally associated with larger vines.
3. Yields trended downward as generation number increased.
4. Strains selected for larger vines and greater yield often produced larger vines and a greater yield than non-strain sources.
5. Tubers of CORN 3 were less true to type than all other strains and sources.
6. Among the non-strain sources, NYU appears relatively strong whereas CORN S, MSU, and PMC appear relatively weak.
7. The yield of CORN S, the source of Russet Norkotah that Colorado uses as its standard, was similar to the yield of MSU and PMC but significantly less than the yield of NYU.

FUTURE PLANS

Approximately the same set of strains and sources of seed will be planted in a continuation of this field study in 2000.

LITERATURE CITED

Carling, D.E. 1999. Influence of strain and generation number on performance of the potato variety Russet Norkotah. University of Alaska Fairbanks, Agricultural and Forestry Experiment Station, Research Progress Report 36.

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. Plant diameter and performance, ranked by US#1 yield, of 18 sources of Russet Norkotah in 1999.[1]

Source Description[2]	Plant Size[3] (6–23–99)	Plant Size[3] (7–7–99)	US#1[4]	Small[5]	Other[6]	Total	Percent US#1	Tuber Wt.[7]	Specific Gravity
CORN 3	1.8	3.8	21.4	1.6	1.3	24.3	88	5.9	1.085
CORN 8	2.5	4.0	18.6	2.7	1.4	22.7	82	5.9	1.078
NYU	2.5	3.5	18.5	1.4	1.1	21.0	88	6.7	1.078
TXNS 223	1.3	3.3	18.2	2.1	1.1	21.4	85	5.8	1.077
TXNS 296	1.0	2.5	18.1	1.5	2.0	21.6	84	6.7	1.078
NYU	1.3	2.8	17.9	1.7	0.6	20.2	89	6.0	1.081
NYU	2.0	3.3	17.9	1.7	0.6	20.2	89	6.1	1.079
EAC	1.8	3.8	17.3	1.2	1.0	19.4	89	7.1	1.077
TXNS 112	1.5	3.0	16.3	3.2	1.5	20.9	78	5.2	1.079
NYU	1.3	3.0	15.9	1.8	1.1	18.7	85	6.8	1.078
PMC	1.0	2.3	15.8	2.3	0.5	18.6	85	5.5	1.079
MSU	1.3	2.5	15.8	1.6	1.3	18.7	85	6.2	1.074
PMC	1.3	2.5	15.7	1.9	0.5	18.2	86	5.6	1.077
CORN S	1.0	2.5	15.7	3.2	1.4	20.3	77	5.2	1.078
EAC	1.0	2.0	15.6	2.0	0.8	18.4	85	5.7	1.077
PMC	1.8	3.5	15.5	2.0	0.5	18.0	86	5.5	1.077
PMC	2.0	3.5	15.4	2.2	1.1	18.7	83	6.0	1.076
PMC	2.3	3.3	13.7	1.3	1.0	15.9	86	7.1	1.075
LSD[8]			1.9			2.2			

[1]Yields expressed in tons per acre

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

[3] An assessment of plant vigor based on relative plant diameter approximately six and 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.

[4]#1 market grade as defined by the USDA

[5]Tubers less than 1.88 inches in diameter

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

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

[8]LSD = Least significant difference

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