Washington Potato Seed Lot Trial
Current and Historical Disease Content and Other Factors

Robert E. Thornton, Washington State University

INTRODUCTION

The Washington potato seed lot trial has been carried out for 37 years, 1961-1978 and 1982-2000. The primary objective of the seed lot trial is to provide the opportunity to observe the performance of seed lots that are being grown in commercial plantings in Washington the year of the trial.

METHODS

This is accomplished by planting samples of single drop tubers side by side at a common location. The location of the trials over the years has been the Washington State University Research Unit at either Othello or Royal Slope. Because the primary objective of the trial is the observation of seed lots that are in use in Washington tuber samples for the trial are accepted **only** from Washington seed receivers. The individual or operation submitting the sample is responsible for providing the sample identity. Sample identification information includes, 1) Washington receiver, 2) variety and 3) seed source, including seed producer and seed production area. After samples are collected and delivered to the trial site, usually the WSU Othello Research Unit they are held until the scheduled planting. If the planting date is more than a week from the date samples are received they are held in a refrigerated storage and removed a few days before being planted.

Planting dates are scheduled to represent the planting season of the commercial industry, normally the first planting takes place in mid March and the final planting is during the first ten days of May. Plantings are scheduled for every two-week once the first planting is completed. Each sample is comprised of 200-300 single drop tubers. The desired tuber size is 2-4 ounces. Individual tuber samples are planted in a single row with an in row spacing of twelve inches. Information relative to performance is obtained during three periods of the trial; 1) at planting, 2) early season and 3) the field readings.

At Planting: Information relative to the sample identity, i.e. variety, seed receiver, seed grower, planting date, seed tuber size and condition and sample size is recorded.

Early Season: Emergence date is determined on individual lots by daily observation of the rows, emergence is deemed to have occurred when there are enough plants present for the lot to be "rowed". Measuring the length of the planted row, and dividing by the number of plants in each row is used to estimate percent stand.

Field readings: Readings to determine disease content and plant condition are conducted by faculty, staff, and students of Washington State University, Washington State Department of Agriculture potato certification inspectors and industry representatives. The first reading takes place two to three weeks before the scheduled date of the field day. When the first reading is conducted depends on how rapidly the plants develop. A second reading is preformed 2-3 days prior to the field day. Potato Leaf Roll Virus, Blackleg and Mosaic presence are based on visual inspection of plant symptoms, only under special circumstances are these identifications subjected to further verification. Plants that are one half or less in size compared to the size of the general population of a lot are considered to be Weak Plants. A number of additional factors are identified and recorded in a category designated as Other. These are Calico, Phytoplasma Like Organisms (Witches Broom, Haywire, Purple Top), seed born Herbicide, Giant Hill, variety mix and off type.

SEED LOT RESULTS 1995-2000

Sample Number: The number of samples received each year during the five-year period, excluding the most recent year has, been relatively constant: 313, 318, 330, 326, and 328 respectively for 1995, 1996, 1997, 1998 and 1999. In 2000 there were 385 seed lots. It has been speculated that the increase in sample numbers in 2000 was due to the high incidence of Potato Leaf Roll Virus experienced in commercial plantings in 1999.

Variety content (Table 1): Four varieties make up nearly 90% of the total entries (data not shown). A legitimate question at this point is " what evidence is there that the variety make up of the seed lot represents the variety make up in use by the industry any give year"? An answer to this question was offered when the seed lot results were reviewed at the 2000 Washington State Potato Conference relative to the occurrence of Potato Leaf Roll Virus in recent years (1). At that time the variety make up of the seed lot each year for the 18 year period 1982 through 1999 was compared to the variety make up for Washington as reported in the National Potato Council Potato Statistical Year Book (2). When the variety information from the two sources is grouped into, Russets (Russet Burbank), Norkotah, Early Processing and Other and graphed the profile of the graphs are nearly identical. This similarity has lead to the conclusion that the seed lot variety make up does reflect the potato varieties used by the Washington industry in a given year. The most obvious change in variety make up during this six-year period is a steady and significant increase in use of varieties in the Early Processing group. This group includes Shepody, Ranger Russet and Umatilla Russet. The similarity in the variety information from these two widely different sources suggests that the quality information obtained during the readings of the seed lot trial is a reasonable estimate of the quality of the seed potatoes that were planted in commercial fields in Washington the year of the trial.

Planting Date (Table 2): The shift in production to the Early Processing group of varieties suggests the possibility of a shift to earlier planting. The percent of seed lots planted in May has declined, and the percent planted in April has increased. March planting percentage has remained relatively constant but masked in these planting date groupings is the trend for the March plantings to be in the earlier part of March in 1999 and 2000.

Seed Source (Table 3): During the 1996-2000 period over 90% of the seed lot samples have come from six seed producing areas. Although there are some notable changes form year to year in general the percent of lots form any one area has remain relatively constant. One of the weaknesses in the information as presented is that seed lots identified as coming from Canada are not identified as coming from the various distinct potato seed producing areas within Canada. The dominant area of Canada that provides seed tuber sample for the trial is Alberta (data not shown), however some of the lots from there are identified only as being from Canada. Where the seed producer identified for these lots is known to be from a specific production area that information is used.

Overall Disease and Plant Condition (Table 4): Seed lot quality factors recorded during the field readings are based on visual inspection of plant symptoms. The four major quality factors presented in the reading summary are percent of lots with one or more plants with identifiable symptoms of Potato Leaf Roll Virus, Black Leg, Mosaic and Weak Plants. When reviewing the information in this and the upcoming tables keep in mind that lots with different numbers of plants with symptoms are all given equal weight, i.e.; a lot with 2 leaf roll plants has the same value as a lot with 10 leaf roll plants. The absence of a system for weighting the number of plants present in a given lot results in under estimating the potential detrimental impact of the lots that have a high incidence of any of the factors. The actual number of effected plants observed during the field readings however are presented in the written report provided at the potato field day and available on request from Washington State University and the Washington State Potato Commission. Of the three quality factors presented in table 4 the incidence of leaf roll and weak plants show the most variation from year to year. This is particularly true over the past three years. Over the five-year period the average of lots with PLRV is 16%, the lowest was 6% in 1998 and the highest 21% in 2000. The high percent of lots showing weak plants each of the five years is cause for concern. Even the lowest reading of 37% of lots with weak plants in 1998 is higher than is desirable. Limited destructive sampling of weak plants following the field day has indicated that a high proportion of the weak plants had severe stem cankers due to Rhizoctonia. Percent of lots with Black Leg and Mosaic vary somewhat from year to year but in all years the levels are high enough to be of concern.

Potato Leaf Roll Virus(PLRV) X Variety (Table 5): With the increase in Early Processing variety use (Table 3) there has been speculation that seed born PLRV content of these varieties (Shepody, Umatilla Russet and Ranger Russet) have contributed to the reported increase in net necrosis in tubers of Russet Burbank.

The average PLRV content of the individual varieties over the recent five-year period does not support this assumption. It is possible to make such a case some years, for example in 2000 the amount of seed born PLRV in the early processing varieties is considerably higher than it is in Russet Burbank. In 1999 however the opposite is true and that has been reported to be a year with one of the highest incidences of tuber net necrosis in Russet Burbank in recent years.

Black Leg X Variety (Table 6): The percent of seed lots that have one or more black leg plants varies by variety with a five-year average of 3% for Russet Burbank to 16% for Ranger Russet. Across all varieties the amount of Black Leg also varies between years from a high of 13% in 1999 to a low of 6% in 1996. During the five-year period every variety had the highest and lowest percentage of lots with one or more plants having observable symptoms of Black Leg.

Mosaic X Variety (Table 7): Shepody consistently had the highest percent of lots with Mosaic with a five-year average of 29%. Norkotah Russet had the next highest five-year average of 19%. With the exception of the 8% average for the trial in 1999 the percent of all lots with Mosaic across varieties is relatively constant for the five-year period.

Weak Plants X Variety (Table 8): The five-year average of seed lots with one or more weak plants across varieties varies from a low of 37% in 1998 to a high of 75% in 1999. The variation within each variety across the five-year period varies even more, from 100% for Umatilla Russet in 1997 and 1998 to 36% in 2000. The general trend over the five-year period for all varieties except Ranger Russet has been to fewer lots with weak plants.

Seed Lot Reading X Seed Source:
Potato Leaf Roll Virus (Table 9): During the five-year period the percent of lots with PLRV plants from any one seed source varied widely, in one instance (Oregon) from the lowest (0% in 1998) to the highest (56% in 1999). Although this was the extreme, seed lots from other sources varied from among the lowest percentage in one year to among the highest the following year. No one seed source consistently had the lowest percent of lots with PLRV for the five-year period. Idaho and Washington seed lot samples tended to have a higher percentage of lots with PLRV than lots from the other sources although lots from these two sources have years where the percent of lots with PLRV is among the lowest.

Black Leg (Table 10): The two seed sources with the highest five-year average percent of lots with one or more plants with symptoms of black leg (Canada and Idaho) did not have the lowest percentage in any of the five years. Several seed sources with five-year averages among the lowest had at least one year when the percent of lots with black leg was among the highest.

Mosaic (Table 11): Of the six seed sources that have had samples in the trial each of the past five years two (Montana and Canada) have had the lowest percent of lots with one or more plants with symptoms of mosaic for two of those five

years. Two (Idaho and North Dakota) have had the highest percent of lots with mosaic for two of the five years. These same two sources have the highest average percent of lots with mosaic for the period.

Weak Plants (Table 12): Two of the seed lot sources with samples in the trial for each of the recent five-year period (Montana and Oregon) have the lowest percent of lots with one or more weak plants two of those years. Two other sample sources (Idaho and North Dakota) have the highest percent of lots with weak plants two of the years. In no instance are the sources with the low percent years ever the ones with the highest percent, and in no instance were the sources with the high percent years ever the sources with the lowest percent of lots with weak plants.

IMPORTANT REMINDERS

1-Information relative to the performance of seed lots from the various sources is influenced by the variety makeup of the samples from that area,
2-Seed lot trial information must be used IN ADDITION to all other sources of information on seed potato quality,
3-The seed lot trial is only of value when the samples that are submitted represent a large portion to the seed potato sources used for commercial planting,
4-To be of value the information relative to each seed lots identification must be accurate and complete,
5-Although the results of the trial are available in the printed annual report the full value of the trial is obtained by viewing the individual lots at the annual potato field day.

SEED LOT SAMPLE SUBMISSION PROCEEDURES

1-Place 200-300 randomly selected single drop (2-4 oz.) tubers in clean burlap bag;
2-Place one identification tag inside the bag and tie the bag with a second identification tag attached to the tie. Include the following information on the tag: Variety, Washington seed receiver, Seed producer, Seed production area,
3-Deliver the sample(s) to the Washington State University Othello Research Unit located on Booker Road six miles east of Othello, or five miles east of the highway 26 highway 17 intersection one mile east of Othello OR to a designated collection site for the local area,
4-Contact the Washington State University area Extension office for information and/or assistance.

REFERENCES:
1-Thornton, Robert E. 2000. Factors Influencing the Incidence of PLRV in the Columbia Basin of Washington State. Proceedings of the 39th Annual Washington State Potato Conference and Trade Show. Moses Lake, Washington. February 1-3, 2000. p. 37-42.
2-National Potato Council Annual Potato Statistical Yearbook. 1983-2000. National Potato Council, 5690 DTC Boulevard, Suite 230E, Englewood, CO 80111-3200.

ACKNOWLEDGMENT

Operational support for the Washington Potato Seed Lot Trial is provided by the Washington State Potato Commission.

Table 1. Seed Lot Variety Content (% of total)

	2000	1999	1998	1997	1996	1995
Russet	32	32	43	40	45	44
Norkotah	18	19	17	19	19	17
Early Processing	46	42	33	33	28	26
Other	4	7	7	8	8	13

Table 2. % Lots by Planting Date

	March	April	May
2000	35	61	4
1999	34	49	17
1998	21	40	39
1997	39	32	29
1996	28	59	13
1995	32	52	16
5 Year Avenue	32	48	20

Table 3. % Seed Lots from Seed Supplying Areas

	MT	CAN	ID	WA	OR	ND	COL	Other
2000	38	25	14	8	6	3	3	3
1999	46	24	10	7	3	3	2	5
1998	46	27	12	7	1	3	0	4
1997	38	26	6	10	3	6	1	10
1996	38	31	11	7	3	5	0	5
5 Year Avenue	41	26	11	8	3	4	1	6

Table 4. Disease Content/Plant Condition

	% Leaf Roll	% Black Leg	% Mosaic	% Weak Plant
2000	21	7	14	39
1999	18	13	8	75
1998	6	11	12	37
1997	17	9	15	48
1996	17	6	14	59
5 Year Avenue	16%	9%	13%	52%

Table 5. % Seed Lots with Leaf Roll x Variety

	Russet	Ranger	Norkotah	Umatilla	Shepody	Other	5 Year Avenue
2000	13	20	32	23	20	19	21%
1999	27	13	15	17	14	13	18%
1998	2	7	11	0	16	0	6%
1997	15	25	18	0	6	20	17%
1996	15	15	18	0	17	27	17%
5 Year Avenue	14%	16%	19%	8%	15%	16%	

Table 6. % Seed Lots with Black Leg x Variety

	Russet	Ranger	Norkotah	Umatilla	Shepody	Other	5 Year Avenue
2000	2	10	9	10	8	19	7%
1999	5	24	3	40	17	4	13%
1998	3	6	7	29	16	18	11%
1997	2	22	11	0	3	16	9%
1996	3	18	3	0	9	12	6%
5 Year Avenue	3%	16%	7%	16%	11%	14%	

Table 7. % Seed Lots with Mosaic x Variety

	Russet	Ranger	Norkotah	Umatilla	Shepody	Other	5 Year Avenue
2000	12	11	12	10	33	25	14%
1999	5	7	6	7	22	13	8%
1998	11	0	24	14	32	5	12%
1997	5	13	31	0	26	24	15%
1996	6	3	22	0	33	27	14%
5 Year Avenue	8%	7%	19%	6%	29%	19%	

Table 8. % Seed Lots with Weak Plants x Variety

	Russet	Ranger	Norkotah	Umatilla	Shepody	Other	5 Year Avenue
2000	21	61	35	36	60	44	39%
1999	57	88	71	90	89	87	75%
1998	36	38	31	43	40	45	37%
1997	39	51	46	100	54	68	48%
1996	48	60	67	100	67	81	59%
5 Year Avenue	40%	60%	50%	74%	62%	65%	

Table 9. % Seed Lots with Leaf Roll x Seed Source

	MT	CAN	ID	WA	OR	ND	CO	Other	5 Year Avenue
2000	14	17	37	55	13	17	50	9	21%
1999	25	3	15	8	56	36	0	2	18%
1998	2	2	5	26	0	10	---	33	6%
1997	8	13	55	34	18	15	---	25	17%
1996	14	14	15	59	11	11	---	11	17%
5 Year Avenue	13%	10%	25%	36%	17%	18%	25%	16%	

Table 10. % Seed Lots with Black Leg x Seed Source

	MT	CAN	ID	WA	OR	ND	CO	Other	5 Year Avenue
2000	5	13	9	16	4	0	0	0	7%
1999	11	13	33	8	11	1	0	1	13%
1998	1	30	13	4	25	0	---	0	11%
1997	7	13	5	6	0	5	---	19	9%
1996	3	7	12	0	0	22	---	5	6%
5 Year Avenue	5%	15%	14%	7%	8%	6%	0%	5%	

Table 11. % Seed Lots with Mosaic x Seed Source

	MT	CAN	ID	WA	OR	ND	CO	Other	5 Year Avenue
2000	9	14	35	13	17	8	42	11	14%
1999	9	3	12	4	11	2	0	3	8%
1998	11	3	13	26	25	50	---	25	12%
1997	12	12	20	25	18	20	---	22	16%
1996	8	12	24	14	11	28	---	39	15%
5 Year Avenue	10%	9%	21%	16%	16%	22%	21%	20%	

Table 12. % Seed Lots with Weak Plants x Seed Source

	MT	CAN	ID	WA	OR	ND	CO	Other	5 Year Avenue
2000	26	53	46	45	46	42	50	18	24
1999	68	86	88	58	78	82	83	79	75
1998	33	45	33	30	25	50	---	42	37
1997	36	58	65	50	36	60	---	50	48
1996	43	72	53	73	67	78	---	61	59
5 Year Avenue	41	63	57	51	50	62	67	50	