WASHINGTON SEED LOT TRIALS

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A. Purpose

The general purpose of the Washington Seed Lot Trial when it was started in 1961 was "to evaluate potato seed from various sources for their disease content." That purpose is still a true and valid one. In 1970, however, the project is to be rewritten and updated and will include three purposes:

1) To determine the disease content of seed potatoes entering the State of Washington.
2) To educate the commercial potato industry as to the difference existing in seed from various sources.
3) To assist seed growing areas by encouraging improved seed quality.

The hope for the original trial was that "the disease pattern in the seed areas may change considerably for the future seed crop years either as a direct result of these trials or because of changes in natural conditions. However, if the pattern persists, adjustments in seed buying will naturally follow."

B. History

In 1961 under the direction of the late Nicolas Sandar who was then County Extension Agent at Othello the seed lot trials were planted on the Othello Research Unit for the first time. That planting consisted of 229 lots of seed, 49 percent of which showed seed borne leaf roll. Since the first planting in 1961 a seed lot trial has been planted each year up to and including 1969.

From 1964 through 1966 Don Bakes who was Extension Horticulture Specialist at Prosser was in charge of the seed lot trial. In 1967 through the present time the trials are being conducted by the Horticulture Department at Washington State University and the results are being handled by the current Extension Horticulture Specialist stationed at Pullman, Robert Thornton.

From their beginning these trials have been funded by the Washington State Potato Commission.

C. Procedure

Sampling

Procedures have changed as the trials developed over the years; the current procedure will be described. Each year the Horticulture inspectors from the Washington State Department of Agriculture collect seed samples from seed delivered for planting in the State of Washington. They deliver the samples to the potato storage at the Othello Research Unit. Each sample consists of at least 300 single drop tubers, hopefully not in excess of five ounces in size. These tubers are to be selected at random from a seed lot. The sample when it arrives at Othello is in a closed bag and is tagged with two tags. One is an original tag of the certifying agency in the area of origin. The second is a special indentification tag provided for the seed lot trials. When the seed is received at Othello it is placed into refrigerated storage and held at 38-39 degrees F. until 10 days before planting.

Planting

Ten days prior to planting seed lot samples are removed from cold storage and are warmed up. Just prior to planting the seed lots sample bags are grouped by areas and varieties for planting.

Planting so far has been with an assist feed planter and only whole tubers are planted. No seed sample is ever cut treated or washed. In the past few years the seed lot samples have been planted some time during the first 15 days of May.

Seed lots are brought to the field in the closed tagged bags. As they are placed onto the planter each tag is numbered in accordance with the row number into which it is planted. Only after it has been placed on the planter is the tag removed and the bag opened. The numbered tags are recorded and the rows staked. Row numbers and identification information is recorded into a field record book. This field book becomes the official record of the seed lot trials and is checked against the tag information at least twice again before the records are considered final. Both the original certification tag and the seed lot identification tag are numbered and saved in chronological order for further identification.

Disease Readings

Official seed lot disease readings are taken when the plants are in condition to give the best disease symptom expression.

For the past several years the disease readings have been the responsibility of Dr. W. G. Hoyman, Pathologist, USDA, Prosser, Washington. Assistance has been obtained from Washington State Department of Agriculture and the Washington State University research and extension personnel. All diseased plants are staked with stakes bearing colored flags for seed lot Field Day observation. Disease readings are recorded for permanent record. Each row reported as having disease is double checked before the count becomes final.

Summary information is usually limited to the virus disease leaf roll and the bacterial disease Blackleg, although all diseases observed are recorded in the official readings.

Seed Lot Reports

After planting is complete and the plants are growing, the planting plan is reproduced and mailed to each individual entering seed lots in the trials. This is to aid in the observation of the lots which they have submitted. Observation may be made at any time during the growing season but the major observation opportunity is at the Annual Seed lot Trial Field Day usually held 60-65 days following planting.

At the annual Field Day copies of the identification of the seed lot rows as to seed grower and disease readings are available. Copies of these readings are also mailed to each individual submitting seed samples. In addition each seed certification agency which is represented in the seed lot trial receives a copy of the seed lot readings. Additional copies are available on request from either Washington State University Extension Horticulture Specialist or from the office of the Washington State Potato Commission.

D. Results

Results from the last two years are summarized and included since the immediate past is of more importance to the industry.

1969 Seed Lot Trial Results

Lots Entered

383 lots were submitted and planted in the Test Plot.

Summary of Lots Entered

Variety	1969	1968
Norgold	153	133
Russet Burbank	214	92
Kennebec	12	7
Norchip	4	0
LaSota	0	5
Cascade (48-1)	0	2
Miscellaneous	0	5
Total	383	244

This is a 57 percent increase in total samples received in 1969 over the 1968 trials.

Seed Sources Represented

Again this year seed was received from eight different seed areas. Eighty-one percent of the seed lots came from four areas (Montana, North Dakota, Washington, and California.)

Local Firms Participating

Samples of seed were submitted from 49 different local participating companies or individuals. In 1968 there were 33 participants who submitted samples or an increase of 48 percent.

Readings

Leaf Roll

Summary - Leaf Roll Readings

Percent Lots Showing Seed Borne Leaf Roll

	1968 Average	1969 Average	1969 Russet Burbank	1969 Norgold
California	29	40	42	40
Canada	40	31	33	0
Idaho	28	11	12	0
Minnesota	8	10	0	12
Montana	13	7	7	0
North Dakota	3	1	0	1
Oregon	25	35	33	50
Washington	35	84	100	80
Average	15	16	16	15

The number of seed lots showing leaf roll remained nearly the same in 1969 as in 1968. This is a continuation of a trend toward more seed borne leaf roll each year for the past two years. There were some lots with higher amounts of leaf roll present. One seed lot from California showed about 10% of the plants with seed borne leaf roll (34 diseased plants out of a 300 + tuber sample.) California certification authorities questioned the reading on the lot and indicated the field and winter readings of this lot showed no seed borne leaf roll. No further word has been received from them following transmittal of picture copies of the original certification tag to them. In checking with the seed supplier and the Washington State Department of Agriculture it is felt the seed lot was a true sample of the seed delivered. Field observations of commercial plantings of this seed substantiates this assumption.

Blackleg

Summary - Blackleg Readings

Percent of Lots Showing Blackleg

	1968		1969		
	Average	Norgold	Average	Russet Burbank	Norgold
California	43	43	28	15	100
Canada	20	-	0	0	0
Idaho	20	53	7	0	100
Minnesota	58	60	63	0	73
Montana	8	66	8	5	60
North Dakota	38	36	32	0	33
Oregon	25	25	27	22	50
Washington	35	40	20	0	25
Average	26	43	21	6	44

The overall average number of seed lots with blackleg showed a slight decrease over 1968 but is still higher than in the previous years. More important though is the increase in the percent of lots of Norgold showing blackleg. Although this increase is not great the level of blackleg is quite high to begin with and any increase should be considered detrimental. There was a reduction in the level of blackleg in seed lots from one-half the areas represented while the other half showed an increase.

Follow-up Readings

Again this year a second reading was taken following the seed lot Field Day. In 1968 the follow-up readings indicated the initial readings were adequate for both leaf roll and blackleg content. In 1969 this was not the case and the follow-up readings of both were reported as a final reading.

The final seed lot reading included quite a number of changes (increase) in number of blackleg plants identified. These additional plants included lots already reported to contain disease on the first reading and seed lots which did not show diseased plants during the first reading. Virus disease content was also observed to be greater at the time of the final reading than on the initial reading.

Additional Observations

This year for the first time the seed lots contained a number (5) of seed lots in which seed borne chemical (herbicide) damage was observed. This was confined to the Russet Burbank variety. Some of these lots contained as high as 50 percent or more of the plants showing damage. Follow-up observations in commercial plantings in the company of the certification people from the state of origin confirmed the seed lot readings. How much reduction in production resulted is not known; the symptons on the plants in the seed lots were not identifiable after the plants reached bloom stage.

This year for the first time a number (12) of seed lot samples submitted to the trials were not accompanied by a certification tag from the state of origin. Some of these lots were identified as being bulk shipped lots. Those that were not so identified on the seed lot sampling tag were not identified as bulk lots for reporting purposes although they may have been.

Another first for samples received this year were those identified as being either virus free or virus tested. These were all of the Norgold variety, seventeen lots in all. What significance this type of seed has for our commercial growers in Washington is at this time unknown. No seed lot reported as virus tested or virus free was found to contain leaf roll virus.

Summary tables for each of the seed lot trials, 1961-1969, are included as an appendix to this report.

Discussion

It should be kept in mind that at no time are the seed lot trials intended to be an absolute record of the seed in the State of Washington. This does not mean that the trials are not a true and valid source of information on the seed available, it merely means there are numerous limitations on trials of this kind which prohibit generalizations on an industry wide basis.

Sample size is one of the biggest limiting factors in drawing industry wide conclusions from samples submitted for seed lot testing. The validity of a 300 or even a 400 tuber sample for judging a grower's potatoes is questionable. Some times the sample represents a carload of a grower's seed and perhaps in extreme cases a sample could represent ten carloads of seed. If diseased tubers were randomly distributed within a seed lot this may not be an important point but they are not. Insect spread viruses are spread unevenly within a field because insects tend to move into fields from the edge and the virus tends to be disseminated in the vicinity of diseased plants. Bacterial diseases, especially ring rot, are spread mechanically. An infected tuber spreads the disease to only a limited number of plants in either the cutting or planting process creating "islands" of infection within a seed lot.

With this non-randomization of disease incidence in seed lots, randomization of samples is quite important. This can take considerable time and effort.

To test the validity of the representation of each sample would also require an expenditure of considerable time and effort. Both of which are not presently available. This coming season, however, plans are being made to field check a limited number of seed lot samples. This is to be done by taking extensive disease readings in commercial fields planted to seed from seed lots which are represented in the seed lot trials.

Another aspect of the disease reading which can be misleading is that a seed lot is recorded as diseased whether it has one diseased plant or many. A seed lot is recorded in both the blackleg summary and the leaf roll summary when a plant of each occurs in the seed lot trials.

Leaf Roll

Since the original intent of the seed lot trials was to improve the quality of seed available to and purchased by the potato industry in Washington we need to stop and analyze the success of the

program. One way is to see if any change has been shown on the disease contect occuring in the seed lots entered each year. Since leaf roll is one of the most important seed borne diseases in Washington a comparison of the current year's readings and those of the past should be of value.

Percent Seed Lot Samples With Seed Borne Leaf Roll

	1961	1962	1963	1964	1965	1966	1967	1968	1969	Average
California	50	43	33	0	88	67	0	29	40	51
Canada	50	43	33	0	61	85	20	40	31	46
Idaho	14	19	8	21	8	6	23	28	11	15
Minnesota	62	40	17	0	0	6	0	8	10	14
Montana	6	12	13	14	8	8	5	13	7	8
North Dakota	57	20	0	12	0	6	2	3	1	7
Oregon	60	-	86	20	33	50	50	25	35	43
Washington	78	40	44	18	22	33	30	35	84	52
Average	34	26	21	15	24	16	9	15	16	

From an observation of these data it can be seen that the disease content of the seed lot is erratic to say the least and there seems to be very little influence of the leaf roll content of the seed lots in the seed lot trial on the disease content of the seed lots submitted the following year.

Another way to evaluate if there is any influence on the quality of the seed lots sumbitted is to observe the percent of the seed lots submitted from areas reported to have the lowest seed borne leaf roll content.

When the seed areas are ranked according to the average seed borne leaf roll content over the years of the seed lot trials we get the following:

Seed Source by Area
1961-1969 Average

		Percent Leaf Roll
1.	North Dakota	7
2.	Montana	8
3.	Minnesota	14
4.	Idaho	15
5.	Oregon	45
6.	Canada	46
7.	California	51
8.	Washington	52

Percent Seed Lots From Four Highest Ranking Seed Areas

	Percent Seed Lots	Percent Leaf Roll
1961	79	34
1962	74	26
1963	76	21
1964	79	15
1965	64	24
1966	82	16
1967	88	9
1968	73	15
1969	78	16

From this comparison it can be seen that the percent of seed lots from the four highest ranking areas remained quite constant. In general though the higher the percent of seed lots from these areas the lower the percent of leaf roll in the lots received. It is interesting to note that in 1965 following the short potato supply year the percent of seed from the four high ranking areas was substantially reduced.

A comparison of 1969 Washington State seed arrivals as reported by the State Department of Agriculture is also enlightening.

	1961-1969 Seed Lot Rank	1969 Seed Arrivals	
		Rank	Percent
Montana	2	1	49
North Dakota	1	2	18
Idaho	4	3	9
Washington	8	4	8
Minnesota	3	5	7
California	7	6	5
Canada	6	7	4
Oregon & Others	5	8	Nil

From this it can be seen that the four seed areas which are highest on the seed lot trial rating account for 83 percent of the seed reported received in the state in 1969. This might be interpreted as being a desirable influence resulting from seed lot trials.

Blackleg

Since the Norgold variety has become an important variety in the state's potato production picture the influence of seed on the incidence of blackleg has become more important. Whether blackleg is indeed seed borne

or whether the incidence of blackleg in a seed lot is due to other factors that affect seed performance is still a question of debate. The fact remains there are differences in the amount of blackleg observed in different seed lots. Blackleg readings have been included in the seed lot reading from the beginning but have been used in the summary data only since 1965. To evaluate these readings comparisons similar to those used for the leaf roll readings are interesting.

Seed Lot Seed Source
by Area

1965-1969 Average

	Percent Blackleg
Canada	3
Montana	6
Idaho	7
Washington	15
California	23
Oregon	24
Minnesota	27
North Dakota	34

To determine if there is any influence from this ranking a comparison of the percent of the total seed lots being submitted from the highest ranking areas might be of value.

Percent Seed Lots From Four Highest Ranking Seed Areas

	Percent Seed Lots	Percent Blackleg
1965	75	7
1966	78	11
1967	62	16
1968	54	26
1969	53	21

These results indicate that over the past five years there has been a consistent trend to fewer of the seed lot samples coming from areas which had the lower blackleg incidence in the seed lot trials the previous years.

A comparison of Washington State Seed arrivals in 1969 with the rank of areas in the seed lot trials shows the following:

	1965-1969 Seed Lot Rank	1969 Seed Arrivals	
		Rank	Percent
Canada	1	7	4
Montana	2	1	49
Idaho	3	3	9
Washington	4	4	8
California	5	6	5
Oregon	6	8	Nil
Minnesota	7	5	7
North Dakota	8	2	18

Only 71 percent of the seed which was planted commercially in Washington in 1969 was from the highest rated areas for blackleg according to the seed lot trials. This indicates that the blackleg readings in the seed lot trials are of less influence on seed lot selection in commercial production than the leaf roll content appears to be.

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Washington Seed Lot Trials

1961 Potato Seed Evaluation Trials

Source of Sample	Number of Samples	Number of Samples with Leaf Roll	Percent Samples with Leaf Roll
Canada	42	21	50
Idaho	48	7	14
Minnesota	8	5	62
Montana	52	3	6
Nebraska	2	1	50
North Dakota	7	4	57
Oregon	10	6	60
Washington	23	18	78
Total	198	65	34%

1962 Potato Seed Evaluation Trials

Source of Sample	Number of Samples	Number of Samples with Leaf Roll	Percent Samples with Leaf Roll
Canada	7	3	43
Idaho	48	9	19
Minnesota	5	2	40
Montana	50	6	12
Nebraska	1	1	100
North Dakota	5	1	20
Washington	17	12	40
Total	133	34	26%

1963 Potato Seed Evaluation Trials

Source of Sample	Number of Samples	Number of Samples with Leaf Roll	Percent Samples with Leaf Roll
Canada	9	3	33
Idaho	25	2	8
Minnesota	6	1	17
Montana	63	8	13
North Dakota	3	0	0
Oregon	7	6	86
Washington	16	7	44
Total	129	27	21%

1964 Potato Seed Evaluation Trials

Source of Sample	Number of Samples	Number of Samples with Leaf Roll	Percent Samples with Leaf Roll
Canada	6	0	0
Idaho	24	5	21
Minnesota	3	0	0
Montana	70	10	14
North Dakota	8	1	12
Oregon	5	1	20
Washington	17	3	18
Total	133	20	15%

1965 Potato Seed Evaluation Trials

Source of Sample	Number of Samples	Number of Samples with Leaf Roll	Percent Samples with Leaf Roll	Number of Samples with Blackleg	Percent Samples with Blackleg
California	17	15	88	2	12
Canada	18	11	61	0	0
Idaho	39	3	8	1	3
Minnesota	6	0	0	0	0
Montana	59	5	8	0	0
Nebraska	1	0	0	0	0
North Dakota	9	0	0	0	0
Oregon	6	2	33	0	0
Washington	18	4	22	0	0
Total	179	40	24%	3	7%

1966 Potato Seed Evaluation Trials

Source of Sample	Number of Samples	Number of Samples with Leaf Roll	Percent Samples with Leaf Roll	Number of Samples with Blackleg	Percent Samples with Blackleg
California	6	4	66	1	17
Canada	13	11	85	0	0
Idaho	47	3	6	1	2
Minnesota	18	1	6	2	11
Montana	92	7	8	2	2
North Dakota	31	2	6	18	58
Oregon	4	2	50	1	25
Washington	18	6	33	1	6
Total	229	36	16%	26	11%

Summary - Seed Lot Trials 1967

Source of Sample	Number of Samples	Leaf Roll Number Samples	Leaf Roll Percent Samples	Blackleg Number Samples	Blackleg Percent Samples
California	4	0	0	0	25
Canada	10	2	20	1	10
Idaho	26	6	23	3	11
Minnesota	15	0	0	2	13
Montana	73	3	5	6	9
North Dakota	50	1	2	14	28
Oregon	4	2	50	2	50
Washington	10	3	30	1	10
Total	192	17	9%	30	16%

Summary - Seed Lot Trials 1968

Source of Sample	Number of Samples	Leaf Roll Number Samples	Leaf Roll Percent Samples	Blackleg Number Samples	Blackleg Percent Samples
California	7	2	29	3	43
Canada	5	2	40	1	20
Idaho	25	7	28	5	20
Minnesota	24	2	8	14	58
Montana	75	10	13	6	8
North Dakota	66	2	3	23	35
Oregon	4	1	25	1	25
Washington	17	6	35	6	35
Wisconsin	2	0	0	0	0
Utah	1	1	100	0	0
Total	226	33	15	59	26

Summary - Seed Lot Trials 1969

Source of Sample	Number of Samples	Leaf Roll		Blackleg	
		Number Samples	Percent Samples	Number Samples	Percent Samples
California	32	13	40	9	28
Canada	13	14	31	0	0
Idaho	27	3	11	7	7
Minnesota	30	3	10	19	63
Montana	137	9	7	11	8
North Dakota	92	1	1	29	32
Oregon	11	9	35	3	27
Washington	25	21	84	5	20
Total	383	58	16	78	21

Summary - Seed Lot Trials

Source of Sample	Number of Samples	Number of Samples with Leaf Roll	Percent of Samples with Leaf Roll
California	66	34	51
Canada	123	57	46
Idaho	309	46	15
Minnesota	105	15	14
Montana	771	61	8
North Dakota	171	12	7
Oregon	51	31	43
Washington	161	84	52
Total	1890	340	8%