

SOME FACTORS AFFECTING PRODUCTIVITY  
OF RUSSET BURBANK SEED POTATOES<sup>1</sup>W. M. IRITANI<sup>2</sup>

Went (11) found that seed potatoes grown under relatively cool temperatures produced higher yields than seed which had been grown under warmer conditions. He further stated that whatever factor is present in tubers grown at low temperatures disappears upon storage. Werner (12) expressed the opinion that when seed stocks are free and remain free of virus diseases, environmental conditions have little direct effect upon the quality of seed potatoes. Length of storage period of seed seems to affect its performance. Hankins (2) proposed that 180 days from planting to planting was optimum for the highest yields of White Rose potatoes. Kawakami (4) proposed that optimum age tubers (4-6 months) be obtained by growing in different areas or by late planting. According to Madec and Perennec (6) the physiological age of the seed tuber exerts considerable influence on growth rates, size and time of maturity of plants. They stated that such factors as, early planting of crop, digging of immature tubers and high temperature storage result in more rapid physiological aging of seed tubers and affects subsequent field growth. Werner (12) has found late planted seed to be more productive than early planted stock. When considering potatoes planted on any one date, the lots harvested early were generally more productive.

Considerable work has been done on the effect of storage temperatures and humidity on the seed value of potatoes, Smith (7), Hartman (3), Stuart et al. (10). It has been found that storage at 40 F with high humidity was the most desirable for high yields.

Generally, yield increases as size of seed piece increases; Chucka and Steinmetz (1), Kraus (5), Stuart et al. (10). The literature shows discrepancy as to whether whole or cut seed is more productive. Stuart et al (10) stated that although considerable work has been done on the merits of whole vs cut seed, it is still a moot question. Stewart (8), Stuart et al (9) and more recently Chucka (1) have shown slightly higher yields with whole rather than cut seed. Kraus (5) found that in general the larger the tuber from which a given size seed piece was obtained the lower the yield.

The results presented herein are some preliminary observations on the behavior of seed lots of Russet Burbank from various areas of Idaho. Greenhouse investigations on comparison of whole vs cut seed, seed size, periderm removal and the effect of bruising of seed on productivity are also presented. Seed storage temperature effects are being investigated as well as the effect of seed maturity. Chemical analysis by chromatography is being initiated to shed further light on seed behavior and productivity.

## MATERIALS AND METHODS

On April 8, 1965, twenty-two different lots of Russet Burbank seed potatoes representing all of the major seed areas of Idaho were planted

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in the greenhouse in 7½ inch pots. Whole seed approximately 1½ to 2 ounces in size were used. The seed lots were replicated 10 times in a randomized block design with one seed set per pot and one pot per treatment per replicate. The growing medium was a sand, vermiculite, peat in the ratio by volume of 5:9:9 with a small amount of Morgro fertilizer. The seed had been stored together from a month after harvest until planting.

On April 20, data were taken on rate of emergence, number of stems and at harvest time on June 15, foliage weight, tuber number and weight, and weight of root system.

All of these same lots of seed, except three, were also planted in the field on May 6, 1965 in 25-foot single row plots replicated 5 times. Whole seed of approximately the same size were used in all plots. They were harvested the first week in October and data taken on total, U.S. No. 1 (2 inch or 4 oz. minimum), malformed and small tuber yield (less than 2 inch). Specific gravities were determined by weight in air, weight in water method.

In a second experiment seed pieces were cut into 1 oz, 1½ oz, 2 oz and 2½ oz sizes from the bud portion of 4 oz tubers and compared with 1½ oz whole seed in pots in the greenhouse. One set per pot was planted in all instances. This experiment was conducted on two different dates. Since the same results were obtained both times, the data presented are those of the earlier experiment.

The sprouting behavior of bruised, scarred, cut, peeled and waxed seed 2-3 oz in size (Table 4) were compared in a third experiment by planting them in flats filled with peat moss. Five tubers were planted per treatment per flat using three flats. After a period of approximately 2 weeks, at which time the sprouts were 2-3 inches long, they were taken out of the peat and data taken on number and length of sprouts and extent of the root system.

#### RESULTS AND DISCUSSION

Statistically significant differences according to Duncan's Test were obtained in the performance of seed lots in the greenhouse (Table 1). Since Duncan's Test is awkward to present with a large amount of data, LSD's are shown so that differences can be more easily discerned. Plants of some lots of seed tended to emerge significantly earlier than others. However, these lots did not necessarily attain the largest weight of foliage. The correlation coefficient between emergence rate and foliage weight at harvest was +0.19. Significant differences were obtained in average stem number per pot. No explanation for this is evident at this time. Generally increased stem number is associated with an increase in seed size. Significant differences were also obtained in tuber weight and foliage weight. It appears that some lots tended to set tubers sooner than others. A negative correlation coefficient of -0.725 was calculated between foliage weight and tuber weight suggesting that the lots which started to set tubers sooner than others limited the vegetative growth. Number of tubers was highly correlated with total tuber weight indicating that, at this stage of growth, the increase in tuber weight was largely due to increase in tuber numbers rather than an increase in size.

There was some association ( $r = 0.49$ ) between stem number and

TABLE 1.—*Results of comparison of Russet Burbank seed from major seed areas in Idaho grown in greenhouse, 1965. Planted April 8 — harvested June 15.*

Lot No.	Emer. Ht. (inches)	Weight foliage (grams)	Stem No.	Tuber weight (grams)	Tuber No.	Root weight (grams)
1	1.39*	145.1	1.9	47.9	5.7	42.7
2	0.72	141.8	2.0	58.5	6.6	55.3
3	0.78	144.7	1.9	45.8	6.8	49.2
4	0.44	148.4	1.4	30.7	5.1	52.7
5	0.50	121.1	1.6	56.2	7.2	47.9
6	0.11	135.5	1.8	31.0	4.6	48.7
7	0.22	131.0	1.4	32.7	3.9	46.2
8	0.83	116.5	1.3	50.5	5.0	50.8
9	0.33	118.8	1.2	30.1	5.3	47.1
10	0.28	152.9	1.3	16.1	3.4	48.7
11	0.44	159.7	1.2	11.0	2.2	55.1
12	0.50	176.0	1.4	8.9	2.2	52.2
13	0.94	166.4	1.9	7.8	1.9	55.8
14	0.44	157.5	1.2	17.0	3.3	48.9
15	0.28	133.4	1.7	19.4	3.3	47.2
16	0.28	162.9	1.3	18.9	3.2	47.9
17	0.44	164.1	1.8	16.1	3.5	48.5
18	0.28	120.3	2.0	33.9	5.3	57.0
19	0.28	132.1	1.9	36.3	5.7	52.2
20	0.22	133.5	1.9	36.7	6.5	48.4
21	0.44	136.0	2.0	38.7	5.7	53.2
22	0.72	157.4	2.1	32.9	5.1	59.4
LSD @ 5%	0.38	25.3	0.59	19.4	2.2	8.8
LSD @ 1%	0.51	33.4	0.78	25.6	2.9	11.7

\*Average of 10 replicates taken April 20.

tuber number. A poor relationship existed between foliage weight and root weight. No explanation is evident for this. Larger plants generally have large root systems.

Yield differences were obtained in the field (Table 2). Very poor correlations were obtained between performance in the field and in the greenhouse, indicating that results in the greenhouse cannot necessarily be projected to the field. Statistically significant differences were obtained in U.S. No. 1 and undersize yield. Specific gravity was not significantly different.

These results would tend to indicate that variations exist in the performance of Idaho grown Russet Burbank seed. Since the lots were all placed together in a common storage, differences in storage temperatures can be discounted as a source of variation. No one particular area of production appears to be associated with a particular type of performance. Factors, such as maturity at harvest time, date of planting, etc. are being investigated as possible sources of variation. The fact that differences were obtained lends encouragement for continued research in trying to increase the productive capacity of Russet Burbank seed. In the second experiment, plants from cut seed emerged at a significantly faster rate than those from whole seed (Table 3). A possible explanation for this is that cutting of the seed stimulates sprout growth. There was no

TABLE 2.—*Results of comparison of Russet Burbank seed lots in field, 1965. Planted May 6 - harvested Oct. 2.*

Lot No.	Total Yield	No. 1 Yield	Small	Specific Gravity
	cwt/A	cwt/A	cwt/A	
1	272*	205	33	1.0898
2	285	224	29	1.0866
3	269	198	34	1.0897
4	268	182	18	1.0896
5	272	180	44	1.0858
6	274	198	26	1.0873
7	281	180	40	1.0869
8	268	174	28	1.0896
9	277	203	27	1.0860
10	256	209	19	1.0884
11	285	204	34	1.0874
12	281	189	31	1.0907
13	272	223	24	1.0897
14	271	204	28	1.0877
15	263	175	31	1.0880
16	277	201	38	1.0857
17	272	175	30	1.0856
18	275	213	22	1.0889
19	300	234	23	1.0904
20	274	211	30	1.0900
21	288	205	21	1.0843
22	292	212	22	1.0870
LSD @ 5%	N.S.	32	10	N.S.
LSD @ 1%	N.S.	43	14	N.S.

\*Average of five replications.

significant difference among the treatments as to number of stems per pot, although the trend was for increased number of stems with larger seed pieces. Foliage weight increased, as expected, as seed piece size increased. The most significant finding was th large top growth which plants from whole seed attained at this stage of growth even though the emergence rate was much slower than the other treatments. This was verified in two separate experiments. However, whole seed, at this stage of growth produced less tuber weight. These results suggst that cut seed tends to set tubers at an earlier date limiting top growth and since emergence was earlier they would probably mature and die down sooner than plants of whole seed. There was no significant difference in the average number of tubers per pot. Plants from whole seed had a significantly larger root system than any of the plants from the cut seed. No explanation is evident at this time for the superior performance of whole seed. Chromatograms of extracts from whole and cut seed which have started to grow will be made to try to determine if any differences are present on amount and kind of growth regulators.

Table 4 shows results of sprouting in peat moss of variously treated seed (Experiment 3). There appears to be a significant increase in the number of sprouts due to injury to the seed piece caused by dropping, peeling or otherwise. This can offer an explanation for the large number of sprouts some seed pieces have in the field in comparison to others

TABLE 3.—*The effect of Russet Burbank seed size and whole vs cut seed on performance in the greenhouse. Jan. 8 - March 24, 1965.*

	Emer. Ht. (in.) Feb. 10	Ave. Stem No.	Foliage weight (gm)	Ave. Wt. tubers pot	Ave. No. tubers pot	Ave. Wt. Roots/ pot (gm)
1. 1 oz. cut .....	2.7*	1.0	70.4	102.0	4.5	21.1
2. 1½ oz. cut .....	2.1	1.0	77.5	98.5	4.0	20.2
3. 2 oz. cut .....	2.3	1.4	78.0	105.0	4.1	20.4
4. 2½ oz. cut .....	2.0	1.2	83.3	97.1	4.0	27.1
5. 1½ oz. (whole) ....	0.1	1.0	97.8	64.3	4.6	39.3
LSD @ 5% .....	0.88	N.S.	6.8	13.2	N.S.	4.9
LSD @ 1% .....	1.15	N.S.	9.1	17.6	N.S.	6.6

\*All readings are based on one plant per pot and the average of 10 pots (replicates).

TABLE 4.—*Summary of sprouting of variously treated Russet Burbank seed potatoes in peat moss.*

	Number of sprouts	Ave. length sprouts (in.)	Root system rating
1. Check (whole) .....	2.9*	2.1	1.3†
2. Bruised by dropping .....	4.7	2.0	2.5
3. Scarred with knife .....	4.5	2.2	2.5
4. Cut in half .....	3.1	2.4	2.3
5. ½ peeled dipped in wax .....	3.5	1.8	1.1
6. Half peeled .....	4.1	2.2	2.6
LSD @ 5% .....	1.5	N.S.	0.2
LSD @ 1% .....	2.2	N.S.	0.5

\*Based on per seed piece and the average of five tubers/flat and three flats.

†Rating based on 1 = fair, 3 = good root system.

of the same type and size. There was no significant difference in length of sprouts among any of the treatments, although injured seed pieces generally tend to sprout sooner than uninjured. Ratings on the extent of root system shows that at the particular stage of growth at which readings were taken the injured seed had more extensive roots, indicating either a faster rate of development or injury caused more roots to form. In all probability, injury accelerated the rate of development. Treatment 5 shows that dipping of the peeled portion in paraffin made the seed behave similar to the check (whole seed) as far as the root development is concerned. However, peeling still caused an increase in stem number.

#### SUMMARY

Significant differences in behavior were found among Idaho certified Russet Burbank seed lots when grown both in the greenhouse and in the field. Investigations are being made to determine why variations exist. From this it is hoped that suggestions can be made for increasing the productive capacity of Russet Burbank seed.

Comparisons were made in the greenhouse of seed size and whole vs cut seed. Although whole seed emerged much later than cut seed of the same size, it attained a larger foliage area and root system than cut seed.

Injury to the tubers such as dropping, cutting and peeling, caused an increase in number of sprouts formed and they also appeared to have a more extensive root system at the particular stage of development at which readings were taken.

#### RESUMEN

Diferencias significantes en comportamiento fueron observadas entre lotes de semilla certificada de Idaho Russet Burbank cuando éstos fueron sembrados en el invernadero y el campo. Se están conduciendo investigaciones para determinar porque existen estas variaciones. Se espera que de este modo se alcanzarán sugerencias para incrementar la capacidad productiva de la semilla Russet Burbank.

En el invernadero comparaciones han sido hechas entre el tamaño de la semilla y también entre semilla entera y cortada. Aunque la semilla entera brotó mucho más tarde que la semilla cortada del mismo tamaño, la semilla entera alcanzó a tener un área foliar más grande y también un sistema de raíz más desarrollado que las plantas brotadas de semilla cortada.

El daño a los tubérculos, tal como golpeado, cortada, y descortezamiento, causaron un incremento en el número de brotes y estas plantas tenían también, al parecer, un sistema radical más extenso en la etapa precisa de desarrollo en que las observaciones habían sido hechas.

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