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EFFECT OF IRRIGATION WATER ON VIGOR AND VITALITY OF SEED POTATOES

EDMUNDSON, W.C.

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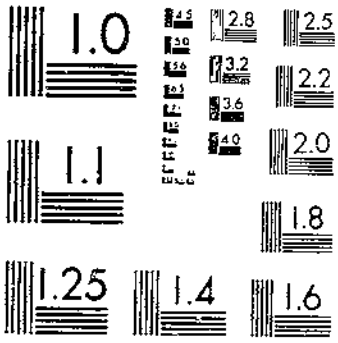

MICROCOPY RESOLUTION TEST CHART
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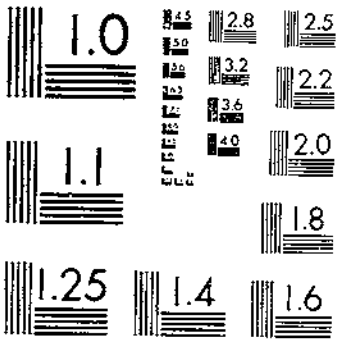

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UNITED STATES DEPARTMENT OF AGRICULTURE
WASHINGTON, D. C.

EFFECT OF IRRIGATION WATER ON VIGOR AND VITALITY OF SEED POTATOES

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INTRODUCTION

Potato growers in the irrigated districts and elsewhere, for the most part, have been prejudiced against the use of seed grown with the aid of irrigation water, the common belief being that such water impairs the vigor and vitality of seed. It has been the general practice of most growers in the irrigated districts to purchase nonirrigated seed stock every year or two. Practices among growers differ, however; some never plant irrigated seed, while others maintain that the best yields are obtained with seed planted the second year under irrigation, and still others plant seed until yields are reduced mainly by diseases. A few growers have been known to maintain a strain of seed for years under irrigation by careful selection of seed. (Fig. 1.) Few growers of irrigated potatoes, however, maintain a seed plot or rogue their fields to improve their seed. In most States seed growing has never been encouraged in the irrigated districts, and some States have refused to inspect fields in the irrigated districts for certification.

OUTLINE OF EXPERIMENT

Studies concerning the effect of irrigation water on the vigor and vitality of seed potatoes were conducted at the Colorado Potato Experiment Station, Greeley, Colo.

From 1921 to 1924, inclusive, seed grown under a varying number of light applications of irrigation water was tested. From 1926 to 1929, inclusive, comparisons were made of seed receiving different numbers of light irrigations, seed grown without irrigation (fig. 2), and seed grown in wet soil (fig. 3). Throughout the experiment the same strain of Rural New Yorker seed was used, all irrigated seed being grown at the experiment station at Greeley.

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The nonirrigated seed used in planting the test plots from 1926 to 1929 was grown in the mountains 50 miles west of Greeley at an elevation of 7,500 feet. The nonirrigated seed planted in 1926 was

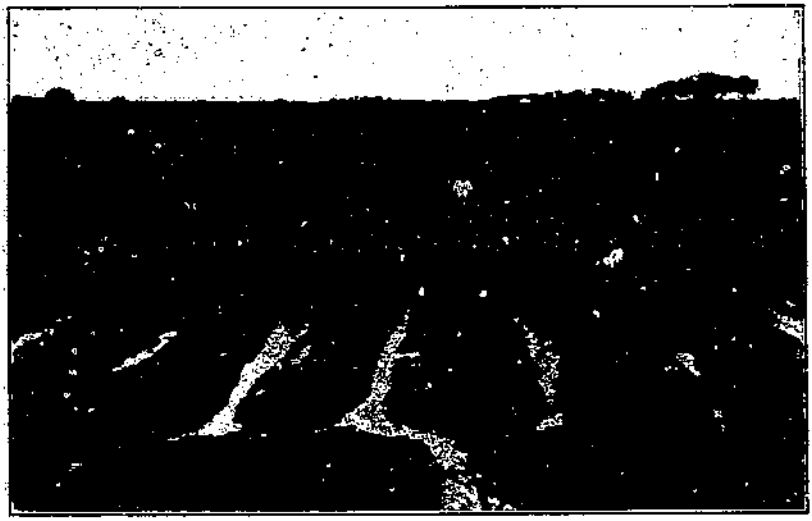

FIGURE 1.—Potato plants produced from seed grown for 15 years under irrigation. Note the strong, even vine growth

grown but one year without irrigation, whereas the nonirrigated seed planted in 1927, 1928, and 1929 was grown without irrigation for two years before being planted in the test plots. Late in the fall of 1924 the Colorado Potato Experiment Station was moved to a new location.

FIGURE 2.—Growing nonirrigated seed potatoes at an elevation of 7,500 feet

Because of some low, seepy ground at the new location it was possible to grow seed in wet soil where the water table was very near the surface and where the soil surrounding the tubers could be saturated with

water, producing tubers with protruding lenticels. These conditions offered an excellent opportunity for testing seed grown in wet soil.

All plots producing seed for the tests were rogued carefully, and all weak and diseased hills were removed. Tubers weighing from 3 to 10 ounces were selected for planting the test plots. These tubers were cut into blocky seed pieces weighing from 1½ to 2 ounces, after which the seed was spread out on the dugout floor for six or seven days until the cut surfaces were healed over.

The weight of the seed pieces and the method of handling the seed planted in each test plot were the same throughout the experiment. The rows were 242 feet long each year of the test with the exception of 1926, when the rows were 484 feet long. The plots consisted of four rows each, planted in duplicate, except in 1929, when the plots consisted of two rows each, planted in triplicate. All rows throughout the experiment were spaced 3 feet apart.

In all the test plots the dates of planting, cultivation, irrigation, and all cultural practices were the same each year. Irrigation water

FIGURE 3.—Growing seed potatoes in wet, seepy soil with heavy irrigation

was supplied throughout the growing season to the plots whenever the plants seemed to require it to make a continuous, vigorous growth, the quantity applied with each irrigation varying according to the size of the plants, soil moisture, and color of foliage.

EXPERIMENTAL RESULTS

In 1921 tests were made with seed receiving 2, 4, and 6 irrigations the previous year. Table 1 shows that the plots grown from seed receiving two irrigations in 1920 produced 352.88 bushels of primes[1] per acre. The plots grown from seed receiving four irrigations in 1920 produced 339.38 bushels of primes, whereas the plots grown from seed receiving six irrigations produced 308.50 bushels of primes per acre. The plots grown from seed receiving the least amount of irrigation water produced the largest yield of primes and the smallest

[1] All tubers passing over the 1⅞-inch square mesh screen of the sorter were considered as primes. Those passing through it were classed as culls.

yield of culls. The plots grown from seed receiving six irrigations produced the lowest yield of primes and the highest yield of culls. The difference in the total yield was 17.75 bushels.

In 1922 the plots were grown with seed receiving 3, 5, and 7 irrigations. Examination of Table 1 reveals that the highest yield of both primes and culls was produced by seed receiving the greatest number of irrigations. Comparison of the yields of primes shows that there was a difference of but 7.56 bushels in the yields produced from the seed receiving seven irrigations and in those from seed receiving three irrigations.

TABLE 1.—*Comparison of relative yields of Rural New Yorker No. 2 potatoes from irrigated seed varying in number of irrigations at Greeley, Colo., 1921–1924*

Year in which crop was produced	Year in which seed was grown	Irrigations of seed crop	Hills	Weight [1]		Acre yields		
				Primes	Culls	Primes	Culls	Total
		Number	*Number*	*Pounds*	*Pounds*	*Bushels*	*Bushels*	*Bushels*
1921 [2]	1920	2	813	1,411.5	105.0	352.88	26.25	379.13
		4	854	1,357.5	144.5	339.38	36.13	375.51
		6	855	1,234.0	211.5	308.50	52.88	361.38
1922 [3]	1921	3	1,711	2,823.5	293.0	352.94	36.63	389.57
		5	1,714	2,726.0	289.0	340.75	36.13	376.88
		7	1,706	2,884.0	320.5	360.50	40.06	400.56
1923 [3]	1922	4	1,708	2,246.5	235.5	280.81	29.44	310.25
		7	1,745	2,416.0	248.0	302.00	31.00	333.00
		10	1,721	2,276.5	229.5	284.56	28.69	313.25
1924 [3]	1923	2	1,772	2,714.0	147.5	339.25	18.44	357.69
		3	1,779	2,703.0	146.0	337.88	18.25	356.13
		5	1,774	2,699.5	123.5	337.44	15.44	352.88

[1] Average weight of potatoes per plot. [2] One-fifteenth of an acre. [3] Two-fifteenths of an acre.

In 1923 plots were planted with seed receiving 4, 7, and 10 irrigations. The yields were practically the same for the plot receiving 4 irrigations and that receiving 10 irrigations. The highest yield of primes per acre in 1923 was 302 bushels, the high yield being produced from seed that had received 7 irrigations the previous year.

In 1924 there was practically no difference in yield of plots planted with seed receiving 2, 3, and 5 irrigations, there being less than 2 bushels difference in the yield of primes between the highest and the lowest yielding plots.

As previously stated, in 1926 nonirrigated seed and seed grown with very heavy irrigation was added to the experiment. A comparison in Table 2 reveals the fact that very little difference in yields resulted. The seed receiving no irrigation produced 466.88 bushels of primes per acre. The plots grown from seed produced in wet, seepy soil yielded 473.5 bushels of primes, while the seed receiving two and four irrigations in 1925 produced very similar yields.

In 1927 the yields produced were again very similar, there being a difference of only 7.81 bushels of primes per acre between the highest and the lowest yielding plots. The nonirrigated seed produced the lowest yield, or 393.13 bushels per acre, while the plot producing the highest yield, or 400.94 bushels of primes per acre, was from seed receiving four irrigations in 1926. It will be further noted that the seed grown in wet, seepy soil produced 395.25 bushels of primes per acre.

TABLE 2.—*Comparison of relative yields of Rural New Yorker No. 2 potatoes from irrigated seed varying in number of irrigations, from seed grown in wet, seepy soil and from nonirrigated seed at Greeley, Colo., 1926–1929*

Year in which test crop was produced	Year in which seed was grown	Irrigations of seed crop	Hills	Weight [1]		Acre yields		
				Primes	Culls	Primes	Culls	Total
		Number	*Number*	*Pounds*	*Pounds*	*Bushels*	*Bushels*	*Bushels* [1]
1926 [2]	1925	0	1,775	3,735.0	185.5	466.88	23.19	490.07
		2	1,765	3,785.5	197.5	473.19	24.69	497.88
		4	1,760	3,769.0	143.5	471.13	17.94	489.07
		(3)	1,757	3,788.0	178.5	473.50	22.31	495.81
1927 [2]	1926	0	1,924	3,145.0	132.0	393.13	16.50	409.63
		4	1,922	3,207.5	167.0	400.94	20.87	421.81
		5	1,933	3,180.0	152.5	397.50	19.06	416.56
		[4] 5	1,929	3,163.5	129.0	395.44	16.12	411.56
		(3)	1,917	3,162.0	124.0	395.25	15.50	410.75
1928 [2]	1927	0	1,894	2,199.5	217.5	274.94	27.19	302.13
		3	1,870	2,276.0	172.5	284.50	21.56	306.06
		4	1,877	2,282.5	152.5	285.31	19.06	304.37
		5	1,859	2,291.5	151.0	286.44	18.87	305.31
		(3)	1,895	2,197.0	180.0	274.63	22.50	297.13
1929 [2]	1928	0	1,373	1,181.0	238.5	196.83	39.75	236.58
		4	1,370	1,274.0	236.0	212.33	39.33	251.66
		5	1,350	1,243.0	223.0	207.17	37.17	244.34
		6	1,350	1,212.5	189.0	202.08	31.50	233.58
		(3)	1,352	1,213.0	220.5	202.17	36.75	238.92
		(6)	859	794.0	159.5	198.50	39.88	238.38

[1] Average weight of potatoes per plot.
[2] Two-fifteenths of an acre.
[3] Wet, seepy soil.
[4] Heavy irrigations.
[5] First 5 plots, one-tenth of an acre; last plot, one-fifteenth of an acre.
[6] Irrigated for 15 years.

In 1928 all plot yields were greatly reduced by hail injury to the vines during the growing season. Each plot received about the same amount of injury, and although yields were reduced, they are comparable. A comparison of the yields shows that there is no great difference in the yield from seed grown without irrigation and that grown in wet, seepy soil, or from varying numbers of irrigations.

In 1929 test plots were planted with nonirrigated seed, with seed receiving 4, 5, and 6 light applications of irrigation water, with seed that had been grown in wet, seepy soil, and with seed that had been grown for 15 years under irrigation. A frost on September 8 killed the vines of all plots in the experiment and greatly reduced the yields. The early frost also accounts for the exceptionally high yields of culls. A comparison of yields reveals the fact that there was little difference in results obtained in 1929. The lowest yield of primes was 196.83 bushels and was produced from nonirrigated seed. The highest yield of primes was 212.33 bushels per acre and was produced with seed that had received four irrigations the previous year. Seed receiving five and six irrigations and seed grown in wet, seepy ground produced very similar yields. Seed grown for 15 years under irrigation produced 198.5 bushels of primes per acre.

Figure 4 represents average yields for four years of Rural New Yorker potatoes, in bushels per acre resulting from nonirrigated seed, seed receiving four light irrigations, and seed grown in wet soil. Figure 4 shows that the yields of primes from nonirrigated seed, seed receiving four light irrigations, and from seed grown in wet soil were practically the same. The yields of culls from nonirrigated seed, seed receiving four light irrigations, and from seed grown in wet soil likewise showed practically no difference.

DISCUSSION

Strains of seed of the Rural New Yorker variety received from several of the Northern States were tested in comparison with irrigated seed of the same variety, and in practically all tests no superiority was noted for the nonirrigated seed. While the data here presented deal only with the Rural New Yorker variety grown in the Greeley district, strains of other varieties are known to have been developed and maintained for years under irrigation in this and other irrigated districts. Although it is believed that irrigation water has little or no effect on the vigor and vitality of seed, it is also the belief that there may be varieties which are grown commercially under irrigation, the seed of which can not be successfully grown in the same locality. Climatic conditions doubtless have some influence in seed production. Excessive vine growth under irrigation makes the growing of seed more difficult, often hiding weak and diseased plants. Disease is spread more rapidly because of rank vine growth and contact of one plant with another. Plants grown under irrigation occasionally develop a water mottling of the leaves which is very difficult to dis-

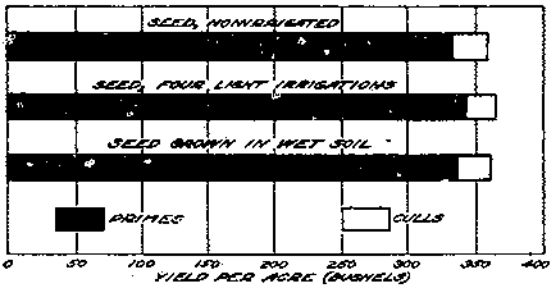

FIGURE 4.—Graphic comparison of average yields of Rural New Yorker potatoes (in bushels per acre) from nonirrigated seed, from seed receiving four light irrigations, and from seed grown in wet soil at Greeley, Colo., 1926–1929

tinguish from mosaic. Irrigation water also has a decided influence on the color of the foliage. Lack of moisture causes plants to turn dark, whereas an oversupply in the soil causes the foliage to assume a lighter color than is normal for the variety.

SUMMARY

The experimental results herein noted with the Rural New Yorker, the leading commercial potato variety of the Greeley (Colo.) district, indicate that irrigation water has little or no effect on the vigor and vitality of seed.

From 1921 to 1924, inclusive, irrigated seed grown under a varying number of light applications of irrigation water produced very similar yields.

From 1926 to 1929, inclusive, comparisons made of seed receiving different numbers of light irrigations, seed grown without irrigation, and seed grown in wet, seepy soil resulted in similar yields.

Seed grown for 15 years under irrigation produced yields comparable with nonirrigated seed.

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