

## Madras Potato Variety x Irrigation x Nitrogen Fertilization Experiment

An experiment was established in cooperation with Dr. C. H. Ullery of the OSU Soils Department to obtain information on the performance of advanced potato lines when under irrigation stress at normal and excessive nitrogen fertilizer rates.

The following was taken from Dr. Ullery's report to the Oregon Potato Commission where it refers to the Madras experiment.

### Methods & Materials

Experiments were conducted in 1974 at Hermiston, Madras, and Klamath Falls, Oregon, to evaluate the effect of irrigation management and nitrogen fertilization on the yield, grade, size, and processing quality of five russet-type varieties of potatoes. The three locations varied in soil type, length of growing season, and number of days with maximum daily temperatures exceeding 90° F. and are representative of many production areas in the Pacific Northwest.

Variables included in the experiments were: (1) excessive short-term soil moisture stress, (2) rate of nitrogen fertilization, and (3) potato variety. Irrigation treatments were optimal as determined by previous experiments and excessive soil moisture stress for two to three weeks during either the early (tubers were less than one inch in diameter), the middle, or the end of the growing season. Irrigation was optimal except when excessive soil moisture stress is applied. Nitrogen treatments consisted of optimum and excessively high rate of nitrogen fertilization as determined by previous experiments. (The specific dates of excessive soil moisture stress and the actual rates of nitrogen fertilization for each experiment are given in the sections describing each experiment).

Varieties included in the experiments were: Russet Burbank, Nampa, A6371-2, A63122-3, and A63126-9. The seed was obtained from Joe Pavak, Aberdeen, Idaho and was shipped by motor freight to Oregon on March 20. Several days prior to planting, the potatoes were cut into 1½ ounce seed pieces and dusted with Captan. Adequate sanitation precautions were taken to assure that no contamination of the seed occurred during the cutting operation.

Immediately after digging (20 to 25 feet of record row) the experimental plots were graded and sized. Size classes were: less than 4, 4 to 6, 6 to 10, and greater than 10 ounces. The potatoes were graded at number 1, 2, or cull using standards established for processing use. During grading, a representative 8 to 10 pound sample of 5 to 12-ounce tubers were taken and placed in netted sacks and then in plastic bags. Within 2 to 4 days after digging, the samples were placed in storage where the temperature and relative humidity were held constant at 40° F. and 85 percent, respectively. A second sample was taken from the Hermiston experiment and processed within 3 days after digging.

After approximately 2½ months, the samples were removed from storage and washed. Specific gravity was determined by weighing in air and water. The samples were shipped by motor freight to Caldwell, Idaho where they were processed into french fries within two weeks at the J. R. Simplot plant.

Processing characteristics evaluated included: solid content, distribution of solids, average fry color, and the amount and length of fries exhibiting excessive dark color. The reducing sugar content of whole tuber and bud and stem-end was measured on all samples which had been held in storage, while only the reducing sugar content of the whole tuber was determined for the Hermiston samples processed directly after harvesting. The dinitrophenol procedure was followed to determine the reducing sugar content of tuber sap.

A randomized, complete block experimental design with a split plot arrangement were used at the three locations. The irrigation, nitrogen, and variety variables were applied to the whole, split, and split plots respectively. There were three replications at Hermiston and Klamath Falls while there were four replications at Madras. Analysis of variance and LSD were used to interpret the data. An arc-sine transformation was used on all processing data except specific gravity, solid content, and reducing sugar content prior to statistical analysis.

Madras Experiment: Potatoes are planted in a Madras loam soil May 22 at a 20,500 seed-piece population in 34-inch rows at a 9-inch spacing. A preplant application of Eptam was incorporated by disking for weed control. Fertilization consisted of a band application at 160 lbs. each of nitrogen, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O and 80 lbs. S per acre at planting. On June 19, a side dress application of Dysiston was applied for aphid control. On June 6, the excessively high rate of nitrogen fertilization treatment (240 lbs. N per acre) was established by broadcasting an additional 80 lbs. N per acre.

Irrigation treatments consisted of: (1) optimum: -1 atmospheres tension at the 8-inch depth within the row, 3 to 7 day irrigation frequency; (2) early season soil moisture stress: -2 atmospheres tension at 8-inch depth within a row, 2 drying cycles between July 16 and August 12; (3) mid-season soil moisture stress: -2 atmospheres tension at the 8-inch depth within the row, 1 drying cycle between August 6 and August 16; and (4) late season soil moisture stress: -2 atmospheres tension at the 8-inch depth within the row, 1 drying cycle between August 15 and August 31.

Application of irrigation water was terminated September 16 and the vines were killed using a herbicide on September 23. The plots were harvested and graded October 9 to 10.

Table 26. Effect of irrigation and Nitrogen fertilization on the reducing sugar content of five russet-type varieties, Madras, 1974.

Treatment	Percent reducing sugar			Ratio stem/bud
	whole	stem	bud	
<b>Irrigation</b>				
Optimum	2.26	2.92	2.04	1.71
Early Stress	2.34	3.14	1.99	1.68
Mid-Stress	2.19	2.90	1.88	1.84
Late Stress	2.63	3.30	2.26	1.61
<b>Nitrogen Rate, #N/A</b>				
160	2.40	3.10	2.12	1.63
240	2.31	3.03	1.97	1.79
<b>Variety</b>				
Russet Burbank	1.92	2.76	1.45	2.19
A6371-2	2.69	3.11	2.47	1.28
A63126-9	2.06	2.81	1.70	1.85
A63122-3	2.32	3.20	1.80	1.96
Nampa	2.81	3.45	2.80	1.27

Table 27. Effect of irrigation and nitrogen fertilization on the yield, grade, and size of five russet-type varieties, Madras, 1974.

Treatment	Total	#1	#2	Cull 4 oz+	Less 4 Oz	4-6 oz		6-10 oz		10 oz plus	
						#1	Total	#1	Total	#1	Total
-----Tons/Acre-----											
<b>Irrigation</b>											
Optimum	22.55	20.16	.53	.11	1.75	2.55	2.55	7.39	7.46	10.21	10.67
Early stress	19.10	16.50	.68	.03	1.89	2.86	2.86	6.73	6.83	6.91	7.48
Mid-stress	21.41	19.28	.34	.03	1.77	2.63	2.63	7.32	7.40	9.32	9.58
Late stress	21.12	19.04	.38	.03	1.70	2.82	2.82	7.30	7.32	8.92	9.26
LSD 05	3.31	3.64	.34	.05	.31	.49	.50	.93	.34	2.98	2.91
<b>Nitrogen, #/A</b>											
160	21.53	19.20	.51	.05	1.77	2.78	2.78	7.25	7.31	9.17	9.62
240	20.56	18.28	.43	.04	1.78	2.65	2.65	7.12	7.20	8.51	8.87
LSD 05	1.67	1.70	.24	.06	.21	.34	.34	.51	.51	1.50	1.51
<b>Variety</b>											
Russ. Bur.	19.43	16.90	.43	.09	1.98	3.38	3.38	7.86	7.95	5.67	6.02
A6371-2	21.34	18.84	.12	.01	2.38	3.46	3.46	8.13	8.16	7.25	7.32
A63126-9	22.42	20.30	.69	.06	1.37	2.04	2.04	6.03	6.09	12.23	12.85
A63122-3	23.93	21.56	.70	.06	1.61	2.45	2.46	7.51	7.61	11.58	12.19
Nampa	18.11	16.10	.45	.03	1.52	2.24	2.24	6.40	6.45	7.45	7.86
LSD 05	1.46	1.44	.26	.10	.25	.35	.35	.74	.74	1.24	1.28