lack Spot in Santa Maria Valley

deficiency of important nutrient found to exist in soils of many potato fields during survey and fertilizer experiments

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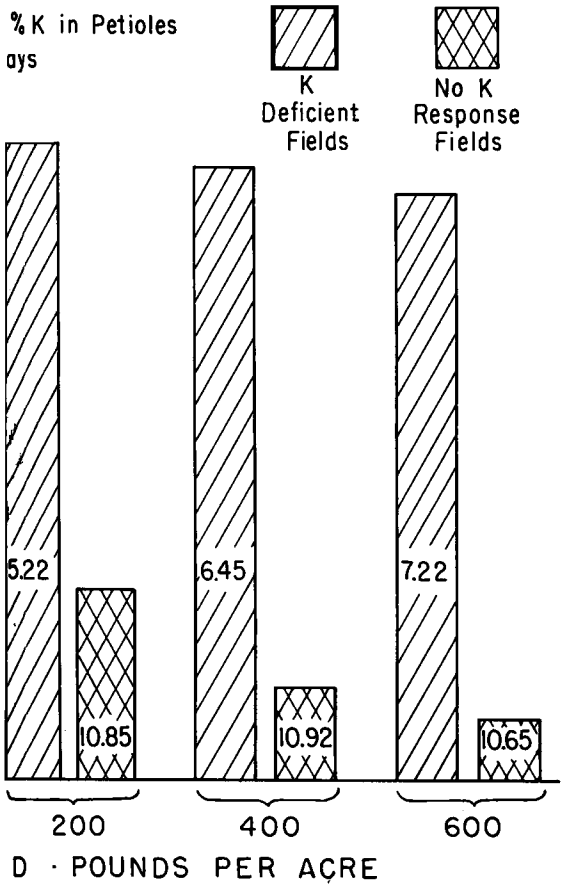
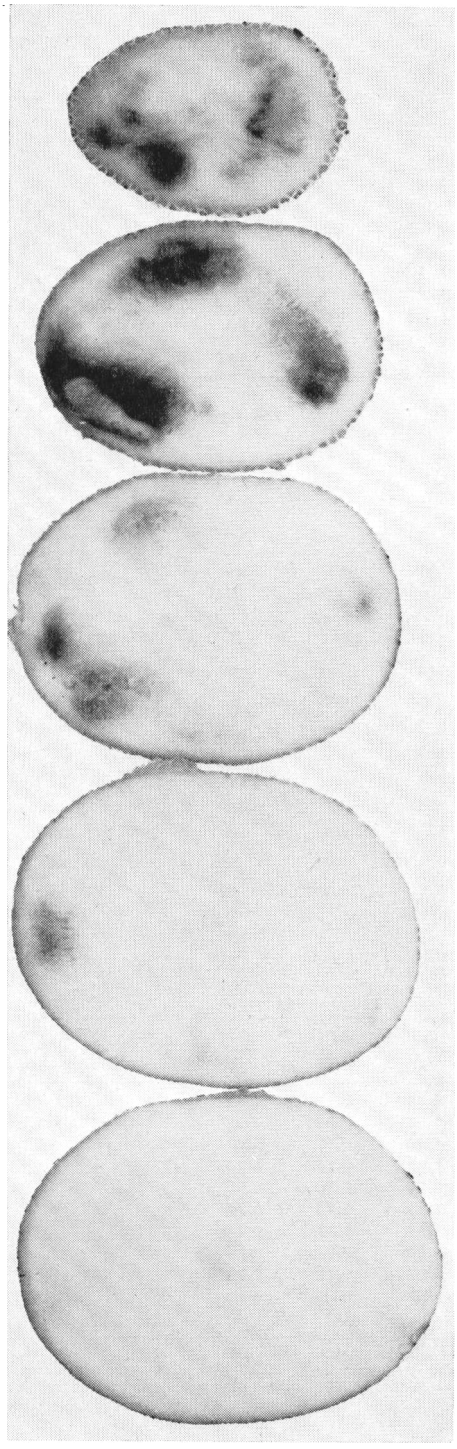
Fertilizer experiments in six potato fields and a nutrient survey of some 25 additional potato fields in the Santa Maria Valley showed that over half the fields were receiving insufficient quantities of potash fertilizers.

Studies were begun because reports and observations had indicated that certain lots of Netted Gem potatoes grown in the Santa Maria Valley developed an internal blackening following harvest. During the past few seasons, blackening or discoloration has been of prime economic importance to the commercial Netted Gem potato growers of that area. The studies included requirements of nitrogen and phosphorus fertilizers, as well as potash. In the field tests, nitrogen applications from ammonium sulfate were made at rates of 0, 60, 120, and 180 pounds per acre. Phosphoric acid from treble superphosphate was compared at rates of 0 and 100 pounds per acre and potassium sulfate was applied at rates of 0, 100, 200, 400, and 600 pounds of potash per acre.

to ubsequent severity of black spot in tubers. with two fields that showed no potash response.



Potato black spot. Potato showing successive cuts from the stem end—top—to middle of tuber. Note the decreasing intensity of black spot in tissues away from the stem end.



Nitrogen

Nitrogen fertilizer gave large increases in yield in four field experiments and small differences in two others. In three of the six fields, higher yields were obtained from applications of 120 or 180 pounds of nitrogen per acre than from only 60 pounds. Based on these tests, the usual grower application of from 120 to 180 pounds of nitrogen per acre should result in maximum production. Because of the excessive leaching of nitrogen in potato culture, the ammoniacal forms of nitrogen were most satisfactory.

The nutrient survey of the 25 growers' fields showed practically all samples analyzed as high in nitrate content indicating growers are currently supplying adequate quantities of nitrogen fertilizers.

Phosphorus

There was no increase in yield from phosphorus application in any of the six tests, which was consistent with the observations obtained from the nutrient survey of most of the growers' fields, although plants from several fields were observed to have a fairly low phosphorus content. Petiole tissue of plants from an average field had a phosphate phosphorus content of about 3,000 ppm—parts per million—dry weight basis early in the season which decreased to about 1,000 ppm as the plants approached maturity. Probably growers had been supplying more phosphorus than was needed. Many soils undoubtedly had received heavy phosphorus applications over a number of years and the phosphorus level in the soil had been built up. Phosphorus is a nutrient which does not leach from the soil and is removed by the crop in relatively small amounts.

Potash

Potash fertilizers produced significant increases in yields in four of the six tests. In one field, considerably higher

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POTATO

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yields were obtained from applications of 200 pounds per acre or more of potash than from only 100 pounds. In that same field, the yield was practically doubled by applying 100 pounds per acre of potash as compared to none. An average of all fields showed plots without potash to yield 301 sacks per acre as compared to 345 sacks in plots receiving 100 pounds per acre of potash, 362 sacks with 200 pounds, and 373 sacks with 400 pounds per acre. Potash deficiency symptoms were commonly observed on plants grown on plots not receiving potash and were characterized by leaf scorch, bronzing, and spotting on the leaves and by small necrotic areas on the stems and at the nodes.

In the field experiments, it was determined that potassium levels in the petiole tissue of about 10% at 50 days after planting, 8% at 65 days after planting and 6% at 80 days after planting approached the deficiency levels. Potassium contents of the petiole tissue much below those levels were associated with reduced yields and deficiency symptoms in the foliage. On the basis of these levels, over half of the samples from growers' fields were deficient in potash and it is probable that yields could have been noticeably increased by higher rates of potash application.

Fertilizer Treatments and Total Yields of Potatoes
Six fertilizer experiments in the Santa Maria Valley

Fertilizer treatment Nitrogen-Phosphorus pentoxide-Potassium oxide (Pounds/acre)	Cwt. per acre						
	Fields						Average 6 fields
	1	2	3	4	5	6	
0–100–100	244	270	253	356	265	248	273
60–100–100	314	398	310	387	297	334	340
120–100–100	266	461	337	360	281	366	345
180–100–100	305	517	356	367	296	362	367
120– 0–100	331	483	343	379	270	366	362
120–100– 0	149	403	289	356	282	327	301
120–100–200	339	467	341	367	284	371	362
120–100–400	361	475	368	364	310	357	373
120–100–600	331	494	365	376	313	356	373
LSD[1] 5% level	58	43	33	NSD[2]	NSD	38	

[1] Least significant difference.
[2] No significant difference.

Forrest Fullmer of the American Potash Institute assisted in the above studies.

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BLACK SPOT

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with the amount of handling. Discoloration was mild in tubers that had been handled only to the extent of machine digging as compared to those that had been artificially bruised. The defect did not develop following handling of potatoes from plants that were only 70–75 days old but tubers became increasingly susceptible as the plants matured.

Responses to Potash

In three of the test fields—fields *1*, *2*, *3*—black spot was a severe problem. Those fields exhibited potassium deficiency symptoms in the vines, showed significant yield responses to potash, and showed low percentages—under 6% at 80 days following planting—of potassium in the vines.

In fields *4* and *5* potash was sufficient as indicated by absence of symptoms, no yield response, and high—over 9.5% potassium at 80 days—potash levels in the vines. Black spot was of no consequence in either of those fields. Bruising index was under 0.4 in both.

Field *6* was intermediate in potash requirement and its tuber progeny showed an intermediate severity of black spot.

In the three potash-deficient fields—*1*, *2*, *3*—the addition of potash up to 600 pounds per acre significantly reduced black spot severity but not enough to approach a field control. Six hundred pounds potash per acre raised the potassium levels in the 80-day-old plants to an average of 7.22% in those fields.

In the 25 fields included in a nutrient survey, black spot was consistently more severe in the tubers from fields in which potash content—as revealed by petiole analysis—was low. On those fields in which the bruising index of tubers was invariably 0.50 or less at harvest the petiole tissue analyzed 9%–10% potassium at approximately 80 days.

Internal black spot of potatoes is in some way linked to the potassium nutrition of the crop, but was not corrected in the Santa Maria tests by applications of potash up to 600 pounds per acre. Although maximum yields and normal appearing vines were associated with potassium levels in the petiole tissues of about 6% at 80 days after planting, black spot was mild or absent only where potassium levels were about 10% at this stage of growth.

Severity of Internal Black Spot of Potatoes on Test Fields In the Santa Maria Valley

Fertilizer treatment Nitrogen-Phosphorus pentoxide-Potassium oxide (Pounds/acre)	Bruising Index						
	Fields						Average 6 fields
	1	2	3	4	5	6	
0–100–100	1.03[1]	0.98	1.14	0.24	0.47	0.31	0.70
60–100–100	1.06	1.47	1.44	0.20	0.39	0.39	0.83
120–100–100	0.95	1.43	1.40	0.17	0.41	0.37	0.79
180–100–100	0.94	1.94	1.42	0.26	0.25	0.49	0.88
120– 0–100	0.61	1.83	1.30	0.23	0.28	0.36	0.77
120–100– 0	0.94	1.50	1.21	0.33	0.37	0.74	0.85
120–100–200	0.77	1.34	1.31	0.57	0.24	0.53	0.79
120–100–400	0.72	1.44	1.14	0.14	0.36	0.47	0.71
120–100–600	0.71	1.25	1.22	0.18	0.20	0.28	0.64
LSD[2]—5% level	NSD[3]	0.41	NSD	NSD	NSD	0.21	0.16
LSD —1% level							0.21

[1] Bruising index indicates the average severity of black spot in the tubers (1 = mild; 2 = moderate; 3 = severe). An index of 1.03 means that the average degree of black spot of all tubers was slightly more than mild. An index of approximately 0.50 or over represents an economic amount of disease.
[2] Least significant difference.
[3] No significant difference.

Forrest Fullmer of the American Potash Institute assisted in the above studies.

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