THE LAST DECADE IN 38 YEARS OF POTASH STUDIES FOR POTATO FERTILIZERS IN MAINE[1]

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INTRODUCTION

Source of potash studies for potato fertilizers have been conducted in many potato areas of North America ad over a long period of time. Previous studies of potash sources have been reported inn Maine by Chucka et al. (1), Terman (12), and Murphy and Goven (8). This paper summarizes the source of potash studies conducted in Maine during the last ten year period of 1956 to 1965.

In general there are many studies (5, 3, 8, 4, 13, 12, 11, 6, 7) that indicate potassium chloride in potato fertilizers depresses specific gravity of potato tubers when compared with potassium sulfate. The extent of the reduced specific gravity varied from slight trends to highly significant differences.

The effect on yields of potatoes as a result of different sources of potash have in recent years shown less variation than the effect on specific gravities. Timm and Merkle (14) reported in 1963 that potato yields were not affected by either the sulfate or chloride sources of potash. In the same year, Rowberry (12) in Canada reported that yields were influenced at only two locations out of nine during the 1957-60 period. In 1965, Murphy and Goven (7) also presented data which indicated sulfate of potash produced higher yields than potassium chloride.

Literature on potato nutrition has very few references to the effect of source of potash on chip color. Eastwood and Watts (2) reported in 1956 that muriate of potash produced slightly lighter chip color than sulfate of potash when used at the same application level. Murphy and Goven (8) also found that sulfate of potash consistently produced darker colored potato chips.

From 1956 to 1965 source of potash studies were conducted in Maine comparing three sources of potash applied at two rates. In adddition mixtures of sulfate and chloride were also compared to determine if the yield and chip color associated with chloride could be combined with higher specific gravity produced by sulfate.

MATERIALS AND METHODS

Katahdin potatoes were grown in replicated field plots using a complete fertilizer. From 1956 to 1959 nitrogen was used at the rate of 150 pounds per acre and from 1960 to 1965 at the rate of 120 pounds. Phosphorus varied from 180 pounds of P_2O_5 (78.5P) per acre during the 1956-59 period to 140 pounds of P_2O_5 (61.1P) from 1960 to 1965. Potash rates of either 120 pounds of K_2O (99.6K) per acre or 240 pounds of K_2O (199.2K) were used during the entire 10-year period. All mixtures contained 30 pounds of MgO (18Mg) per ton.

All the fertilizer was applied in two bands two inches to the side and slightly below the seedpiece level. Plots were arranged in randomized

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block designs and replicated six times. Plot sizes were generally 25 feet in length and with the exception of 1956 all were single row plots. Cultural practices used, such as cultivation, hilling, insect and disease control, and vine killing were similar to commercial practices used in the area.

At harvest time yields were obtained and tuber samples saved for specific gravity and chip color determinations. Specific gravity determinations were made by the air and water method shortly after harvest and then the same samples were stored at 50 F until chip color determinations were completed in early December of each year. Chip color values were obtained by the method described by Murphy et al (9).

Results

Data presented in Table 1 indicate the effect of three sources of potash applied as single carriers and combinations of sulfate and chloride source on yield of potatoes. The 10-year average of yields presented in Table 1 indicates no significant differences or numerical trends that would favor one source or combination of sources over no potash. In only two years out of ten, 1962 and 1965, was there any advantage to using any potash. In all other years, zero potash treatments produced yields that were not significantly different from treatments of 99.6 and/or 199.2 pounds of potassium per acre. The only logical explanation for this lack of yield response from potassium might be that soil reserves of potassium were relatively high except for 1962. In 1962 the exchangeable soil potassium was only 100 pounds per acre as indicated at the bottom of Table 1.

The effect of source of potash on specific gravity of potato tubers is shown in Table 2. The 10-year average of specific gravities indicate that potassium chloride decreased the specific gravity of tubers as compared to either potassium sulfate or potassium nitrate sources of potash. The 10-year average, also, indicates that the nitrate and sulfate sources of potash were about equal in their effect on specific gravity.

The combinations of the chloride and sulfate sources of potash in general, produced specific gravities which were slightly lower than when all of the potash was obtained from single carriers. This was not so however when the high rate of potash came from potassium chloride. Data in Table 2 indicate a trend for slightly higher specific gravities where the potash source combinations contained the most potassium sulfate.

The influence of source of potash on potato chip color is shown by the data presented in Table 3. In general there were no differences in chip color between the no potash-potatoes and those receiving potash. There are, however, two trends worthy of note shown in Table 3. The most apparent trend was that potassium chloride produced potatoes which made chips of lighter color than did either the nitrate or sulfate sources of potash. This trend was evident in the long-time average and in nine years out of the 10-year study. The second trend appeared to be that lighter colored potato chips were associated with the higher rates of potassium applied, although the differences were very slight.

TABLE 1.—*Effect of rate and source of potash on yield of potatoes. Maine — (1956-65).*

Rate of potassium	Source of potash	Year and yield — Cwt./Acre										10 Yr. average
		1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	
lbs./A.[1]												
0		340	292	328	396	205	338	280	258	326	286	305
99.6	sulfate	337	290	338	412	202	367	307	259	341	291	314
99.6	chloride	332	305	347	406	207	360	316	259	360	312	320
99.6	nitrate	321	303	334	403	202	346	293	246	351	291	308
199.2	sulfate	349	307	349	407	193	356	310	271	344	322	321
199.2	chloride	326	290	337	391	219	369	314	272	368	312	320
199.2	nitrate	305	304	343	389	193	344	281	252	323	290	296
199.2	1/3 chloride 2/3 sulfate	345	301	340	406	202	356	305	277	369	310	321
199.2	2/3 chloride 1/3 sulfate	335	284	324	405	203	349	320	258	356	317	315
199.2	1/2 chloride 1/2 sulfate	334	291	352	425	209	343	324	265	355	306	320
I.S.D. (0.05)		N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	16	N.S.	N.S.	22	N.S.
Soil test levels of potassium-lbs./A.		200	200	200	200	150	200	100	300	200	150	

[1]Applied in a complete fertilizer. Nitrogen and phosphorus held constant.

TABLE 2.—*Effect of rate and source of potash on specific gravity of potatoes. Maine — (1956-1965)*

Rate of potassium	Source of potash	Year and specific gravity										10 Yr. average
		1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	
lbs./A.[1]												
0		1.080	1.082	1.071	1.067	1.102	1.068	1.078	1.070	1.076	1.067	1.076
99.6	sulfate	1.079	1.081	1.070	1.066	1.098	1.067	1.079	1.070	1.072	1.066	1.075
99.6	chloride	1.076	1.079	1.069	1.061	1.095	1.064	1.073	1.068	1.071	1.066	1.072
99.6	nitrate	1.078	1.080	1.068	1.066	1.100	1.066	1.077	1.070	1.073	1.067	1.074
199.2	sulfate	1.076	1.080	1.069	1.064	1.099	1.067	1.075	1.069	1.070	1.065	1.073
199.2	chloride	1.073	1.078	1.068	1.058	1.091	1.068	1.070	1.065	1.068	1.062	1.070
199.2	nitrate	1.075	1.079	1.069	1.064	1.098	1.066	1.077	1.069	1.071	1.066	1.073
199.2	⅓ chloride ⅔ sulfate	1.074	1.078	1.069	1.062	1.094	1.066	1.073	1.066	1.069	1.064	1.072
199.2	⅔ chloride ⅓ sulfate	1.073	1.077	1.069	1.058	1.094	1.068	1.070	1.066	1.069	1.064	1.071
199.2	½ chloride ½ suufate	1.074	1.078	1.067	1.061	1.094	1.067	1.071	1.066	1.067	1.063	1.071
L.S.D. (0.05)		0.004	0.002	N.S.	0.003	0.003	N.S.	0.002	0.003	0.002	0.003	0.002
L.S.D. (0.01)		0.005	0.003		0.004	0.004		0.003	0.004	0.003	0.004	0.003

[1]Applied in a complete fertilizer. Nitrogen and phosphorus held constant.

TABLE 3.—*Effect of rate and source of potash on potato chip color. Maine — (1956-65).*

Rate of potassium	Source of potash	Year and chip color[1]										10 Yr. average
		1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	
lbs./A.												
0		9.0	6.4	7.1	8.5	4.8	7.8	10.0	8.6	9.9	8.0	8.0
99.6	sulfate	8.9	6.3	7.2	8.2	5.0	8.0	10.0	8.0	9.3	7.8	7.9
99.6	chloride	8.1	5.7	7.1	8.0	5.3	7.5	9.8	7.4	7.1	7.5	7.6
99.6	nitrate	8.7	6.4	7.1	8.4	5.1	7.4	9.9	8.0	9.3	7.4	7.8
199.2	sulfate	8.8	5.6	7.1	8.1	4.4	7.4	9.9	7.6	9.2	7.8	7.6
199.2	chloride	8.2	5.7	7.0	8.5	4.8	7.2	9.4	7.3	8.3	7.2	7.4
199.2	nitrate	8.4	6.4	7.3	8.6	5.0	7.4	10.0	7.4	8.5	7.7	7.7
199.2	⅓ chloride ⅔ sulfate	8.4	6.4	7.0	8.1	5.1	7.4	9.6	7.5	8.8	7.4	7.6
199.2	⅔ chloride ⅓ sulfate	8.2	6.0	7.0	8.1	4.5	7.3	9.6	7.0	8.2	7.2	7.3
199.2	½ chloride ½ sulfate	8.7	5.5	7.2	8.3	4.7	7.3	9.9	6.9	8.5	7.0	7.4
L.S.D. (0.05)		N.S.	N.S.	N.S.	N.S.	N.S.	0.4	0.2	0.5	0.6	0.6	N.S.
L.S.D. (0.01)							0.6	0.3	0.7	0.8	N.S.	

[1]Higher indice numbers indicate darker colored chips.

Summary

The results of a 10-year source of potash study indicate: 1) source of potash did not influence yield of potatoes, 2) sulfate and nitrate of potash were equal in their effect on the production of tubers of higher specific gravity than potassium chloride, 3) there was a trend for potatoes fertilized with potassium chloride to produce chips of lighter color than the sulfate and nitrate sources of potash, and 4) the higher rate of potash used resulted in lower specific gravity and a trend toward lighter colored potato chips.

Resumen

Los resultados de los estudios de 10 años, de fuentes de potasio indican 1) Las fuentes de potasio no influyeron en el rendimiento de la papa, 2) El sulfato y el nitrato de potasio, fueron ifuales en su efecto en la producción de tubérculos de más alta gravedad específica, que el cloruro de potasio, 3) Hubo una tendencia de las papas fertilizadas con cloruro de potasio, para producir ojuelas de color más claro, que aquellas en las cuales se aplicó sulfato y nitrato de potasio, y 4) le aplicación del nivel más alto de potasio usado, resutló en ojuelas de papa de menor gravedad especifica y con tendencia a ser de color más claro.

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