THE EFFECT OF POTASH FERTILIZER ON THE COLOR OF BOILED POTATOES WITH SOME REFERENCE TO YIELD

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by

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INTRODUCTION

Quality in potatoes is difficult to define as no standard is available which is accepted by all consumers. For example, in France where deep-fat frying is a common method of cooking, consumers prefer a non-mealy potato which will not disintegrate but remain firm when cooked. In the United States, potatoes are most commonly boiled and the American consumer prefers potatoes which are mealy and is insistent that they remain white after being cooked. Many lots of potatoes in Michigan and other states turn gray or dark as soon as they are boiled and displease the consumer to the extent that some growers and shippers have found it difficult to hold their markets.

For many years experimenters have studied factors that may affect the cohesion, texture and flavor of cooked potatoes, but only recently have they given much attention to factors that cause potatoes to cook dark. Their results indicate that variety, maturity, type of soil, storage temperature, and mechanical injury may be some of the factors affecting the color of boiled potatoes.

Three investigators in Wisconsin and one in Scotland reported that potash applied to the soil as a fertilizer reduced darkening while one in New York state obtained negative results. Since the results of four widely separated experiments were in close accord, and since the amounts of potash

applied on Michigan potato fields vary greatly, it was decided to investigate the influence of varying amounts of potash on the color of boiled potatoes. Also to observe their effects on the yield per acre and on the market grade of potatoes grown under different soil conditions.

Review of Literature

Ashby (1), working in England, states that physical properties of the soil cause the greatest influence on quality, especially temperature and water supply. Loamy soils gave uniform warmth and water supply, therefore produced the best quality.

Bewell (2) states that good culinary quality is associated with a dry matter content of 30 per cent, and poor quality is associated with a dry matter content of 15 per cent.

Butler, Morrison and Boll (3) found that mealiness was modified by the water content, potatoes high in water being less mealy than those relatively low in water. The percentage of starch in the tuber was not an indicator of mealiness, and the presence of sugar tended to produce an undesirable taste.

Carolus (4) found that, "The potato crop is a gross feeder and has a large total nitrogen, phosphorus, potassium, magnesium and calcium requirement." The maximum nutrient requirement of the potato plant usually occurs about 50 to 80 days after planting.

Cobb (5) states that chemical and cooking tests show that good culinary quality of potatoes is closely related to high dry matter, high starch and low nitrogen contents of the tuber.

Dietz (6) found that potash is needed to produce high yields of potatoes.

Findlay (7), working in Scotland, showed that:

1. A light type of soil produced better quality potatoes than a heavier type of soil such as clay or peat.
2. The use of a poorly balanced fertilizer or excessive amounts of nitrogen resulted in poor quality.
3. Early planting in wet or dry seasons usually gave extremely dry potatoes, while late plantings gave wet, soapy potatoes.

Hantke (8) from his work at University of Wisconsin, concludes that:

1. "The blackening is caused by the reaction of certain free amino acids in the potato and oxygen."
2. "The condition is physiological and not pathological."
3. When the rainfall or soil moisture is sufficient throughout the season, the application of potash to the soil is associated with a decrease in the darkening of tubers when cooked.
4. The addition of some rare elements such as boron, copper, zinc and manganese to the soil may have some effect on the darkening of the potatoes.

Hardenburg (9), in New York State, concludes that good quality is a result of many factors. Two of the most important are:

1. Cultural methods: proper rotations and better seed.

2. Harvesting and grading methods: Harvesting potatoes when immature usually results in poor quality as the tender skin will slough off. The potatoes will bruise very easily. Thorough grading as to size, shape and appearance is very important from the consumers standpoint.

Neil and Whittemore (10) found that potatoes were more mealy when fertilized with a high quantity of potash than when fertilized with a low quantity of potash in the form of muriate or sulphate; the value of these two forms seems to be equal in producing a mealy potato. No correlation was noted between mealiness and starch content.

Odland (11) found that the amount of phosphorus does not influence the potato yields as much as variations in nitrogen or potash.

Smith (12) found that the darkening of cooked potatoes is not associated with the amount of potash used in the fertilizer.

Stevenson and Whitman (13) state that the inherent differences of some varieties have a tendency to prevent blackening of the tubers.

Sweetman (14) concludes from factors affecting the cooking qualities of potatoes that:

1. The consumer prefers potatoes which are uniform in size, have a bright skin, and possess good cooking quality.

2. The conflicting evidence as to what causes good cooking quality in potatoes is probably due to the standards by which quality is determined and evaluated.

Tottingham, Nagy, and Ross (15) conclude from their work on culinary quality of potatoes that:

1. "The blackening of cooked potatoes does not appear to be associated with transmissible pathological conditions."

2. Analysis in the raw state of tubers which blacken upon cooking shows high content of free amino acids. This association applies particularly to tyrosine.

3. "Samples of potatoes containing large proportions of blackening tubers contained an average of less than 1.8 per cent K_2O in the dry matter, whereas the average content was above this level in the normal tubers."

Location and Size of Plats

The experimental work herein reported was conducted at each of three locations: Potato Experiment Station, Lake City, Michigan State College Agricultural Experiment Station, East Lansing, and in cooperation with Mr. Percy King, Waterford, Michigan.

The experimental area at Lake City was laid out on Ottawa sandy loam; the area at the College and the King plats was on Hillsdale loam.

Previous to planting time a cover crop of rye, at the Lake City and College Stations, and an alfalfa sod, at the King farm, was plowed under. At the time of planting, representative soil samples were taken from each area and tested by the Spurway Simplex Method for available potash. They showed comparatively medium potash at the Lake City station and the King farm, and low potash at the College station.

The size of the plats varied with the location. At Lake City, they were 40 feet long x 12 feet (4 rows) wide and at the other two places they were 40 feet long x 9 feet (3 rows) wide.

All plats were randomized and replicated six times at Lake City, four times at East Lansing, and three times at King's. Lack of space prevented a uniform number of six replications in all trials.

Treatments Used

The treatments and rates of application which made up the experiment were as follows:

Treatment No.	Treatment	Rate of Application
1	4 - 16 - 0	400 lbs. per acre
2	4 - 16 - 4	" " " "
3	4 - 16 - 8	" " " "
4	*4 - 16 - 8	" " " "
5	*4 - 16 - 8	800 " " "
6	4 - 16 -16	400 " " "
7	4 - 16 -24	" " " "
8	4 - 16 -32	" " " "
9	Check	No treatment

*Commercially mixed fertilizers, all others hand-mixed.

The hand-mixed fertilizers were made up of sulphate of ammonia, 20% superphosphate, and muriate of potash.

The Russet Rural, which is grown extensively by Michigan farmers, was used in the experiment. This seed was certified and was relatively free of virus diseases. The seed was cut into uniform pieces and spaced approximately 13 inches apart in the rows which were 36 inches apart.

The fertilizer for each plat was applied evenly in the rows and thoroughly mixed with the soil. The potatoes were planted at Lake City on May 18, at East Lansing on June 7, and at King's on June 16.

Stand Observations Made During the Growing Season

Table (1) presents the average per cent of stand of each treatment for each individual location. It is seen that treatments 7 and 8 seriously reduced the stand.

Table (1) The average per cent stand per treatment at each location.

Treatment No.	Treatment	Location		
		Lake City	East Lansing	King's
1	4 - 16 - 0	100.0	88.2	93.2
2	4 - 16 - 4	100.0	85.8	95.3
3	4 - 16 - 8	100.0	78.0	95.4
4	*4 - 16 - 8	100.0	94.3	98.2
5	*4 - 16 - 8	100.0	100.0	97.5
6	4 - 16 -16	97.0	77.2	90.8
7	4 - 16 -24	87.6	73.3	84.5
8	4 - 16 -32	89.7	56.2	69.6
9	Check	100.0	100.0	100.0

*Commercially mixed fertilizer; T_5 at 800 lbs. per acre.

Method of Harvesting

The dates of harvest were October 4, at Lake City, October 8, at King's, and October 10, at East Lansing. A 40-foot row was harvested from the center row of each plat except at Lake City, where the two center rows were harvested. All yield data are presented on the basis of a single 40-foot row. The potatoes from each plat were graded and weighed separately. Only those potatoes which met the specifications of a U. S. No. 1 grade were considered in this experiment. From this grade a cooking sample of 10 to 15 tubers were taken at random from each plat. After harvest, all samples from each location were placed in storage at Lansing, where they remained at a temperature of 40°F. until March 27, 1939, when they were taken from the storage room for cooking tests.

Method of Cooking

Four tubers of uniform size were selected from each sample. The potatoes were washed free of dirt, peeled thinly, and placed in an aluminum kettle and boiled with just enough water to cover the tubers. The kettle was provided with a galvanized wire basket divided into four compartments, one for each tuber, and was so built that the bottom of the container did not reach the bottom of the kettle. The potatoes were boiled until they could be pierced easily with a fork, then removed from the water and placed on a table to cool. One-half of each of the four tubers was riced and used as a representative sample of the lot to be judged for taste. The other half was judged for color. Ordinarily, samples were

left 10 to 15 minutes to cool before judging. Since color was the most important factor in this experiment, it was decided to lengthen the time of cooling to 30 minutes before judging to determine more definitely the intensity of color of each cooked sample.

Method of Determining Culinary Quality

The culinary quality of the potatoes was determined on the basis of color, texture, cohesion, mealiness and flavor. The score card submitted by the Bureau of Home Economics, United States Department of Agriculture was used. A study of the results showed practically no variations in texture, cohesion, mealiness and flavor of the potatoes grown under the various treatments. Considerable variation was found in color and it is only this culinary quality factor which is hereafter discussed in this report. The color score card used is given in Table 2.

Table 2, Score card used by the Bureau of Home Economics, United States Department of Agriculture, to designate color of boiled potatoes.

COLOR	WHITE √	CREAM	YELLOW	GRAY	DARK
INTENSITY	1:2	3:4	5:6 √	7:8	9:10

Three members of the Farm Crops Department acted as judges and indicated their score of color on individual cards for each sample and for each judge.

The sample of boiled potatoes was scored on the basis of its color and then on the intensity of the color throughout the sample. The intensity factor indicated the amount or degree of the color.

Several sample lots of cooked potatoes were scored by the judges individually. Their scores were then compared so that the standard of color would remain relatively constant throughout the entire cooking test.

White and cream were considered equally desirable colors of boiled potatoes while yellow and gray were undesirable. To facilitate the analysis of the results a continuous numerical classification was used as is shown in Table 3. Intermediate intensities on the score card (Table 2) are given whole numbers in the revised score (Table 3).

Table 3. Revised score card to allow for complete numerical classification of color of boiled potatoes.

WHITE AND CREAM

INTENSITY	10	9	8	7	6	5	4	3	2	1
SCORE	40	38	36	34	32	30	28	26	24	22

YELLOW AND GRAY

INTENSITY	10	9	8	7	6	5	4	3	2	1
SCORE	20	18	16	14	12	10	8	6	4	2

The revised color scores as obtained by Table 3, were used in all subsequent tables. For example, the color

and intensity as checked by the judge, Table 2, might have intensity of 6, would give a revised score according to Table 3 of 32.

Method of Statistical Analysis

Since the experiment was completely randomized in layout and each plat was represented in the cooking test and in the yield determinations, the data obtained on color scores and yield were analyzed by the variance method to determine the significance of differences between treatments for each location and for the three locations taken together.

RESULTS AND DISCUSSION

Analytical Comparison of Results Between Treatments and Color of Boiled Potatoes.

Table 4 gives the judge's score as to color of boiled potatoes for each plat in the Lake City test and Table 5 gives the treatment mean scores arranged in order of score magnitude. From Table 5 it may be seen that the most desirable color (high score value) was not uniformly due to high amounts of potash nor were the color scores of the three higher potash treatments (6, 7 and 8) all higher than, and significantly different from, the three lower potash treatments (2, 3 and 4). High potash in the fertilizer, seemingly, was not the determining factor for high color score.

Table 4. The judge's color scores of boiled potatoes from the nine treatments and six replications grown at Lake City.

Replic.	Treatment								
	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9
					Judge A				
1	24	24	37	31	35	37	36	33	36
2	26	24	37	35	37	35	36	34	34
3	24	28	36	34	32	31	36	36	31
4	26	33	34	33	26	35	36	36	26
5	24	36	34	35	34	33	36	33	34
6	26	31	35	38	33	32	32	35	35
Mean	25.0	29.3	35.5	34.3	32.8	33.8	35.3	34.5	32.7
					Judge B				
1	6	24	37	32	35	34	34	36	36
2	10	11	36	35	36	28	35	32	34
3	31	8	35	32	33	30	34	34	32
4	10	36	34	33	10	34	36	36	11
5	12	36	28	32	33	32	34	32	33
6	34	32	34	35	35	28	34	32	35
Mean	17.2	24.5	34.0	33.2	30.3	31.0	34.5	33.7	30.2
					Judge C				
1	10	16	36	34	34	36	34	34	35
2	34	34	34	36	36	12	30	8	32
3	14	14	36	34	34	16	35	32	30
4	12	36	35	15	6	34	38	36	8
5	26	36	32	36	14	32	35	32	14
6	34	32	34	38	35	32	34	35	16
Mean	21.7	28.0	34.5	32.2	26.5	27.0	34.3	29.5	22.5

Table 5. The treatment mean color scores of potatoes grown at Lake City.

Treatment No.	Treatment	Mean Score
7	4 - 16 -24	34.7
3	4 - 16 - 8	34.7
4	*4 - 16 - 8	33.2
8	4 - 16 -32	32.5
6	4 - 16 -16	30.6
5	*4 - 16 - 8	29.9
9	Check	28.4
2	4 - 16 - 4	27.3
1	4 - 16 - 0	21.3

* Commercially mixed fertilizer; T_5 at 800 lbs. per acre. The experimental error was 5.79 and all differences between means greater than 3.8 are significant (5% point) and greater than 5.9 are highly significant (1% point).

Table 6 gives the judge's score as to color for each plat in the East Lansing test and Table 7 gives the treatment mean scores arranged in order of score magnitude. It is again seen that the most desirable color of boiled potatoes was not strongly dependent upon the amount of potash added in the fertilizer.

Table 6. The judge's color scores of boiled potatoes from the nine treatments and four replications grown at East Lansing.

Replic.	Treatment								
	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9
					Judge A				
1	32	32	34	14	10	34	30	35	35
2	33	30	36	33	34	34	30	36	7
3	37	34	36	36	10	34	30	34	34
4	36	33	34	9	34	36	36	33	32
Mean	34.5	32.2	35.0	23.0	22.0	34.5	31.5	34.5	27.0
					Judge B				
1	32	29	32	26	11	15	33	35	32
2	34	10	33	12	36	14	32	36	6
3	36	16	34	33	33	33	31	34	35
4	33	23	33	8	34	34	34	36	34
Mean	33.7	19.5	33.0	19.7	28.5	24.0	32.5	35.2	26.7
					Judge C				
1	8	36	32	14	23	34	16	32	34
2	14	14	35	12	35	36	31	34	5
3	34	8	36	34	10	34	16	26	28
4	35	14	34	8	35	34	34	30	34
Mean	22.7	18.0	34.2	19.9	17.0	34.5	24.2	30.5	25.2

Table 7. The treatment mean color scores of potatoes grown at East Lansing.

Treatment No.	Treatment	Mean Score
3	4 - 16 - 8	34.1
8	4 - 16 -32	33.4
6	4 - 16 -16	31.0
1	4 - 16 - 0	30.3
7	4 - 16 -24	29.4
9	Check	26.3
5	*4 - 16 - 8	25.4
2	4 - 16 - 4	23.2
4	*4 - 16 - 8	19.9

*Commercially mixed fertilizer; T_5 at 800 lbs. per acre. The experimental error was 5.67 and all differences between means greater than 4.6 are significant (5% point), and greater than 6.2 are highly significant (1% point).

Table 8 gives the judge's score as to color for each plat in the King farm test and Table 9 gives the treatment mean scores arranged in order of score magnitude. It may be seen that high color score again was not dependent upon the varying amounts of potash added in the fertilizer.

Table 8. The judge's color scores of boiled potatoes from nine treatments and three replications grown at the King farm.

Replic.	Treatment								
	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9
				Judge A					
1	24	27	28	28	36	35	32	30	32
2	34	35	30	34	36	36	34	34	26
3	35	36	32	34	32	38	34	38	34
Mean	31.0	32.7	30.0	32.0	34.7	36.3	33.3	34.0	30.7
				Judge B					
1	12	28	28	13	33	35	38	31	32
2	32	34	28	32	34	35	37	34	12
3	35	32	31	34	34	36	34	35	18
Mean	26.3	31.3	29.0	26.3	33.7	35.3	36.3	33.3	20.7
				Judge C					
1	14	28	28	18	36	34	34	35	36
2	34	36	18	34	32	36	34	16	10
3	36	34	10	36	32	38	34	35	30
Mean	28.0	32.7	18.7	29.3	33.3	36.0	34.0	28.7	25.3

Table 9. The treatment mean scores of potatoes grown at the King farm.

Treatment No.	Treatment	Mean Score
6	4 - 16 -16	35.9
7	4 - 16 -24	34.5
5	*4 - 16 - 8	33.9
2	4 - 16 - 4	32.2
8	4 - 16 -32	32.0
4	*4 - 16 - 8	29.2
1	4 - 16 - 0	28.4
3	4 - 16 - 8	25.9
9	Check	25.6

*Commercially mixed fertilizer; T_5 at 800 lbs. per acre. The experimental error was 4.39 and all differences between means greater than 4.2 are significant (5% point) and greater than 5.7 are highly significant (1% point).

The results, then, from each location would lead to the same conclusion that desirable color of boiled potatoes (high color score value) was not dependent upon the amount of potash added in the fertilizer whether it be on the sandy loam at Lake City or the heavier loams at East Lansing and the King farm.

Even though each location gave evidence that high color score was not uniformly due to high potash content of the fertilizer, it was deemed advisable to average all three locations and compare the resulting treatment mean color scores. Table 10 gives these values.

Table 10. The treatment mean color scores of potatoes when all three locations were taken together.

Treatment No.	Treatment	Mean Score
7	4 - 16 -24	32.9
8	4 - 16 -32	32.6
6	4 - 16 -16	32.5
3	4 - 16 - 8	31.6
5	*4 - 16 - 8	29.7
2	4 - 16 - 4	27.6
4	*4 - 16 - 8	27.4
9	Check	26.8
1	4 - 16 - 0	26.7

*Commercially mixed fertilizer; T_5 at 800 lbs. per acre.
The experimental error was 3.43 and all differences between means greater than 3.3 are significant (5% point) and greater than 4.4 are highly significant (1% point).

It may be seen that when considering the three locations together, the three treatments containing the higher amounts of potash (6, 7 and 8) did produce the most desirable color of boiled potatoes, although not significantly higher than the lower potash treatment 3.

In studying the location mean color scores it was found that the King farm had the highest mean score with 30.9, Lake City followed closely with a mean of 30.3 and that East Lansing had the significantly lower score of 28.1. (The 5% difference level was 2.1 and 1% difference level was 2.8).

That personal bias is a factor which must be eliminated wherever possible is well brought out by the judge mean color scores. Judge A gave an average score of 31.9 which is significantly higher than 29.4 of judge B and highly significantly different from 27.9 of judge C. (The different levels of significance being the same as for locations.)

Analytical Comparison of Results Between Treatments and Yield per Acre.

Although the study of the relation of fertilizers with varying amounts of potash to color score was the primary object of this investigation, yet it was deemed advisable to study the relation of these varying amounts of potash to yield of U. S. No. 1 potatoes. As with the color scores the plat results for each location and for all three locations are given.

Table II gives the yield in pounds per plat for the Lake City test and Table 12 gives the treatment averages both in pounds per plat and in bushels per acre. It is seen that the amount of potash was not directly associated with the yield of U. S. No. 1 grade potatoes.

Table 11. The pounds per plat of U. S. No. 1 potatoes grown at Lake City.

Replic.	Treatments								
	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9
1	31	27	29	12	29	23	9	31	20
2	21	35	37	38	29	34	20	27	17
3	18	37	37	34	37	33	22	45	13
4	30	31	29	20	39	38	39	36	21
5	38	31	36	53	48	38	42	28	29
6	59	39	59	29	46	40	39	30	28
Mean	32.8	33.3	37.8	31.0	38.0	34.3	28.5	32.8	21.3

Table 12. The mean yields in pounds per plat and the yields in bushels per acre of potatoes grown at Lake City.

Treatment No.	Treatment	Mean yield in pounds per plat	Bushels per acre
5	*4 - 16 - 8	38.0	233
3	4 - 16 - 8	37.8	230
6	4 - 16 -16	34.3	209
2	4 - 16 - 4	33.3	204
8	4 - 16 -32	32.8	200
1	4 - 16 - 0	32.8	200
4	*4 - 16 - 8	31.0	190
7	4 - 16 -24	28.5	174
9	Check	21.3	131

*Commercially mixed fertilizer; T_5 at 800 lbs. per acre.

The experimental error was 8.39 lbs. and all differences between means greater than 9.8 lbs. per plat are significant (5% point) and greater than 13.1 lbs. per plat are highly significant (1% point).

The yields in pounds per plat for the East Lansing test are given in Table 13 and the treatment averages both in pounds per plat and in bushels per acre are given in Table 14. In this test the treatments containing 16 per cent or less of potash had a tendency to produce larger yields of U. S. No. 1 grade potatoes than did the treatments containing over 16 per cent potash.

Table 13. The pounds per plat of U. S. No. 1 potatoes grown at East Lansing.

Replic.	Treatments								
	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9
1	14	29	12	43	40	41	23	8	24
2	49	40	60	49	54	43	18	21	32
3	39	51	54	59	34	31	15	2	42
4	7	34	21	21	59	51	35	16	32
Mean	27.2	38.5	36.7	43.0	46.7	41.5	22.7	11.7	32.5

Table 14. The mean yields in pounds per plat and the yields in bushels per acre of potatoes grown at East Lansing.

Treatment No.	Treatment	Mean Yield in Pounds Per Plat	Bushels Per Acre
5	*4 - 16 - 8	46.7	283
4	*4 - 16 - 8	43.0	260
6	4 - 16 -16	41.5	251
2	4 - 16 - 4	38.5	233
3	4 - 16 - 8	36.7	222
9	Check	32.5	197
1	4 - 16 - 0	27.2	165
7	4 - 16 -24	22.7	138
8	4 - 16 -32	11.7	71

*Commercially mixed fertilizer; T_5 at 800 lbs. per acre.

The experimental error was 13.00 lbs. and all differences between means greater than 13.4 lbs. per plat are significant

(5% point) and greater than 18.2 lbs. per plat are highly significant (1% point).

The yields in pounds per plat for the King farm are given in Table 15 and the treatment averages both in pounds per plat and in bushels per acre are given in Table 16 as at East Lansing, the treatments containing 16 per cent or less of potash had a tendency to produce larger yields of U. S. No. 1 potatoes than did the treatments containing over 16 per cent potash.

Table 15. The pounds per plat of U. S. No. 1 potatoes grown at the King farm.

Replic.	Treatments								
	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9
1	18	27	33	23	29	22	16	14	27
2	25	33	26	24	30	27	23	13	17
3	18	27	31	28	30	32	14	9	12
Mean	20.3	29.0	30.0	25.0	29.7	27.0	17.7	12.0	18.7

Table 16. The mean yields in pounds per plat and the yields in bushels per acre of potatoes grown at the King farm.

Treatment No.	Treatment	Mean Yields in Pounds Per Plat	Bushels Per Acre
3	4 - 16 - 8	30.0	181
5	*4 - 16 - 8	29.7	179
2	4 - 16 - 4	29.0	175
6	4 - 16 -16	27.0	163
4	*4 - 16 - 8	25.0	151
1	4 - 16 - 0	20.3	123
9	Check	18.7	113
7	4 - 16 -24	17.7	107
8	4 - 16 -32	12.0	73

*Commercially mixed fertilizer; T_5 at 800 lbs. per acre.

The experimental error was 4.36 lbs. and all differences between means greater than 7.5 lbs. per plat are significant (5% point) and greater than 10.4 lbs. per plat are highly significant (1% point).

Table 17. The mean yields in pounds per plat of potatoes grown at all three locations.

Treatment No.	Treatment	Mean Yields in Pounds Per Plat	Bushels Per Acre
5	*4 - 16 - 8	38.1	230
3	4 - 16 - 8	34.8	210
6	4 - 16 -16	34.3	207
2	4 - 16 - 4	33.6	203
4	*4 - 16 - 8	33.0	200
1	4 - 16 - 0	26.8	162
9	Check	24.2	146
7	4 - 16 -24	23.0	139
8	4 - 16 -32	18.8	114

*Commercially mixed fertilizer; T_5 at 800 lbs. per acre. The experimental error was 5.48 and all differences greater than 9.5 pounds per plat are significant (5% point) and greater than 13.0 pounds per plat are highly significant (1% point).

Table 17 shows the treatment mean yields in pounds per plat and in bushels per acre when the three locations are combined. It is seen in this table that treatments containing over 16 per cent of potash produced significantly less U. S. No. 1 potatoes than treatments containing 16 per cent or less potash. The yield results from the Lake City (Tables 11 and 12) were inconsistent when compared with those from East Lansing (Table 13 and 14) and the King farm (Table 15 and 16). It has been previously shown in Table 1

that treatments containing over 16 per cent potash had a tendency to reduce the stand. The soil at Lake City was a sandy soil compared to the heavy loam soil at East Lansing and the King farm. It is possible that the mixture of soil and fertilizer around the seed piece was more thorough in the sandy soil than in the loam soil. The thoroughness of mixing may be a possible explanation for the inconsistent results between locations when yield of U. S. No. 1 potatoes is considered.

SUMMARY

The foregoing experiment would indicate that of the characters used in judging culinary quality of boiled potatoes, namely color, texture, cohesion and flavor, color was the only one affected sufficiently by different treatments and location to warrant statistical analysis.

White or cream color of boiled potatoes (high color score) was considered to be more desirable and indicate better quality than yellow or gray color (low color score). From the study of each individual location it may be concluded, in most cases, that varying amounts of potash applied did not give consistent results when the color of boiled potatoes was considered. However, when the results of all three locations were considered together, the treatments containing 16 per cent or more potash produced the best color of boiled potatoes.

When considering the yield of U. S. No. 1 potatoes, treatments containing 16 per cent or less potash produced the higher yields per acre. The treatments containing over 16 per cent potash seriously reduced the stand of plants.

From the results obtained this one year (1938), no definite recommendations can be made as to the particular fertilizer analysis to use to promote white or cream color in boiled potatoes. The results tend to show, however, that high analysis fertilizers when used on heavy loam soils may so reduce stands that yields of U. S. No. 1 grade potatoes are appreciably reduced.

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