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FOUR YEARS OF COMMERCIAL FERTILIZERS ON CURRANTS IN THE HUDSON RIVER VALLEY

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ABSTRACT

The results are reported of 4 years of fertilizer applications on a Hudson Valley currant plantation. The experiments were conducted in Ulster County where more currants are grown commercially than anywhere else in the United States. The experiments were designed to study the effects of nitrogen, potash, and phosphorous alone and in different combinations and to observe the effects of seven different nitrogen carriers.

The currants were kept under clean cultivation and a fairly good cover crop of weeds. Under this system of management, they responded to applications of nitrogen. No evidence has appeared to indicate any benefit from phosphorous or potash, either alone or in combination. No definite evidence was obtained to prove that any one of the seven nitrogen carriers used was more beneficial than the other for currants. Each one kept the foliage green and the bush healthy, and the differences in yield were due more to the location than to the fertilizers used.

The rows located on that portion of the patch enriched by manures in former years produced healthier and more vigorous bushes and the greatest yields. An application of nitrogen on a part of these enriched rows proved profitable. However, exactly the opposite conditions prevailed on that portion of the patch where the soil had been depleted by full-grown apple trees. Here the cultivation was poor due to the old stumps which remained; and even tho yearly applications of a nitrogenous fertilizer were made, the growth was the poorest and the yields the lowest of all of the tests.

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INTRODUCTION

Currant growing in the Hudson River Valley is of limited commercial importance. In certain localities, however, commercial plantings of currants are of such size and distribution that they form an important part of the fruit-growing industry. The low prices of currants in 1931 and 1932 have adversely affected new plantings with the result that few new plantings have been set out during the last two or three years. In normal times in those regions where currants do well, a favorable profit is obtained and there is no reason to suppose that sooner or later currants will not again show a sufficient margin of profit to encourage new plantings.

A serious disease affecting white pines, known as the white pine blister rust, passes one stage in its life history on gooseberries or currants, and thus the disease is a limiting factor in new plantings of these fruits. The only practical method of control is to remove one or the other of the host plants so that the disease cannot complete its life cycle. In several localities in New York State, therefore, where white pines are of importance, the growing of red currants and gooseberries has been prohibited by the State Conservation Department. Black currants are also prohibited in New York State.[1]

The Norwegian Red Dutch variety of red currant is considered immune to the blister rust disease and may soon be released for planting in regions where the red currant is now prohibited. The

[1] The planting, possession, or propagation of currants and gooseberries is prohibited in the following localities: All of the Adirondack Park and Catskill Park and all of Clinton, Essex, Warren, Washington, Saratoga, Fulton, Herkimer, and Lewis counties; the towns of Trenton, Remsen, Forestport, Boonville, and Steuben in Oneida County; the towns of Clare, Clifton, Colton, Pine, Hopkinton, Parishville, Piercefield, and Pitcairn in St. Lawrence County; the towns of Altamont, Belmont, Brighton, Duane, Franklin, Harrietstown, Santa Clara, and Waverly in Franklin County; and the towns of Porter, Lewiston, and Niagara in Niagara County.

Office of Forest Pathology of the United States Department of Agriculture is sponsoring this variety.

A comparatively small amount of experimental work has been done with fertilizers on currants. The culture of currants and gooseberries is similar in many respects, and most of the literature deals with these fruits together. Commercial plantings of currants and gooseberries in the Hudson River Valley are very largely interplanted in vineyards and orchards. It is difficult, therefore, to find plantings in solid blocks of sufficient size and uniform soil conditions to make a worth while fertilizer experiment. The experiments reported here were made in a solid planting of the variety Diploma, with no other crops interplanted, and the planting was large enough so that a fairly comprehensive experiment could be laid out. However, for reasons that will be explained later, the selection of the site for this experiment proved unfortunate; and altho the results are largely negative, it is thought advisable to publish the data since so little information is available on the fertilization of red currants.

Ulster County is the leading center of currant growing in the United States. According to the 1930 census, Ulster County had 20 per cent of the total acreage and 34 per cent of the total production of currants for the United States. Between 1920 and 1930 the number of acres used for growing currants in Ulster County was reduced about one-half, a proportionate decrease holding true for the United States. While the acreage was materially reduced in this period, the yield per acre showed an increase of about 40 per cent. The yield per acre in Ulster County in 1920 was 1,640 quarts (New York State, 1,243 quarts; United States, 1,032 quarts), and in 1930 the yield per acre had increased to 2,204 quarts (New York State, 1,891 quarts; United States, 1,312 quarts).

The experiment was located in Ulster County on the farm of William A. Lawrence about a mile west of the village of Highland on the road to Clintondale. The soil is a Dutchess stony loam of good average fertility for fruit. The variability of the soils in this soil series is usually great, and therefore, it is not an ideal soil for experimental purposes. The soil where the currants were grown also varied widely in fertility due to previous artificial treatments.

The plantation has had the usual care given by the average grower in that section. The latter part of April each year just before blossoming, the soil was plowed away from the bushes and later

plowed back to the plants. Three or four cultivations followed at intervals up to the time it was necessary to stop because of the danger of damaging the fruit. No cover crop was seeded, but a fairly rank growth of weeds supplied the necessary organic matter. Spraying consisted of at least one application of bordeaux and lead arsenate and more often two applications. Nicotine sulfate was used when aphids were a problem. During the last season of the experiment (1932), the planting received less care and less cultivation due to the poor prices of the previous year and the poor outlook for the 1932 season.

Commercial fertilizers had been used previously in this planting, both phosphorous and nitrogen having been applied in medium quantities. Two years after the beginning of the experiment it became apparent that the rows used as checks were growing and yielding out of proportion to the treated rows, and this was also somewhat true of the rows receiving phosphoric acid. Altho the farm had changed hands in the meantime and not much was known about the previous treatment of the soil, it was learned that the first four rows, which included the checks and one of the phosphoric acid rows, had been used as a hog yard for an indeterminate number of years previous to 1922. Also, a row of old Greening apple trees had been removed in 1924 on the other side of the experiment. Stumps are still standing in between the rows receiving applications of Nitrophoska. Previous to the planting of the currants, raspberries were grown on this site.

Samples of soil were taken along the sides and thru the middle of the experimental rows and the organic matter determined.[2] The samples showed that the soil along the east side (Fig. 1) and the south central portion contained the highest organic matter content and that along the west the lowest. This shows the residual effect on the soil of the hog yard and of the full-grown apple trees of previous years and gives an indication of what the effect might be in the present performance of the currant bushes in these different locations.

FERTILIZER APPLICATIONS AND RECORD TAKING

The currant patch was divided into two parts, providing for two experiments. There were approximately 75 bushes in each row, with 21 rows in the patch, the rows running north and south. The

[2] Soil analyses were kindly furnished by H. G. Beattie of this Station.

bushes were set 5 feet apart each way. One-half of the patch was used for a fertilizer test with nitrate of soda, superphosphate, and potash used singly and in various combinations. The other half was used for a test of seven different kinds of nitrogenous fertilizers. In the two experiments, 35 bushes from either end of the rows were used, leaving 5 bushes in the center to separate the two experiments. From the center the slope is gently to the north with about the same slope from the center to the south.

Each treatment was applied on two rows, giving 70 bushes per treatment. Each plat was separated by one buffer row, thus eliminating the possibility of variation due to competition from neighboring rows. The fertilizers were applied evenly over the surface of the ground and close to the bushes.

Fig. 1 shows the layout of the two experiments. The amounts of the different fertilizers used per acre in experiment A were as follows: 30 pounds of nitrogen, 60 pounds of phosphorous, and 30 pounds of potash. There were 1,750 square feet in each plat (70 bushes set 5 feet apart each way) or 0.04 acre. Therefore,

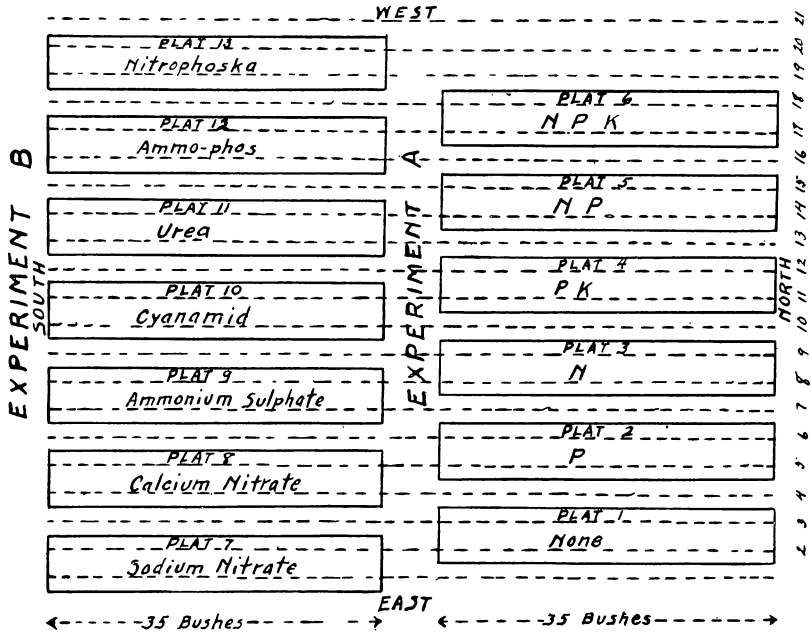

FIG. 1.—DIAGRAM OF THE EXPERIMENTS.

the plats receiving nitrogen were given an application of 7.8 pounds of nitrate of soda; those receiving phosphorous, 15 pounds of 16 per cent superphosphate; and those receiving potash, 2.4 pounds of muriate of potash.

In experiment B, where the nitrogen carriers were compared, the application was at the rate of 30 pounds per acre of nitrogen. Plat 7 received 7.8 pounds of nitrate of soda; plat 8, 7.8 pounds of calcium nitrate; plat 9, 5.9 pounds of sulfate of ammonia; plat 10, 5.5 pounds of Cyanamid; plat 11, 2.6 pounds of urea; plat 12, 10.9 pounds of Ammo-phos, which also contains about 5.2 pounds of phosphoric acid; and plat 13, 8 pounds of Nitrophoska, containing also about 2.4 pounds of phosphoric acid and 1.2 pounds of potash.

RESULTS

EXPERIMENT A

In experiment A, after the first season's application of fertilizers, a slight difference in the color of the foliage between the various treatments was noticeable. By the first of June, the leaves on the rows receiving phosphorous and potash (plat 4) were a lighter green. However, it was not until the second year that the difference in color of foliage on all plats not receiving nitrogen was noticeable. The rows receiving phosphorous and potash (plat 4) were a very light green and many of the leaves showed yellow. While the phosphorous rows (plat 2) and the check rows (plat 1) were slightly off color in comparison with the other treatments, yet they were much better than plat 4. By 1931, the third year of the experiment, the phosphorous and potash rows (plat 4) showed a yellowish foliage and were the poorest rows, many of the bushes seeming to be in a dying condition. In 1931, the rows receiving phosphorous (plat 2) and the checks (plat 1) continued to show a lighter colored foliage than the nitrogen plats, but they were much better than plat 4. The checks showed but little effect from the lack of artificial nitrogen. In 1932, it became necessary to apply nitrogen to plat 4 and during that season the foliage returned to a healthier color, altho the bushes still gave the appearance of being stunted and many of them were weakened.

EFFECT ON GROWTH

Table 1 shows the growth records taken in December of 1931 and 1932. The measurements include all the current season's new

TABLE 1.—EFFECT OF FERTILIZERS ON GROWTH OF CURRANTS, EXPERIMENT A.

PLAT NO.	FERTILIZER TREATMENT	ROW NO.	NEW GROWTH, INCHES			TOTAL NEW GROWTH, 10 BUSHES, 2 YEARS, INCHES	AVERAGE NEW GROWTH PER BUSH PER YEAR, INCHES
			1931	1932	Total		
1	No fertilizer	2	1,159	1,292	2,451	2,382	119.1
		3	1,007	1,306	2,313		
2	Phosphoric acid	5	1,182	1,103	2,285	2,305	115.2
		6	1,178	1,147	2,325		
3	Nitrogen	8	1,280	1,327	2,607	2,553	127.6
		9	1,378	1,122	2,500		
4	Phosphoric acid and potash	11	834	824	1,658	1,750	87.5
		12	781	1,062	1,843		
5	Nitrogen and phosphoric acid	14	878	1,163	2,041	2,238	111.9
		15	1,221	1,215	2,436		
6	Complete fertilizer	17	1,224	1,331	2,555	2,427	121.3
		18	1,230	1,063	2,299		

growth on 10 bushes in each row, thus giving measurements on 20 bushes per treatment. The fertilizers have shown some differences on the new growth during these years. As previously stated, plats 1 and 2 always had thriftier bushes, the soil of these plats retaining sufficient fertility to produce satisfactory growth without the aid of fertilizers. The other four plats may be considered separately.

Phosphoric acid and potash (plat 4) have shown the least effect from the standpoint of amount and length of new growth. The average new growth per bush per season in plat 4 was 87.5 inches, 24.4 inches to 40.1 inches less than for those plats receiving an application of nitrogen either alone or in combination. There was not enough difference in growth between plats 3, 5, and 6 and too few records to compare them accurately, yet it is interesting to note that nitrogen alone (plat 3) has shown the greatest amount of new growth. The applications of phosphorous and potash in this currant plantation have not produced new growth comparable to that obtained where nitrogen was applied. The bushes in these rows were smaller and less thrifty and a few were nearly dead. Nitrogen at the rate of 30 pounds per acre was added to these rows (plat 4) in 1932 and a slight increase in growth was noted over 1931.

EFFECT ON YIELD

The effect of the fertilizers on yield (Table 2) shows somewhat similar results to that on growth. The check rows and the rows receiving phosphoric acid alone (plats 1 and 2) showed a greater

TABLE 2.—EFFECT OF FERTILIZERS ON YIELD OF CURRANTS, EXPERIMENT A.

PLAT NO.	FERTILIZER TREATMENT	ROW NO.	YIELD OF 35 BUSHES, QUARTS				TOTAL YIELD, QUARTS	TOTAL YIELD PER TREATMENT, QUARTS
			1929	1930	1931	1932		
1	No fertilizer	2	88	99	74	44	305	
		3	71	104	58	46	279	584
2	Phosphoric acid	5	104	58	58	32	252	
		6	67	70	63	29	229	481
3	Nitrogen	8	73	69	50	30	222	
		9	52	77	36	32	207	429
4	Phosphoric acid and potash	11	37	54	34	24	149	
		12	73	44	42	28	187	336
5	Nitrogen and phosphoric acid	14	79	59	56	34	228	
		15	79	60	62	30	231	459
6	Complete fertilizer	17	63	55	44	29	191	
		18	76	70	55	22	223	414

yield than the other rows. The rows receiving phosphoric acid and potash (plat 4) had the least amount of fruit in the 4 years, 336 quarts. This was 93 quarts less than the yield from the rows receiving nitrogen alone, and 123 quarts less than that from the rows receiving nitrogen and phosphoric acid. It should be kept in mind that in 1932 nitrogen was added to plat 4 and that the relative yield of this plat in that year did not decrease from the preceding year in proportion to the other plats. The addition of nitrogen may have been the reason. The indications are that in this plantation phosphoric acid and potash did not answer the fertilizer requirements.

EXPERIMENT B

This experiment was made to compare seven nitrogen-carrying fertilizers, some of which also carry lime, phosphoric acid, or phosphoric acid and potash. Row 1 (plat 7) is an outside row, has

always been the thriftiest looking row in the experiment, and is in that portion of the plantation where there had been a hog yard in former years. Row 13 (plat 11) is the row which the spray rig has straddled. It has always been smaller than the neighboring rows. While yield has been cut down somewhat on this row, due to the breaking of branches and the brushing off of leaves and fruit by the spray rig, yet there has been no adverse effect on new growth from year to year. The last two rows (plat 13), particularly row 20, have always been poor. It was thru here that the old Greening apple trees were cut down. Cultivation on these rows has been poor because of the remaining tree roots and stumps.

EFFECT ON COLOR OF FOLIAGE

No differences could be noted between the different treatments in their effect on the color of the foliage. The first two rows (plat 7) always had more luxuriant foliage and larger bushes, while the last two rows (plat 13) always had smaller bushes and slightly lighter colored foliage, but this was due more to their location and poor cultivation than to the fertilizer used.

TABLE 3.—EFFECT OF DIFFERENT NITROGEN CARRIERS ON GROWTH OF CURRANTS, EXPERIMENT B.

PLAT NO.	FERTILIZER TREATMENT	ROW NO.	NEW GROWTH PER 10 BUSHES, INCHES			TOTAL NEW GROWTH, 10 BUSHES, 2 YEARS, INCHES	AVERAGE GROWTH PER BUSH PER YEAR, INCHES
			1931	1932	Total		
7	Sodium nitrate	1	1,184	916	2,100		
		2	1,346	874	2,220	2,160	108.0
8	Calcium nitrate	4	1,438	945	2,383		
		5	1,320	864	2,184	2,284	114.2
9	Ammonium sulfate	7	1,452	996	2,448		
		8	1,302	814	2,116	2,282	114.1
10	Cyanamid	10	1,668	830	2,498		
		11	1,428	748	2,176	2,337	116.9
11	Urea	13	1,001	970	1,971		
		14	1,138	961	2,099	2,035	101.8
12	Ammo-phos	16	1,464	1,156	2,620		
		17	1,304	1,035	2,339	2,480	124.0
13	Nitrophoska	19	780	870	1,650		
		20	532	446	978	1,314	65.7*

*Poor growth due to row of apple trees that formerly occupied this space.

The effect of the different nitrogenous fertilizers on growth is shown in Table 3. All new shoots were measured on the first 10 bushes in each row in the various plats in 1931 and 1932. The figures in Table 3 show a great variation in the amount of new growth between the 2 years and a greater variation than was found in similar figures for experiment A. This difference between the two experiments may be due to the consistently heavier cropping in experiment B. It may also have been a result of less cultivation in 1932 and of the heavier cropping of the year before, the vigor of the bushes in experiment B thus being lowered. The figures for Nitrophoska (plat 13) should not be considered in comparing the effects of these fertilizers because of the poor location of the plat and the poor care it received. However, it is of interest to note that the foliage was a light green but of decidedly better color than the foliage on plat 4 in experiment A where phosphoric acid and potash were used.

Leaving out the Nitrophoska rows and row 13, the row straddled by the spray rig, the greatest difference to be found in growth per

TABLE 4.—EFFECT OF DIFFERENT NITROGEN CARRIERS ON YIELD OF CURRANTS, EXPERIMENT B.

PLAT NO.	FERTILIZER TREATMENT	ROW NO.	YIELD OF 35 BUSHES, QUARTS				TOTAL YIELD, QUARTS	TOTAL YIELD PER TREATMENT, QUARTS
			1929	1930	1931	1932		
7	Sodium nitrate	1	131	163	113	58	465	
		2	118	105	70	49	342	807
8	Calcium nitrate	4	98	83	79	52	312	
		5	83	54	71	48	256	567
9	Ammonium sulfate	7	70	59	63	39	231	
		8	86	78	41	38	243	474
10	Cyanamid	10	90	77	74	28	269	
		11	70	79	67	34	250	519
11	Urea	13	51	52	61	40	204	
		14	125	88	92	33	338	542
12	Ammo-phos	16	104	98	119	32	353	
		17	105	62	79	33	279	632
13	Nitrophoska	19	67	81	48	32	228	
		20	65	36	38	32	171	399*

*Poor yield due to row of apple trees that formerly occupied this space.

bush per season as between the various treatments was 19 inches. This would seem to indicate that there is little difference in value to the currant bush as to the source of nitrogen among the nitrogen-carrying fertilizers used in this experiment.

EFFECT ON YIELD

The figures in Table 4 show the yield of fruit in quarts for a period of 4 years. Each row had 35 bushes from which records were taken. The production on the outside row (row 1, plat 7) was considerably greater than that of any other row. This row was also located in a portion of the old hog yard, as was row 2. The fact that it is an outside row and that it had been benefited by hog manure should be kept in mind when comparing the yield with that of other treatments. Row 13 (plat 11) is the row that was straddled by the spray rig and it shows a lower yield as a result. Again, rows 19 and 20 (plat 13) should not be considered because of reasons previously stated. Allowing for these discrepancies, it will be seen that there is but little choice between the forms of nitrogen-carrying fertilizers used in this experiment.

Cyanamid, besides nitrogen, carries 70 per cent of hydrated lime; Ammo-phos, 48 per cent of phosphoric acid; Nitrophoska, 16 per cent of phosphoric acid and 20 per cent potash; and calcium nitrate, 30 per cent of lime. Differences in yield in this experiment cannot be definitely attributed to any of the nitrogen-carrying fertilizers. To be sure, Ammo-phos showed a higher yield, but it may have been due partly to better soil conditions or to thriftier bushes to start with, or both. From the start, the yields were consistently above average.

In 1932, similar results with regard to yield were recorded as with new growth, both being well below average. Undoubtedly, the time of picking in 1932 was responsible for some of the decrease in yield.

DISCUSSION

The experiments do not show any outstanding results. Observations on color of foliage, yield, and new growth, however, show that treatments of potash and phosphoric acid are not likely to be sufficient to maintain vigor and productivity of the bushes. Some form of nitrogen may be used to advantage in growing currants. However, tests with the different kinds of nitrogen-carrying fer-

tilizers do not show that any one is outstanding for use on currants, hence it becomes largely a question as to which is the cheapest.

It is doubtful whether a smaller quantity (30 pounds) of nitrogen per acre can be used than was employed in this experiment and still obtain satisfactory results on soils of equal fertility. An increase above 30 pounds in the nitrogen application might be used to advantage, particularly on soils low in fertility.

There is nothing in this experiment to indicate that applications of potash or phosphoric acid will directly increase the vigor of the bush or increase the yield.

The growth and production records of 1932 give an indication of the importance of cultivation under the conditions which prevailed in this patch. Less cultivation, coupled with a season of reduced rainfall, altho the latter was only slightly less than in 1931, caused a decided decrease in the length of new growth and of yield in 1932. These experiments indicate that a well-cared-for currant patch, with good cultivation and a good cover crop of some kind, will respond favorably to the judicious use of nitrogen.

The lasting effect of the hog manure on those bushes located on the part of the planting formerly used as a hog yard gives an indication of the importance of manure as a fertilizer for currants. Tho several years had elapsed since this portion of the planting had been used as a hog yard, the yields were greatest on these rows in both experiments whether nitrogen was added or not, but where nitrogen was added the yields were increased, the bushes were more vigorous, and the foliage was more luxuriant.

Exactly the opposite effect was noted where full-sized Greening apple trees had been grown formerly in the space occupied by the currants. The soil was very low in fertility, as shown by analyses made for the organic matter content; the bushes were small, the foliage sparse, and the yields low even tho yearly applications of a nitrogenous fertilizer were made. Poor cultivation due to the old tree stumps was partially responsible for the poor returns from these bushes.