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Fertilization of Apple and Prune Orchards in Idaho

By

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Summary

FERTILIZER tests covering a period of 5 years in apple orchards of southern Idaho, and involving the use of nitrogen, phosphorus and potassium have failed to show any significant benefit from the use of these elements either singly or in combination.

The use of ammonium sulphate in an Italian prune orchard in the Boise Valley for a period of 6 years gave an average increase of 52 per cent in yields over adjacent, unfertilized plots, and increased both twig growth and trunk growth materially. Applications of 1 lb. per tree were nearly as effective as larger applications up to 6 lb. per tree.

In the Payette Valley applications of ammonium sulphate increased the yields of Italian prunes about 18 per cent, and also resulted in more vigorous growth of trees. There was no conclusive evidence of benefit to these prune trees from the use of either phosphorus or potassium, although the latter may have slightly increased the yields.

None of the fertilizers used had any apparent effect on the quality of the fruit produced in either the apple orchards or the prune orchards.

The use of commercial fertilizers in apple and prune orchards of southern Idaho is recommended only where local preliminary tests of such fertilizers have given definite, beneficial results.

Fertilization of Apple and Prune Orchards In Idaho

By
LOWELL R. TUCKER[1]

Introduction

IN recent years a great deal of experimental work has dealt with the use of commercial fertilizer in orchards. The results of these experiments have been so variable, due to differences in soil and climatic conditions, that generally they have been considered applicable only to the immediate localities in which the experiments were conducted. Thus, conclusions from such investigations in fruit growing districts of the east may not be applicable at all to conditions in the Pacific Northwest. The results of fertilizer trials on apple and prune trees in Montana, Washington and Oregon do not necessarily agree with results of similar trials in Idaho. Therefore, except for some general principles to be considered later, it is essential that specific recommendations regarding the use of commercial fertilizers in orchards be based largely on the results of local investigations.

Having in mind this need for local information regarding the value of orchard fertilization the Idaho Agricultural Experiment Station has, during the past 10 years, established orchard test plots in apple or prune orchards at Meridian, Wilder, Payette, Emmett, Weiser, Fruitland and Parma. It was necessary, for one reason or another, to discard some of these plots before complete records had been obtained; but others have been continued for 5 or more years and the results secured on these plots are considered in the present publication.

Materials and Procedure

Results reported in this publication are based on fertilizer plots established in a bearing Italian prune orchard owned by J. H. McBirney, near Meridian; in a bearing Italian prune orchard owned by H. E. Smith, north of Fruitland; in bearing Jonathan and Delicious orchards north of Emmett, owned by the Glass Orchard Company; and in a young apple orchard near Wilder, owned by M. C. Hinshaw. The young orchard was supposed to be Starking Delicious but when it came into bearing it was found to be a mixture of ordinary Delicious and a red strain.

[1] Located at the Parma Substation, Parma, Idaho.

The author wishes to express appreciation of the help given by the late Dr. C. C. Vincent, former Head of the Department of Horticulture, who cooperated in planning the project and collection of the early data; Roscoe E. Bell, formerly Extension Soils Specialist, who helped obtain and apply early fertilizers; Dr. H. W. E. Larsen, Extension Soils Specialist, who carried on the work Bell started. The author has been responsible for most of the records and for analyzing and discussing the data; therefore, the cooperators cannot be held responsible for the interpretations here reported. Acknowledgement is due Messrs. H. E. Smith of Payette, George Ames of Emmett, and M. C. Hinshaw of Wilder for their cordial cooperation in placing portions of their orchards at the disposal of the Experiment Station for these tests; and especially to Mr. J. H. McBirney of Meridian, who not only offered the use of his orchard for the experiments, but also personally recorded many of the data that were taken. The ammonium sulphate used in the prune orchard experiments was donated by the Barrett Company of San Francisco, California.

In the McBirney orchard six adjacent rows of 15 trees each, in a portion of the orchard in which the trees were relatively uniform, were selected for the fertilizer tests. Two of these rows were untreated to serve as checks, and the remaining four rows received annual spring applications of different amounts of ammonium sulphate, as indicated in Table 6. The other orchards, selected several years later for these experiments, were carefully mapped in order to show the positions of missing trees and of trees otherwise unsuitable for experimental use. Plots were then laid out in such a manner that, in the apple orchards, four suitable trees would be available for each treatment, while, in the prune orchard, six trees would be available for each treatment. Each of the treated trees on which records were to be taken was surrounded by trees not included in the experiment but which received the same fertilizer applications. Thus, each record tree was protected by surrounding "buffer" trees against any possible influence of other nearby treatments. Trunk circumference measurements were taken on all record-trees at the beginning of the experiment. Fertilizers were applied annually, either in late fall or in the spring just previous to the time of disking the orchards.

The amounts of fertilizers applied to bearing apple trees were 5 lb. ammonium sulphate, 4 lb. treble-superphosphate or 4 lb. sulphate of potash per tree. Some plots received no fertilizer, some only one kind, some two and some all. The fertilizers applied are listed in accompanying tables in terms of elements applied. The young apple trees in the Hinshaw orchard received 1¼ lb. ammonium sulphate, 1 lb. treble-superphosphate, or 1 lb. sulphate of potash per tree separately or in combination for the first 5 years, 1932-36. For the 1937 applications in this orchard amounts were raised to 2, 3, and 1½ lb., respectively.

Prune trees in the McBirney orchard were fertilized only with ammonium sulphate, which was applied at the rate of 1 lb., 2 lb., 4 lb., and 6 lb., respectively, per tree. In the Smith orchard near Fruitland the prune trees received 3 lb. ammonium sulphate, 2½ lb. treble-superphosphate and 2½ lb. sulphate of potash per tree separately or in combination. This was applied either in the autumn or before spring disking.

All treatments, except in the McBirney orchard, were duplicated, making a total in each orchard of 8 record apple trees and 12 record prune trees per treatment.

In order to determine the effects of the fertilizers, tree growth and fruit yields were recorded annually. Tree growth was determined by measuring trunk circumference increment at a definite, marked height, and the annual growth of terminal twigs. The twigs of bearing apple trees selected for measurement were terminals on limbs 6 to 8 feet from the ground; of prune trees, 5 to 8 feet; of young apple trees, at all heights.

An attempt was also made to determine if fertilizers affected fruit quality. The measures used for apples were ground color and red color; for prunes, fruit size, firmness, and concentration of soluble solids (largely sugar) in the fruit juice. Ten prunes representing five different exposures

from each tree were sampled each year. Maturity tests were made according to methods outlined in Idaho bulletin 196[2].

The bearing Jonathan and Delicious orchards were growing on sandy soil underlaid at depths of 2 to 4 feet with gravel. When the experiment was started an alfalfa cover crop which had been in the orchard for several years was almost exhausted. About 2 years before the project was started these orchards were heavily fertilized with sheep manure.

Results From Fertilization of Apple Trees

A study of twig growth measurements taken during the 5 years the project was carried on in apple orchards shows that terminal growth was influenced but little by the fertilizer treatments. In the Glass Jonathan orchard, for instance, the untreated trees made an average annual terminal growth of 6.0 inches, while the greatest terminal growth made by any of the treated trees amounted to only 6.8 inches and occurred in the plot receiving a complete fertilizer (*Table 1.*) This is a difference of only 13.3 per cent, which, in view of the high degree of variability exhibited in these plots, might well be attributed to chance variations due to causes other than the fertilizer treatments.

TABLE 1.—Summary of terminal shoot growth measurements in inches in Glass Jonathan and Delicious orchards. (Twenty shoots per tree were measured annually.)

Fertilizer	None	P	K	N	NP	NK	NPK
Year	Glass Jonathan Orchard						
1931	5.4	5.1	5.8	5.7	5.8	5.3	7.2
1932	6.7	7.1	7.5	7.4	6.5	6.0	9.6
1933	6.7	7.4	7.5	8.1	9.0	5.9	8.7
1934	6.1	6.4	6.3	6.4	5.8	5.7	6.5
1935	7.3	8.3	7.1	7.8	8.2	6.2	7.5
1936	3.3	4.3	4.1	3.8	3.5	2.9	2.8
Av. 1932-6	6.0	6.7	6.5	6.7	6.6	5.3	6.8
	Glass Delicious Orchard						
1931	4.1	4.4	4.0	5.5	4.7	5.3	5.8
1932	5.9	7.6	5.0	8.0	7.8	9.8	9.6
1933	6.7	7.7	5.6	7.3	8.8	8.6	9.0
1934	6.6	6.4	6.2	7.1	7.2	7.6	6.7
1935	11.1	10.8	11.0	11.4	11.6	11.9	11.2
1936	4.5	4.4	5.3	4.5	5.5	4.5	4.6
Av. 1932-6	7.0	7.4	6.6	7.7	8.2	8.5	8.2

Key to Symbols:
P—treble-superphosphate.
K—sulphate of potash.
N—ammonium sulphate.

In the Glass Delicious orchard we find a somewhat greater range in amount of terminal growth between treated and untreated trees. In this

[2] Tucker, L. R. and Verner, Leif. Prune maturity and storage. Ida. Agr. Exp. Sta. Bul. 196. 1932.

variety the unfertilized plot had an average terminal growth of 7.0 inches per year and the plot receiving nitrogen and potash had an average terminal growth of 8.5 inches, a difference of 21.4 per cent. This might be considered to indicate a significant improvement in tree vigor were it not for the fact that in the Jonathan block in the same orchard the plot receiving the same fertilizer combinations (nitrogen and potash) made the smallest annual terminal growth recorded for any of the plots. It is not to be expected that varietal differences alone would account for such divergent results under the same fertilizer treatment on the same soil, and doubt is cast on the significance of the records of terminal growth on the bearing Delicious trees.

TABLE 2.—Summary of terminal shoot growth measurements in inches in apple orchards.

Fertilizer	None	P	K	N	NP	NK	NPK
Year	Hinshaw Young Starking and Delicious Orchard						
1932	33.6	32.2	37.0	29.6	30.8	31.8	32.3
1933	20.7	20.6	21.4	19.7	20.5	19.9	21.6
1934	25.2	20.0	24.5	28.4	26.6	27.4	25.4
1935	22.6	19.6	22.7	23.6	23.8	26.3	23.1
1936	14.3	13.2	12.8	14.6	15.1	16.4	14.6
1937	9.6	8.9	8.6	11.1	9.8	10.0	9.2
Av.	21.0	19.1	21.1	21.2	21.1	22.0	21.0
	Glass Delicious Orchard Averages						
	7.0	7.4	6.6	7.7	8.2	8.5	8.2
	Glass Jonathan Orchard Averages						
	6.0	6.7	6.5	6.7	6.6	5.3	6.8
	All Orchard's Averages						
	11.3	11.1	11.4	11.9	12.0	11.9	12.0

Key to Symbols:
P—treble-superphosphate.
K—sulphate of potash.
N—ammonium sulphate.

In the young Delicious orchard near Wilder, which is on deeper soil, there was no significant increase in twig growth due to any of the fertilizers (*Table 2*). When the results obtained in all of the apple orchard plots are summarized it is found that all of the plots receiving nitrogen made slightly greater terminal growth than any of the plots in which this element was not supplied (*Table 2*). Whether or not this slight increase in tree vigor where nitrogen was used is of practical importance can best be determined by the extent to which this increased vigor is reflected in increased production.

Trunk circumference measurements showed results slightly different from those dealing with terminal growth (*Table 3*). In the Jonathan block all of the trees receiving phosphorus, either singly or in combination with other elements, exhibited greater trunk circumference increments than were

observed in any of the trees not receiving phosphorus. In the bearing Delicious block all the fertilized plots showed greater increases in trunk circumference than the check plot, but no consistent increase in trunk circumference can be attributed to any of the fertilizer elements. Results in the young Delicious orchard, like those in the Jonathan experiment, suggest a slight

TABLE 3.—Average trunk circumferences in inches under different fertilizer treatments in apple orchards.

Fertilizer	None	P	K	N	NP	NK	NPK
Year	**Glass Jonathan Orchard**						
1931	32.7	31.8	34.3	33.0	32.1	32.8	30.3
1936	38.0	39.6	40.8	39.7	40.0	39.6	37.8
Increase	6.7	7.8	6.5	6.7	7.9	6.8	7.5
	Glass Delicious Orchard						
1931	37.3	36.0	33.6	33.7	32.0	35.0	31.7
1936	42.8	43.2	39.6	41.2	38.6	42.4	39.7
Increase	5.5	7.2	6.0	7.5	6.6	7.4	8.0
	Hinshaw Starking and Delicious Orchard						
1932	6.0	6.1	6.3	6.2	6.0	5.8	6.0
1937	18.2	18.6	18.9	18.5	19.9	18.5	19.6
Increase	12.2	12.5	12.6	12.3	13.9	12.7	13.7
	All Orchards						
Av. Annual Increase	1.6	1.8	1.7	1.8	1.9	1.8	1.9

Key to Symbols:
P—treble-superphosphate.
K—sulphate of potash.
N—ammonium sulphate.

increase in growth from the use of phosphorus. In summarizing the trunk growth measurements (*Table 3*) it is seen that none of the fertilizer treatments gave any consistent or striking results, although the trees in all of the treated plots made slightly greater growth than those in the check plots. Whether or not these slight increases justified the cost of the treatments can best be determined by a study of the fruiting responses of these trees.

Yield records taken during the period of the experiment indicate that the use of none of the fertilizers has consistently resulted in a sufficient increase in yields to return a profit over the cost of the treatment (*Table 4*). In the Jonathan orchard all of the plots in whih potash was used, whether singly or in combination with other elements, gave considerably lower average yields than those plots not receiving potash. This observation might be taken to indicate a deleterious effect of potash on these apple trees, but such a supposition is not borne out by results observed in other varieties. In the bearing Delicious block, for instance, the highest yield recorded for any treatment was that of the plot receiving potash together with nitrogen. The young Delicious orchard showed no consistent increases or decreases in yields under any of the fertilizer treatments; and when the results of all

three blocks of apple trees are summarized it is found that the average yields on the untreated plots were slightly higher than on any of the fertilized plots. While the differences between treatments were neither great enough to warrant a statement that some of the fertilizer treatments were detrimental, at least it is quite certain that they were not beneficial, since the unfertilized trees gave the highest average yields.

TABLE 4.—Average yields in boxes per tree under different fertilizer treatments in apple orchards.

Fertilizer	None	P	K	N	NP	NK	NPK
Year	**Glass Jonathan Orchard**						
1931	8.7	7.7	8.6	8.5	14.0	10.9	9.9
1932	22.9	17.9	16.8	13.6	9.8	9.8	12.5
1933	5.8	5.4	7.8	7.4	13.8	6.6	9.2
1934	10.7	15.7	18.5	15.6	8.9	12.1	7.7
1935	22.2	13.8	17.1	25.1	26.9	21.7	21.8
1936	25.9	33.8	20.3	26.5	29.1	25.0	19.6
Av. 1932-6	17.5	17.3	16.1	17.6	17.7	15.0	14.2
	Glass Delicious Orchard						
1931	10.9	7.8	7.2	10.1	9.6	14.7	8.0
1932	12.3	16.3	16.7	13.8	11.1	15.3	8.4
1933	13.1	11.0	7.6	10.5	10.4	13.2	12.7
1934	7.4	9.1	12.3	9.1	7.7	10.1	7.2
1935	34.6	32.2	28.6	28.0	27.0	35.0	31.0
1936	20.2	9.6	19.2	16.8	12.6	13.8	11.8
Av. 1932-6	17.5	15.7	16.9	15.6	13.8	17.5	14.2
	Hinshaw Delicious and Starking (Young Trees)						
1936	6.1	5.9	6.7	3.9	5.8	4.8	6.2
1937	6.6	6.8	9.0	5.9	7.1	6.3	8.1
Av.	6.4	6.4	7.8	4.9	6.4	5.6	7.2
	All Orchards						
Av. Annual yield per tree	15.6	14.8	15.0	14.7	14.2	14.5	13.0

Key to Symbols:
P—treble-superphosphate.
K—sulphate of potash.
N—ammonium sulphate.

The fact that the fertilized trees did not give higher yields than the untreated trees might be explained in part, at least, by records of the numbers of fruits removed in thinning on the different plots in 1933. The number of apples thinned per tree in each treatment were: check—1271; phosphate —1739; potash—2194; nitrogen—2171; nitrogen and phosphate—2794; nitrogen and potash—1368; nitrogen, phosphate and potash—2772. It is evident that the quantity of thinned fruit was generally much greater on those trees receiving fertilizer than on the untreated trees. If such a condition prevailed throughout the experiment the detrimental effects of this excessively heavy set of fruit may have offset any beneficial effects that might otherwise have been derived from the fertilizer treatments.

Fruit size in the different plots was determined by averaging the dia-

meter measurements of 80 and of 40 fruits per treatment in 1932 and 1933, respectively. These results, summarized in Table 5, show no significant differences in fruit size among the different treatments.

TABLE 5.—Summary of records on fruit quality in Glass apple orchards.

Treatment		None	P	K	N	NP	NK	NPK
Variety	**Year**	**Average Fruit Diameter in Inches**						
Jonathan	1932	2.61	2.62	2.64	2.59	2.70	2.59	2.66
	1933	2.64	2.64	2.65	2.59	2.68	2.40	2.66
	Av.	2.63	2.63	2.64	2.59	2.69	2.50	2.66
Delicious	1932	2.95	2.94	2.94	3.04	3.12	3.03	3.10
	1933	2.84	2.86	2.85	2.87	2.92	2.94	2.90
	Av.	2.90	2.90	2.90	2.95	2.97	2.99	3.00
Both Av.		2.76	2.77	2.77	2.78	2.83	2.74	2.83
		Average Ground Color According to U. S. D. A. Chart						
Jonathan	1932	3.35	3.54	3.18	3.64	3.36	3.20	3.56
Delicious	1932	3.54	3.54	3.58	3.54	3.50	3.66	3.68
	Av.	3.44	3.54	3.38	3.59	3.43	3.43	3.62
		Average Red Color per Fruit in per cent						
Jonathan	1932	73	76	67	77	70	72	72
	1933	82	85	80	86	78	78	88
	Av.	78	80	74	82	74	75	80
Delicious	1932	84	81	84	80	82	77	79
	1933	82	78	84	73	79	70	72
	Av.	83	80	84	76	80	74	76
Both Av.		80	80	79	79	77	74	78

Key to Symbols:
P—treble-superphosphate.
K—sulphate of potash.
N—ammonium sulphate.

Maturity and color development as measured by ground color and red color also are shown in Table 5. Ground color was determined by averaging readings obtained by use of a special ground-color chart published by the United States Department of Agriculture[3]. Red color was determined by averaging the percentages of red coloring on the surfaces of 80 fruits from each treatment. Neither ground color nor red color averages showed any consistent effects of the fertilizers.

Results From Fertilization of Prune Trees

In the McBirney orchard near Meridian, where applications of 1, 2, 4 and 6 lb. per tree of ammonium sulphate were used on bearing prune trees, all of the treated plots showed great improvement over the unfertilized check plots. A summary of 6 years yield and growth records from these plots is given in Table 6. It is at once obvious from a study of these figures that nitrogen fertilizer resulted both in a marked increase in yields and in stimulation of the vegetative growth of the trees. By averaging the yield records

[3] Magness, J. R. et al. The ripening, storage and handling of apples. U. S. D. A. Bul. 1406. 1926.

and the growth averages of the two check plots, it is found that the trees receiving nitrogen produced 52 per cent more prunes (in a 6-year period), and made 42 per cent more terminal shoot growth, than did the unfertilized trees. Average trunk circumference increase in the treated trees was 26 per cent greater than in the untreated ones. More specifically, the fertilized plots produced, annually, 57 lb. more prunes per tree than the check plots, an amount sufficient to pay a wide margin of profit over the cost of the treatments.

TABLE 6.—Summary of yield and growth records for 6 years in McBirney prune orchard

Annual fertilizer application per tree	Average annual yield in lbs. per tree	Average annual terminal growth in inches	Average trunk circumference	
			At beginning of experiment	Per cent increase in six years
Check—no fertilizer	114	1.8	21.1 inches	16
1 lb. ammonium sulphate	162	2.0	23.7 "	21
2 lb. ammonium sulphate	165	2.2	23.4 "	23
4 lb. ammonium sulphate	172	2.1	24.5 "	24
6 lb. ammonium sulphate	171	2.2	23.3 "	23
Check—no fertilizer	107	1.9	22.4 "	20

Further analysis of the figures in Table 6 reveal the fact that the lighter applications of 1 lb. and 2 lb. of ammonium sulphate gave nearly as good results as the heavier applications of 4 lb. and 6 lb. In this particular orchard the 1 lb. treatment probably is the most profitable.

In the Smith orchard at Payette, as previously mentioned, the treated plots received the same kinds of fertilizers as the apple trees but in smaller quantities. One set of plots was on ground that had been in alfalfa sod and a duplicate set was on ground that had been clean cultivated previous to the establishment of this project. From a study of the summarized data dealing with this project (*Table 7*) it appears that nitrogen in the form of ammonium sulphate, both singly and in combination with other elements, gave a marked increase in yields, terminal growth and trunk growth. Thus, for the 5-year period represented, the plots receiving, respectively, nitrogen, nitrogen plus phosphate, and nitrogen plus potash, were superior in performance to those receiving, respectively, no treatment, phosphate only, and potash only. The differences, in favor of the nitrated plots, amounted to 18 per cent in yields, 26 per cent in terminal growth, and 20 per cent in trunk circumference. Similar comparisons of summarized plot records indicate that potash may have slightly increased the yields of these trees, while phosphate apparently was not beneficial. Improvement in the nitrated trees was of a cu-

mulative nature, the effects increasing with continued applications; and these effects appeared first in growth, then in yields.

TABLE 7.—Summary of Growth and Yield Records in Smith Prune Orchard

Treatment	None	P	K	N	NP	NK	NPK	Alfalfa Sod	Cultivated
Year	Average trunk circumference in inches								
1932	19.4	19.0	20.2	19.1	19.8	19.2	20.5	18.7	20.6
1936	22.8	22.3	23.4	23.1	23.9	23.0	24.1	22.3	24.2
Increase	3.4	3.3	3.2	4.0	4.1	3.8	3.6	3.6	3.6
	Average twig lengths in inches (15 measured per tree)								
1932	1.2	1.1	1.0	1.4	1.1	1.3	1.2	1.3	1.1
1933	1.9	1.6	1.8	3.0	2.0	2.6	2.6	2.5	1.9
1934	2.4	2.4	2.6	3.2	2.8	3.2	2.5	3.0	2.4
1935	2.4	2.7	2.2	2.6	2.6	2.4	2.2	2.4	2.5
1936	2.0	1.8	1.7	2.6	2.7	2.8	2.4	1.9	2.4
Av.	2.0	1.9	1.9	2.6	2.2	2.5	2.2	2.2	2.1
	Average yields per tree in pounds								
1932	122	132	150	122	124	136	170	111	148
1933	26	18	24	30	37	32	18	22	31
1934	68	46	73	73	70	116	98	90	66
1935	216	214	218	274	252	259	292	204	288
1936	43	36	31	46	53	47	64	46	45
Av.	95	89	99	109	107	118	128	95	116

Key to Symbols:
P—treble-superphosphate.
K—sulphate of potash.
N—ammonium sulphate.

Fruit quality in the Smith orchard was measured by fruit size, firmness, and the soluble solids content of the juice. As shown in Table 8 there were no outstanding differences in quality of the prunes on the different plots.

TABLE 8.—Summary of Records on Fruit Quality in Smith Prune Orchard.

Treatment	None	P	K	N	NP	NK	NPK	Alfalfa Sod	Cultivated
Year	**Average weight per fruit in grams (10 fruits per tree)**								
1932	27.5	25.5	26.9	26.7	26.2	26.8	27.4	27.0	26.4
1933	33.3	29.6	31.1	35.5	32.2	32.8	33.9	33.8	32.2
1934	30.0	28.5	29.4	30.2	28.2	29.2	30.4	30.0	28.8
Av.	30.3	27.9	29.1	30.7	28.9	29.6	30.6	30.3	29.1
	Average fruit firmness in lbs. measured by 5/16 inch plunger U. S. pressure tester								
1932	13.0	12.8	12.4	13.2	13.2	13.0	12.8	13.4	12.5
1933	13.2	12.8	13.0	13.4	13.3	13.3	13.9	13.2	13.3
1934	10.8	10.5	10.5	10.8	10.8	10.6	10.8	10.4	11.0
1935	12.2	11.7	11.6	12.3	12.1	12.1	12.5	11.9	12.2
Av.	12.3	12.0	11.9	12.4	12.4	12.2	12.5	12.2	12.0
	Average juices soluble solids in per cent measured by refractometer								
1932	16.6	16.6	17.1	16.3	16.2	16.6	16.4	16.6	16.5
1933	18.4	18.3	18.6	17.7	18.6	18.4	18.4	18.1	18.6
1934	16.7	17.2	17.0	16.5	16.5	16.5	16.2	16.9	16.4
1935	17.0	17.5	17.7	18.0	16.8	17.5	16.4	17.7	16.8
Av.	17.2	17.4	17.6	17.1	17.0	17.2	16.8	17.3	17.1

Key to Symbols:
P—treble-superphosphate.
K—sulphate of potash.
N—ammonium sulphate.