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THE EFFECT OF GREEN MANURES AND CROP RESIDUES ON SOIL REACTION

By WALTER G. SACKETT, ALVIN KEZER, IDA W. FERGUSON,
JUSTUS C. WARD

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FOREWORD

This bulletin is the first of a series of reports to be made by Dr. W. G. Sackett of the Bacteriology Section, and Professor Alvin Kezer of the Agronomy Section of this station, who have been cooperating in carrying on work under a project entitled "Arkansas Valley Niter Control."

This project was undertaken for the purpose of working out effective and practical methods which the farmer might use to control the bad conditions of the soil which were shown to exist in the Arkansas Valley, and in some other portions of Colorado, as the result of the researches of Dr. W. P. Headden and Dr. W. G. Sackett which have been published in former bulletins of the station. This unfavorable condition resulting from an excess of nitrates in the soil over considerable areas of agricultural lands in this state, fluctuates in its severity in a given locality from year to year, as the result of seasonal changes and soil conditions but in general, has not greatly changed in recent years and continues to be a serious factor causing heavy losses in agricultural and horticultural crops.

The progress that has already been made in these experiments to determine methods of control is most encouraging, and leads us to believe that the losses to agricultural crops, due to excessive nitrates in the soil, thru the activities of Azotobacter, can be largely overcome by simple and practical methods that any farmer can use.

C. P. GILLETTE, *Director.*

THE EFFECT OF GREEN MANURES AND CROP RESIDUES ON SOIL REACTION

By WALTER G. SACKETT, ALVIN KEZER, IDA W. FERGUSON, JUSTUS C. WARD

In our previous publications* we have called attention to the accumulation of excessive nitrates in certain Colorado soils, have pointed out their harmful effect upon the growing crops and have attempted to explain their origin thru bacterial activity.

Having established the cause of these nitrates beyond a reasonable doubt, the natural sequence of events demanded that we next find some suitable means of controlling their formation or at least of limiting the amount to such as could be utilized to advantage by vegetation.

Inasmuch as any control measure which might prove to be effective would have to stand the test of field practice, the wisdom of carrying on our experiments under actual field conditions is obvious. Accordingly, in the spring of 1922, work was begun on the Experimental Farm at Rocky Ford, Colorado, with the following objectives:

1. To determine the effect of different crops, crop sequences, cultural practices and fertilizer treatments upon the development of soil nitrates.
2. To formulate methods for the control of excessive nitrate production by employing the results obtained from 1.
3. To determine the crops best suited to soils containing excessive nitrates.

The present paper is the first of a series of articles to be published, giving the outcome of different phases of our experiments. In it are reported the results of one season's study of the effect of green manures, crop residues and commercial fertilizers on the soil reaction.

We have taken up this aspect of the question because our problem was primarily a matter of controlling excessive bacterial development, particularly that of Azotobacter.

It is a fact well known to all bacteriologists that the reaction of the cultural medium is a limiting factor to bacterial growth, and these limits of acid and alkali have been established quite accurately by several investigators, both for the growth of Azotobacter and its power to fix atmospheric nitrogen.

Fred and Davenport [1] in their studies of the influence of reaction on nitrogen-assimilating bacteria noted the extreme sensitiveness of

* 6, 7, 8, 9, 10, 11, 12, 15, 16, 17, and 18.

Azotobacter to slight changes in reaction. They established as the growth limits hydrogen-ion concentrations expressed by pH 6.5 for acid and pH 8.6 for alkali.

Johnson and Lipman [13] found that there was an abrupt decrease in the amount of nitrogen fixed by Azotobacter between pH 6.0 and 6.2; that the alkaline limit was near pH 9.0; also that fixation of nitrogen was not greatly affected between pH 6.2 and 8.8 and that the most favorable reaction was between pH 7.0 and 8.0.

Gainey, [2], [3], [4], [5], who has made a very extensive study of this subject reported the acid limit for the growth of pure cultures of Azotobacter to be between pH 5.9 and 6.0. He states that vigorous growth and nitrogen fixation took place at pH 6.1 and 6.5, the optimum for nitrogen fixation being apparently somewhat higher than for growth. As a result of the examination of 418 soils from different parts of the United States, he concluded that there is a very close correlation between the absolute reaction of the soil and the presence or absence of Azotobacter in the soil, and that very few soils having a hydrogen-ion concentration greater than pH 6.0 contain Azotobacter, while this group of organisms is usually present where the hydrogen-ion concentration is lower. According to Gainey's experiments, the average hydrogen-ion concentration for 119 soils, which contained Azotobacter, was pH 6.72, while that for 205 where Azotobacter was absent was pH 5.44.

In the limited number of Colorado soils that have been examined, we have never found Azotobacter present where the hydrogen-ion concentration was greater than pH 6.5. With the exception of three soils, and two of these came from uncultivated mountain sides, Azotobacter has always been found where the reaction was between pH 6.5 and 7.7.

Evidence such as that just cited suggested to us the possibility that the acid formed by the microbial fermentation of green manures and crop residues might be adequate to limit the fixation of atmospheric nitrogen by Azotobacter, if not sufficient to prevent its growth.

HISTORY OF PLOTS

The soil of the Experimental Farm is a silt loam and is representative of the better class of agricultural land in the Arkansas Valley. The normal reaction varies between hydrogen-ion concentrations expressed by pH 7.6 and 7.7. It contains 3.184 percent of calcium carbonate which might be expected to prevent the accumulation of any appreciable amount of free acid. The nitric nitrogen has varied in a single season between 10.00 and 113.55 parts per million, depending upon the time of year the sample was taken and the treatment

the soil had received. Illustrative of the effect which the method of cropping has upon the development of soil nitrates, the following case may be cited:

Neighboring plots, on March 28, 1922, showed 10.00 and 8.17 parts per million of nitric nitrogen respectively. The first was planted to onions and the second to barley. The onions were cultivated at frequent intervals thruout the growing season, but the barley, of course, was not. Determinations of nitric nitrogen made on July 31 showed the onion plot to contain 113.55 and the barley only 6.22 parts per million. On the one hand, nitric nitrogen equivalent to 688.99 pounds of sodium nitrate per acre had been formed in four months in the surface 3 inches; on the other, only 37.74 pounds were present, less than in the beginning. Similar results have been obtained repeatedly under cultivated and non-cultivated crops, which points conclusively to the stimulating effect that cultivation thru aeration has upon nitrogen fixation, ammonification and nitrification.

PLAN OF THE EXPERIMENT

GREEN MANURES AND CROP RESIDUES.—Organic matter, capable of undergoing an acid fermentation, was added to the soil in the form of alfalfa hay, barley straw, corn fodder, green barley and green cane. The first three were finely ground before being applied and were mixed into the soil by sowing them in shallow furrows.

As commercial fertilizers are being used to a limited extent in some of the truck-growing sections of the state, we included dried blood, superphosphate and sulphur in the experiment for the sake of comparison.

RATE OF APPLICATION.—For reasons irrelevant to this investigation, the applications of the dried residues and blood meal were made at the rate of 36.6 pounds of nitrogen per acre which amount represented the weight of the nitrogen in 8000 pounds of dried corn fodder. The nitrogen content being lowest in the fodder, then increasing in the straw, alfalfa and blood meal in the order named, it is apparent that the mass of the material added would be inversely proportional to the nitrogen content. In other words, so far as the materials of our experiment were concerned, the bulk of the fodder was much greater than that of the dried blood; that of the barley straw and alfalfa occupying intermediate positions. These were applied April 21, 1925.

The barley and cane which served as green manures, were planted on March 27 and plowed under on June 29. A second planting was made immediately on June 30 and turned under on August 15. Thus,

two crops of green material were added to the soil during the period of the experiment.

The superphosphate was used at the rate of 500 pounds and the sulphur at 1000 pounds per acre.

Each plot, including two checks, was irrigated and cultivated thruout the season the same as if it had been planted to a crop.

SIZE OF PLOTS.—The areas of the different plots were as follows:
Dried residues and blood meal 1/100 acre.
Superphosphate and sulphur 1/50 acre.
Green barley and green cane 1/2 acre.
Checks 1/12 acre.

METHOD OF PROCEDURE

From April 1 to October 1, daily samples were obtained from each plot for hydrogen-ion determinations. These were taken to a depth of four inches and represented a portion of a composite sample. All of the soils were air dried and ground to pass a 100-mesh sieve before the reaction was determined.

The measurements of the hydrogen-ion concentration were made by the colorimetric method and were checked electrometrically, the results obtained by the two different procedures agreeing so closely that they can be considered identical for all practical purposes.

The soil extracts for the hydrogen-ion determinations were prepared by suspending 15 grams of the air-dried soil sample in 70 c.c. of triply distilled conductivity water. These were shaken vigorously for one minute and allowed to settle for 10 minutes after which 50 c.c. of the supernatant fluid were decanted to centrifuge tubes and centrifuged for 15 minutes. Ten cubic centimeters of the clarified liquid were removed at once with a pipette for the test, and the readings were made according to the technique of Medalia [14].

The daily results for each plot are given in Tables 1 to 11.

Table 1.—Hydrogen-ion Concentration in Soil of North Check Plot. All Dates Are 1925.

Sample No.	Date of Collection	Date of Examination	pH	Sample No.	Date of Collection	Date of Examination	pH
1	April 1	May 4	7.6	201	April 27	May 14	7.3
9	April 2	May 5	7.7	209	April 28	May 14	7.4
17	April 3	May 7	7.5	217	April 29	May 15	7.4
25	April 4	May 7	7.5	225	April 30	May 12	7.5
33	April 5	May 8	7.5	233	May 1	May 12	7.5
41	April 6	May 8	7.5	241	May 2	May 12	7.5
49	April 7	May 8	7.5	249	May 3	May 11	7.5
57	April 8	May 8	7.5	257	May 4	May 11	7.5
65	April 9	May 9	7.6	265	May 5	May 19	7.4
73	April 10	May 9	7.5	273	May 6	May 19	7.5
81	April 11	May 13	7.5	281	May 7	May 19	7.5
89	April 12	May 18	7.5	289	May 8	May 19	7.5
97	April 13	May 18	7.5	297	May 9	May 17	7.6
105	April 14	May 18	7.1	305	May 13	June 17	7.6
113	April 15	May 19	7.3	313	May 14	June 17	7.7
121	April 17	April 29	7.5	321	May 15	June 17	7.7
129	April 18	April 29	7.7	329	May 16	June 17	7.6
137	April 19	April 30	7.5	337	May 17	June 17	7.6
145	April 20	May 1	7.5	345	May 18	June 17	7.6
153	April 21	May 15	7.3	353	May 19	June 17	7.6
161	April 22	May 18	7.5	361	May 20	June 17	7.6
169	April 23	May 18	7.3	369	May 21	June 17	7.6
177	April 24	May 18	7.5	377	May 22	June 20	7.7
185	April 25	May 15	7.5	385	May 23	June 22	7.6
193	April 26	May 15	7.3	393	May 24	June 22	7.6

Table 1.—Hydrogen-ion Concentration in Soil of North Check Plot. All Dates Are 1925.

Sample No.	Date of Collection	Date of Examination	pH
401	May 25	June 24	7.6
409	May 26	June 24	7.6
417	May 27	June 24	7.7
425	May 28	June 26	7.6
433	May 29	June 24	7.6
441	May 30	June 24	7.6
441A	May 31	June 25	7.7
449	June 1	June 25	7.7
457	June 2	June 25	7.6
465	June 3	June 25	7.5
473	June 4	June 25	7.6
481	June 5	June 25	7.6
489	June 6	June 26	7.6
497	June 7	No Sample	
505	June 8	June 26	7.6
513	June 9	June 26	7.6
521	June 10	June 26	7.6
529	June 11	June 26	7.6
537	June 12	June 26	7.6
545	June 13	June 27	7.6
553	June 14	June 27	7.7
561	June 15	June 27	7.6
569	June 16	July 8	7.6
577	June 17	July 8	7.6
586	June 18	July 8	7.6
595	June 19	July 9	7.6
604	June 20	July 10	7.6
613	June 22	July 10	7.6
623	June 23	July 11	7.6
632	June 24	July 11	7.5
641	June 25	July 13	7.6
651	June 26	July 13	7.6
661	June 27	July 13	7.6
671	June 28	July 13	7.6
681	June 29	July 16	7.7
691	June 30	July 16	7.6
701	July 2	July 16	7.6
711	July 3	July 16	7.6
721	July 4	July 16	7.6
731	July 6	July 16	7.6
741	July 7	July 17	7.7
751	July 8	July 24	7.7
761	July 9	July 24	7.6
771	July 10	July 24	7.7
781	July 11	July 24	7.7
791	July 12	July 24	7.6
801	July 13	July 24	7.6
811	July 14	July 24	7.6
821	July 15	July 24	7.6
831	July 16	July 25	7.7
841	July 17	August 6	7.7
851	July 18	August 6	7.7
861	July 20	August 6	7.7
871	July 19	August 22	7.8
881	July 21	August 22	7.7
891	July 22	August 19	7.7
901	July 23	August 19	7.7
911	July 24	August 22	7.7
921	July 25	August 22	7.7
931	July 26	August 22	7.7
941	July 27	August 24	7.7
951	July 28	No Sample	
961	July 29	August 24	7.6
971	August 1	August 24	7.6
981	August 2	August 25	7.7
991	August 3	August 25	7.8
1001	August 4	August 25	7.7
1011	August 5	August 25	7.7
1021	August 6	August 26	7.7
1031	August 7	August 26	7.7
1041	August 8	August 26	7.7
1051	August 9	August 26	7.7
1061	August 11	August 27	7.7
1072	August 12	August 27	7.7
1083	August 14	August 27	7.7
1094	August 15	August 27	7.7
1105	August 16	August 27	7.7
1116	August 17	August 27	7.6
1127	August 18	August 31	7.7
1138	August 19	August 31	7.7
1148	August 20	August 31	7.6
1158	August 21	August 31	7.6
1168	August 22	Sept. 1	7.7
1178	August 23	Sept. 1	7.7
1188	August 24	Sept. 1	7.7
1198	August 25	Sept. 1	7.6
1208	August 26	Sept. 2	7.7
1218	August 27	Sept. 15	7.7
1228	August 28	Sept. 15	7.7
1238	August 29	Sept. 16	7.7
1248	August 30	Sept. 16	7.7
1258	August 31	Sept. 16	7.7
1268	Sept. 1	Sept. 17	7.7
1278	Sept. 2	Sept. 18	7.6
1288	Sept. 3	Sept. 18	7.7
1298	Sept. 4	Oct. 5	7.7
1308	Sept. 5	Oct. 5	7.7
1318	Sept. 6	Oct. 5	7.7
1328	Sept. 7	Oct. 5	7.7
1338	Sept. 8	Oct. 5	7.6
1348	Sept. 9	Oct. 5	7.6
1358	Sept. 10	Oct. 5	7.6
1368	Sept. 11	Oct. 5	7.6
1378	Sept. 12	Oct. 5	7.6
1388	Sept. 13	Oct. 15	7.6
1398	Sept. 14	Oct. 15	7.7
1408	Sept. 15	Oct. 15	7.7
1418	Sept. 16	Oct. 15	7.6

Table 1.—Hydrogen-ion Concentration in Soil of North Check Plot. All Dates Are 1925.

Sample No.	Date of Collection	Date of Examination	pH	Sample No.	Date of Collection	Date of Examination	pH
142S	Sept. 17	Oct. 9	7.6	149S	Sept. 24	Oct. 8	7.6
143S	Sept. 18	Oct. 9	7.6	150S	Sept. 25	Oct. 7	7.7
144S	Sept. 19	Oct. 9	7.6	151S	Sept. 26	Oct. 7	7.6
145S	Sept. 20	Oct. 9	7.6	152S	Sept. 27	Oct. 7	7.6
146S	Sept. 21	Oct. 9	7.6	153S	Sept. 28	Oct. 7	7.6
147S	Sept. 22	Oct. 9	7.6	154S	Sept. 29	Oct. 7	7.7
148S	Sept. 23	Oct. 8	7.6	155S	Sept. 30	Oct. 7	7.7

The results for the season show that 78.69 percent of the determinations gave pH readings of 7.6 or above and 21.31 percent, of 7.5 or below with 77.51 percent from 7.6 to 7.7. From this it is clear that the reaction of the north check plot was well on the alkaline side thruout the experimental period

Table 2.—Hydrogen-ion Concentration in Soil of South Check Plot. All Dates Are 1925.

Sample No.	Date of Collection	Date of Examination	pH	Sample No.	Date of Collection	Date of Examination	pH
2	April 1	May 4	7.7	234	May 1	May 12	7.5
10	April 2	May 4	7.6	242	May 2	May 12	7.5
18	April 3	May 7	7.6	250	May 3	May 11	7.5
26	April 4	May 7	7.6	258	May 4	May 11	7.5
34	April 5	May 8	7.7	266	May 5	May 19	7.5
42	April 6	May 8	7.7	274	May 6	May 19	7.3
50	April 7	May 8	7.6	282	May 7	May 19	7.5
58	April 8	May 8	7.7	290	May 8	May 19	7.3
66	April 9	May 9	7.7	298	May 9	June 17	7.5
74	April 10	May 9	7.7	306	May 13	June 17	7.6
82	April 11	May 13	7.6	314	May 14	June 17	7.7
90	April 12	May 18	7.5	322	May 15	June 17	7.7
98	April 13	May 18	7.6	330	May 16	June 17	7.7
106	April 14	May 18	7.6	338	May 17	June 17	7.5
114	April 15	May 19	7.6	346	May 18	June 17	7.7
122	April 17	April 29	7.7	354	May 19	June 17	7.7
130	April 18	April 29	7.7	362	May 20	June 17	7.7
138	April 19	April 30	7.7	370	May 21	June 17	7.7
146	April 20	May 1	7.6	378	May 22	June 20	7.7
154	April 21	May 15	7.6	386	May 23	June 22	7.7
162	April 22	May 18	7.6	394	May 24	June 22	7.6
170	April 23	May 18	7.6	402	May 25	June 24	7.7
178	April 24	May 18	7.5	410	May 26	June 24	7.7
186	April 25	May 15	7.5	418	May 27	June 24	7.7
194	April 26	May 14	7.5	426	May 28	June 24	7.7
202	April 27	May 14	7.5	434	May 29	June 24	7.6
209	April 28	May 14	7.5	442	May 30	June 24	7.6
218	April 29	May 15	7.5	442A	May 31	June 25	7.7
226	April 30	May 13	7.5	450	June 1	June 25	7.7

Table 2.—Hydrogen-ion Concentration in Soil of South Check Plot. All Dates Are 1925.

Sample No.	Date of Collection	Date of Examination	pH	Sample No.	Date of Collection	Date of Examination	pH
458	June 2	June 25	7.6	1002	August 4	August 25	7.7
466	June 3	June 25	7.6	1012	August 5	August 25	7.7
474	June 4	June 25	7.7	1022	August 6	August 26	7.7
482	June 5	June 25	7.7	1032	August 7	August 26	7.7
490	June 6	June 26	7.7	1042	August 8	August 26	7.8
506	June 8	June 26	7.7	1052	August 9	August 26	7.8
514	June 9	June 26	7.6	1062	August 11	August 27	7.7
522	June 10	June 25	7.7	1073	August 12	August 27	7.7
530	June 11	June 26	7.6	1084	August 14	August 27	7.7
538	June 12	June 26	7.7	1095	August 15	August 27	7.7
546	June 13	June 27	7.7	1106	August 16	August 27	7.7
554	June 14	June 27	7.7	1117	August 17	August 31	7.6
562	June 15	June 27	7.7	1128	August 18	August 31	7.7
570	June 16	July 8	7.7	1139	August 19	August 31	7.7
578	June 17	July 8	7.7	1149	August 20	August 31	7.7
587	June 18	July 8	7.7	1159	August 21	August 31	7.6
595	June 19	July 9	7.7	1169	August 22	Sept. 1	7.7
605	June 20	July 10	7.6	1179	August 23	Sept. 1	7.7
614	June 22	July 11	7.7	1189	August 24	Sept. 1	7.7
624	June 23	July 11	7.6	1199	August 25	Sept. 1	7.8
633	June 24	July 13	7.6	1209	August 26	Sept. 2	7.7
642	June 25	July 13	7.6	1219	August 27	Sept. 15	7.7
652	June 26	July 13	7.7	1229	August 28	Sept. 15	7.7
662	June 27	July 13	7.6	1239	August 29	Sept. 16	7.7
672	June 28	July 13	7.6	1249	August 30	Sept. 16	7.7
682	June 29	July 16	7.7	1259	August 31	Sept. 16	7.7
692	June 30	July 16	7.7	1269	Sept. 1	Sept. 17	7.7
702	July 2	July 16	7.7	1279	Sept. 2	Sept. 18	7.7
712	July 3	July 16	7.6	1289	Sept. 3	Sept. 18	7.7
722	July 5	July 16	7.6	1299	Sept. 4	Oct. 5	7.7
732	July 6	July 16	7.6	1309	Sept. 5	Oct. 5	7.7
742	July 7	July 17	7.7	1319	Sept. 6	Oct. 2	7.7
752	July 8	July 24	7.6	1329	Sept. 7	Oct. 2	7.7
762	July 9	July 24	7.7	1339	Sept. 8	Oct. 2	7.6
772	July 10	July 24	7.7	1349	Sept. 9	Oct. 2	7.7
782	July 11	July 24	7.7	1359	Sept. 10	Oct. 2	7.6
792	July 12	July 24	7.6	1369	Sept. 11	Oct. 2	7.6
802	July 13	July 24	7.6	1379	Sept. 12	Oct. 2	7.6
812	July 14	July 24	7.6	1389	Sept. 13	Oct. 15	7.7
822	July 15	July 24	7.6	1399	Sept. 14	Oct. 15	7.7
832	July 16	July 25	7.7	1409	Sept. 15	Oct. 15	7.7
842	July 17	August 6	7.7	1419	Sept. 16	Oct. 15	7.6
852	July 18	August 6	7.7	1429	Sept. 17	Oct. 9	7.7
862	July 20	August 6	7.7	1439	Sept. 18	Oct. 9	7.7
882	July 21	August 6	7.6	1449	Sept. 19	Oct. 9	7.7
892	July 22	August 19	7.7	1459	Sept. 20	Oct. 9	7.5
902	July 23	August 19	7.8	1469	Sept. 21	Oct. 9	7.7
912	July 24	August 22	7.7	1479	Sept. 22	Oct. 9	7.7
922	July 25	August 22	7.7	1489	Sept. 23	Oct. 8	7.7
932	July 26	August 22	7.7	1499	Sept. 24	Oct. 8	7.7
942	July 27	August 22	7.7	1509	Sept. 25	Oct. 7	7.7
952		No sample		1519	Sept. 26	Oct. 7	7.7
962	July 29	August 24	7.6	1529	Sept. 27	Oct. 7	7.7
972	August 1	August 24	7.6	1539	Sept. 28	Oct. 7	7.7
982	August 2	August 25	7.7	1549	Sept. 29	Oct. 7	7.7
992	August 3	August 25	7.8	1559	Sept. 30	Oct. 9	7.7

The results for the season show that 87.56 percent of the determinations gave pH readings of 7.6 or above and 12.44 percent, of 7.5 or below with 84.61 percent from 7.6 to 7.7. As compared with the other check plot, this one appears to have been slightly more alkaline over a little longer period; but always well on the alkaline side.

Table 3.—Hydrogen-ion Concentration in Soil Which Received Blood Meal. All Dates Are 1925.

Sample No.	Date of Collection	Date of Examination	pH	Sample No.	Date of Collection	Date of Examination	pH
3	April 1	May 4	7.6	371	May 21	June 17	7.6
11	April 2	May 4	7.6	379	May 22	June 20	7.6
19	April 3	May 7	7.5	387	May 23	June 22	7.6
27	April 4	May 7	7.4	395	May 24	June 22	7.6
34	April 5	May 8	7.5	403	May 25	June 24	7.6
43	April 6	May 8	7.5	411	May 26	June 24	7.6
51	April 7	May 8	7.5	419	May 27	June 24	7.7
59	April 8	May 8	7.5	427	May 28	June 24	7.6
67	April 9	May 9	7.5	435	May 29	June 24	7.6
75	April 10	May 9	7.5	443	May 30	June 24	7.6
83	April 11	May 13	7.4	443A	May 31	June 25	7.5
91	April 12	May 18	7.4	451	June 1	June 25	7.7
99	April 13	May 18	7.4	459	June 2	June 25	7.5
107	April 14	May 18	7.3	467	June 3	June 25	7.5
115	April 15	May 19	7.3	475	June 4	June 25	7.6
123	April 17	No Sample		483	June 5	June 25	7.5
131	April 18	April 29	7.5	491	June 6	June 26	7.6
139	April 19	April 30	7.5	507	June 8	June 26	7.6
146	April 20	May 1	7.5	515	June 9	June 26	7.6
155	April 21	May 15	7.2	523	June 10	June 26	7.6
163	April 22	May 18	7.5	531	June 11	June 26	7.6
171	April 23	May 18	7.5	539	June 12	June 26	7.6
179	April 25	May 15	7.4	547	June 13	June 29	7.6
195	April 26	May 14	7.1	555	June 14	June 29	7.6
203	April 27	May 14	7.3	563	June 15	June 29	7.6
211	April 28	May 14	7.3	571	June 16	July 8	7.6
219	April 29	May 15	7.3	579	June 17	July 8	7.6
227	April 30	May 13	7.4	588	June 18	July 8	7.5
235	May 1	May 12	7.4	597	June 19	July 9	7.6
243	May 2	May 12	7.4	606	June 20	July 10	7.6
251	May 3	May 11	7.1	615	June 22	July 10	7.6
259	May 4	May 11	7.4	625	June 23	July 11	7.4
267	May 5	May 19	7.2	634	June 24	July 11	7.5
275	May 6	May 19	7.3	643	June 25	July 13	7.6
283	May 7	May 19	7.4	653	June 26	July 13	7.5
291	May 8	May 19	7.2	663	June 27	July 13	7.5
299	May 9	June 17	7.5	673	June 28	July 13	7.3
307	May 13	June 17	7.6	683	June 29	July 16	7.5
315	May 14	June 17	7.6	693	June 30	July 16	7.5
323	May 15	June 17	7.6	703	July 2	July 16	7.6
331	May 16	June 17	7.6	713	July 3	July 16	7.5
339	May 17	June 17	7.7	723	July 5	July 16	7.6
347	May 18	June 17	7.6	733	July 6	July 16	7.6
355	May 19	June 17	7.6	743	July 7	July 17	7.5
363	May 28	June 17	7.6	753	July 8	July 24	7.6

Table 3.—Hydrogen-ion Concentration in Soil Which Received Blood Meal. All Dates Are 1925.

Sample No.	Date of Collection	Date of Examination	pH	Sample No.	Date of Collection	Date of Examination	pH
763	July 9	July 24	7.6	1180	August 23	Sept. 1	7.7
773	July 10	July 24	7.7	1190	August 24	Sept. 1	7.6
783	July 11	July 24	7.6	1200	August 25	Sept. 1	7.6
793	July 12	July 24	7.6	1210	August 26	Sept. 2	7.6
803	July 13	July 24	7.6	1220	August 27	Sept. 15	7.7
813	July 14	July 24	7.5	1230	August 28	Sept. 15	7.6
823	July 15	July 24	7.6	1240	August 29	Sept. 16	7.7
833	July 16	July 24	7.7	1250	August 30	Sept. 16	7.5
843	July 17	August 6	7.7	1260	August 31	Sept. 16	7.5
853	July 18	August 6	7.7	1270	Sept. 1	Sept. 17	7.6
863	July 20	August 6	7.6	1280	Sept. 2	Sept. 18	7.6
883	July 21	August 6	7.5	1290	Sept. 3	Sept. 18	7.6
893	July 22	August 6	7.7	1300	Sept. 4	Oct. 5	7.6
903	July 23	August 19	7.8	1310	Sept. 5	Oct. 5	7.6
913	July 24	August 22	7.5	1320	Sept. 6	Oct. 2	7.6
923	July 25	August 22	7.5	1330	Sept. 7	Oct. 2	7.6
933	July 26	August 22	7.5	1340	Sept. 8	Oct. 2	7.6
943	July 27	August 24	7.6	1350	Sept. 9	Oct. 2	7.6
953	July 28	No Sample		1360	Sept. 10	Oct. 2	7.6
963	July 29	August 24	7.5	1370	Sept. 11	Oct. 2	7.5
973	August 1	August 24	7.6	1380	Sept. 12	Oct. 2	7.6
983	August 2	August 25	7.6	1390	Sept. 13	Oct. 15	7.6
993	August 3	August 25	7.6	1400	Sept. 14	Oct. 15	7.7
1003	August 4	August 25	7.6	1410	Sept. 15	Oct. 15	7.6
1013	August 5	August 26	7.6	1420	Sept. 16	Oct. 15	7.5
1023	August 6	August 26	7.6	1430	Sept. 17	Oct. 9	7.6
1033	August 7	August 26	7.6	1440	Sept. 18	Oct. 9	7.6
1043	August 8	August 26	7.7	1450	Sept. 19	Oct. 9	7.5
1053	August 9	August 27	7.6	1460	Sept. 20	Oct. 9	7.6
1063	August 11	August 27	7.7	1470	Sept. 21	Oct. 9	7.6
1074	August 12	August 27	7.6	1480	Sept. 22	Oct. 9	7.6
1085	August 14	August 27	7.7	1490	Sept. 23	Oct. 8	7.6
1096	August 15	August 27	7.6	1500	Sept. 24	Oct. 8	7.6
1107	August 16	August 27	7.6	1510	Sept. 25	Oct. 7	7.6
1118	August 17	August 27	7.6	1520	Sept. 26	Oct. 7	7.7
1129	August 18	August 31	7.6	1530	Sept. 27	Oct. 7	7.6
1140	August 19	August 31	7.6	1540	Sept. 28	Oct. 7	7.6
1150	August 20	August 31	7.6	1550	Sept. 29	Oct. 7	7.6
1160	August 21	August 31	7.6	1560	Sept. 30	Oct. 9	7.6
1170	August 22	Sept. 1	7.7				

The results for the season show that 63.68 percent of the determinations gave pH readings of 7.6 or above and 36.32 percent, of 7.5 and below with 63.09 percent from 7.6 to 7.7. While all of the readings are well on the alkaline side, yet the blood meal has shown the greatest tendency toward acid production of any treatment.

Table 4.—Hydrogen-ion Concentration in Soil Which Received Alfalfa Meal. All Dates Are 1925.

Sample No.	Date of Collection	Date of Examination	pH	Sample No.	Date of Collection	Date of Examination	pH
4	April 1	May 4	7.6	436	May 29	June 24	7.6
12	April 2	May 4	7.6	444	May 30	June 24	7.6
20	April 3	May 7	7.4	444A	May 31	June 24	7.7
28	April 4	May 7	7.4	452	June 1	June 25	7.6
36	April 5	May 8	7.5	460	June 2	June 25	7.6
44	April 6	May 8	7.5	468	June 3	June 25	7.6
52	April 7	May 8	7.5	476	June 4	June 25	7.6
60	April 8	May 8	7.5	484	June 5	June 25	7.6
68	April 9	May 9	7.5	492	June 6	June 26	7.6
76	April 10	May 9	7.5	508	June 8	June 26	7.6
84	April 11	May 13	7.5	516	June 9	June 26	7.6
92	April 12	May 18	7.3	524	June 10	June 26	7.6
100	April 13	May 18	7.4	532	June 11	June 26	7.6
108	April 14	May 18	7.5	540	June 12	June 26	7.6
116	April 15	May 19	7.3	548	June 13	June 27	7.7
124	April 17	April 29	7.5	556	June 14	June 27	7.7
132	April 18	April 29	7.5	564	June 15	June 27	7.6
140	April 19	April 30	7.5	572	June 16	July 8	7.6
148	April 20	May 1	7.5	580	June 17	July 8	7.6
156	April 21	May 15	7.5	589	June 18	July 8	7.6
164	April 22	May 18	7.5	598	June 19	July 9	7.6
172	April 23	May 18	7.5	607	June 20	July 10	7.6
180	April 24	May 18	7.5	617	June 22	July 10	7.6
188	April 25	May 15	7.3	626	June 23	July 11	7.5
196	April 26	May 14	7.3	635	June 24	July 11	7.5
204	April 27	May 14	7.2	644	June 25	July 13	7.6
212	April 28	May 14	7.4	654	June 26	July 13	7.6
220	April 29	May 15	7.3	664	June 27	July 13	7.5
228	April 30	May 13	7.4	674	June 28	July 13	7.5
236	May 1	May 12	7.3	684	June 29	July 16	7.5
244	May 2	May 12	7.1	694	June 30	July 16	7.6
252	May 3	May 11	7.5	704	July 2	July 16	7.6
260	May 4	May 11	7.5	714	July 3	July 16	7.5
268	May 5	May 19	7.4	724	July 5	July 16	7.6
276	May 6	May 19	7.1	734	July 6	July 16	7.6
284	May 7	May 19	7.5	744	July 7	July 17	7.5
292	May 8	May 19	7.3	754	July 8	July 24	7.6
300	May 9	June 17	7.3	764	July 9	July 24	7.6
308	May 13	June 17	7.6	774	July 10	July 24	7.7
316	May 14	June 17	7.6	784	July 11	July 24	7.6
325	May 15	June 17	7.6	794	July 12	July 24	7.6
332	May 16	June 17	7.6	804	July 13	July 24	7.6
340	May 17	June 17	7.6	814	July 14	July 24	7.6
348	May 18	June 17	7.6	824	July 15	July 24	7.6
356	May 19	June 17	7.6	834	July 16	July 25	7.7
364	May 20	June 17	7.6	844	July 17	August 6	7.7
372	May 21	June 17	7.6	854	July 18	August 6	7.7
380	May 22	June 20	7.6	864	July 20	August 6	7.7
388	May 23	June 22	7.6	884	July 21	August 6	7.6
396	May 24	June 22	7.6	894	July 22	August 19	7.7
404	May 25	June 24	7.6	904	July 23	August 19	7.8
412	May 26	June 24	7.6	914	July 24	August 22	7.5
420	May 27	June 24	7.7	924	July 25	August 22	7.6
428	May 28	June 24	7.6	934	July 26	August 22	7.6

Table 4.—Hydrogen-ion Concentration in Soil Which Received Alfalfa Meal. All Dates Are 1925.

Sample No.	Date of Collection	Date of Examination	pH	Sample No.	Date of Collection	Date of Examination	pH
944	July 27	August 24	7.6	1261	August 31	Sept. 16	7.7
954	July 28	No Sample		1271	Sept. 1	Sept. 17	7.6
964	July 29	August 24	7.6	1281	Sept. 2	Sept. 18	7.6
974	August 1	August 24	7.6	1291	Sept. 3	Sept. 18	7.7
984	August 2	August 25	7.7	1301	Sept. 4	Oct. 5	7.6
994	August 3	August 25	7.7	1311	Sept. 5	Oct. 5	7.7
1004	August 4	August 25	7.6	1321	Sept. 6	Oct. 5	7.7
1014	August 5	August 25	7.7	1331	Sept. 7	Oct. 2	7.6
1024	August 6	August 26	7.7	1341	Sept. 8	Oct. 2	7.6
1034	August 7	August 26	7.7	1351	Sept. 9	Oct. 2	7.6
1044	August 8	August 26	7.7	1361	Sept. 10	Oct. 2	7.6
1054	August 9	August 26	7.7	1371	Sept. 11	Oct. 2	7.5
1064	August 11	August 27	7.7	1381	Sept. 12	Oct. 2	7.6
1075	August 12	August 27	7.7	1391	Sept. 13	Oct. 15	7.6
1086	August 14	August 27	7.7	1401	Sept. 14	Oct. 15	7.6
1097	August 15	August 27	7.7	1411	Sept. 15	Oct. 15	7.6
1108	August 16	August 27	7.6	1421	Sept. 16	Oct. 15	7.5
1119	August 17	August 27	7.6	1431	Sept. 17	Oct. 9	7.6
1130	August 18	August 31	7.7	1441	Sept. 18	Oct. 9	7.5
1141	August 19	August 31	7.7	1451	Sept. 19	Oct. 9	7.5
1151	August 20	August 31	7.6	1461	Sept. 20	Oct. 9	7.6
1161	August 21	August 31	7.6	1471	Sept. 21	Oct. 9	7.6
1171	August 22	Sept. 1	7.7	1481	Sept. 22	Oct. 9	7.6
1181	August 23	Sept. 1	7.7	1491	Sept. 23	Oct. 8	7.6
1191	August 24	Sept. 1	7.6	1501	Sept. 24	Oct. 8	7.6
1201	August 25	Sept. 1	7.6	1511	Sept. 25	Oct. 7	7.6
1211	August 26	Sept. 2	7.6	1521	Sept. 26	Oct. 7	7.6
1221	August 27	Sept. 15	7.7	1531	Sept. 27	Oct. 7	7.6
1231	August 28	Sept. 15	7.6	1541	Sept. 28	Oct. 7	7.6
1241	August 29	Sept. 16	7.7	1551	Sept. 29	Oct. 7	7.6
1251	August 30	Sept. 16	7.7	1561	Sept. 30	Oct. 9	7.6

The results for the season show that 71.59 percent of the determinations gave pH readings of 7.6 or above and 28.41 percent, of 7.5 or below with 71.00 percent from 7.6 to 7.7. As compared with the check plots, there was a slight tendency to produce a little acid, but not as much as with the blood meal. At all times the plot remained distinctly alkaline.

Table 5.—Hydrogen-ion Concentration in Soil Which Received Barley Straw. All Dates Are 1925.

Sample No.	Date of Collection	Date of Examination	pH
5	April 1	May 4	7.7
13	April 2	May 4	7.6
21	April 3	May 7	7.5
29	April 4	May 7	7.4
37	April 5	May 8	7.6
45	April 6	May 8	7.6
53	April 7	May 8	7.5
61	April 8	May 8	7.5
69	April 9	May 9	7.6
77	April 10	May 9	7.5
85	April 11	May 13	7.5
93	April 12	May 18	7.5
101	April 13	May 18	7.5
109	April 14	May 18	7.3
117	April 15	May 19	7.5
125	April 17	April 29	7.7
133	April 18	April 29	7.6
141	April 19	April 30	7.6
149	April 20	May 1	7.6
157	April 21	May 15	7.5
165	April 22	May 18	7.6
173	April 23	May 18	7.5
181	April 24	May 18	7.5
189	April 25	May 15	7.3
197	April 26	May 14	7.3
205	April 27	May 14	7.1
213	April 28	May 14	7.3
221	April 29	May 15	7.4
229	April 30	May 13	7.5
237	May 1	May 12	7.5
245	May 2	May 12	7.4
253	May 3	May 11	7.5
261	May 4	May 11	7.6
269	May 5	May 19	7.4
277	May 6	May 19	7.4
285	May 7	May 19	7.4
293	May 8	May 19	7.4
301	May 9	June 17	7.4
309	May 13	June 17	7.6
317	May 14	June 17	7.6
325	May 15	June 17	7.6
333	May 16	June 17	7.6
341	May 17	June 17	7.6
349	May 18	June 17	7.6
357	May 19	June 17	7.6
365	May 20	June 17	7.6
373	May 21	June 17	7.7
381	May 22	June 20	7.7
389	May 23	June 22	7.6
397	May 24	June 22	7.6
405	May 25	June 24	7.7
413	May 26	June 24	7.7
421	May 27	June 24	7.7
429	May 28	June 24	7.7
437	May 29	June 24	7.6
445	May 30	June 24	7.6
445A	May 31	June 24	7.7
453	June 1	June 25	7.6
461	June 2	June 25	7.6
469	June 3	June 25	7.6
477	June 4	June 25	7.6
485	June 5	June 25	7.6
493	June 6	June 25	7.6
509	June 8	June 26	7.6
517	June 9	June 26	7.5
525	June 10	June 26	7.5
533	June 11	June 26	7.6
541	June 12	June 26	7.7
549	June 13	June 27	7.7
557	June 14	June 27	7.7
565	June 15	June 27	7.6
573	June 16	July 8	7.6
581	June 17	July 8	7.6
590	June 18	July 8	7.6
599	June 19	July 9	7.6
608	June 20	July 10	7.6
618	June 22	July 10	7.6
627	June 23	July 11	7.6
636	June 24	July 11	7.6
645	June 25	July 13	7.6
655	June 26	July 13	7.6
665	June 27	July 13	7.6
675	June 28	July 16	7.6
685	June 29	July 16	7.6
695	June 30	July 16	7.6
705	July 2	July 16	7.6
715	July 3	July 16	7.6
725	July 5	July 16	7.6
735	July 6	July 16	7.6
745	July 7	July 17	7.6
755	July 8	July 24	7.7
765	July 9	July 24	7.6
775	July 10	July 24	7.6
785	July 11	July 24	7.6
795	July 12	July 24	7.6
805	July 13	July 24	7.6
815	July 14	July 24	7.6
825	July 15	July 24	7.6
835	July 16	July 25	7.7
845	July 17	August 6	7.7
855	July 18	August 6	7.7
865	July 20	August 6	7.7
885	July 21	August 6	7.7
895	July 22	August 19	7.7
905	July 23	August 19	7.7
915	July 24	August 22	7.7
925	July 25	August 22	7.7
935	July 26	August 22	7.7

Table 5.—Hydrogen-ion Concentration in Soil Which Received Barley Straw. All Dates Are 1925.

Sample No.	Date of Collection	Date of Examination	pH	Sample No.	Date of Collection	Date of Examination	pH
945	July 27	August 24	7.6	1262	August 31	Sept. 16	7.7
955	July 28	No Sample		1272	Sept. 1	Sept. 17	7.6
965	July 29	August 24	7.5	1282	Sept. 2	Sept. 18	7.6
975	August 1	August 24	7.6	1292	Sept. 3	Sept. 18	7.6
985	August 2	August 25	7.7	1302	Sept. 4	Oct. 5	7.7
995	August 3	August 25	7.7	1312	Sept. 5	Oct. 5	7.7
1005	August 4	August 25	7.6	1322	Sept. 6	Oct. 5	7.7
1015	August 5	August 25	7.7	1332	Sept. 7	Oct. 2	7.7
1025	August 6	August 26	7.7	1342	Sept. 8	Oct. 2	7.6
1035	August 7	August 26	7.7	1352	Sept. 9	Oct. 2	7.6
1045	August 8	August 26	7.7	1362	Sept. 10	Oct. 2	7.6
1055	August 9	August 26	7.7	1372	Sept. 11	Oct. 2	7.6
1065	August 11	August 27	7.7	1382	Sept. 12	Oct. 2	7.7
1075	August 12	August 27	7.7	1392	Sept. 13	Oct. 15	7.6
1087	August 14	August 27	7.7	1402	Sept. 14	Oct. 15	7.7
1098	August 15	August 27	7.7	1412	Sept. 15	Oct. 15	7.7
1109	August 16	August 27	7.7	1422	Sept. 16	Oct. 15	7.6
1120	August 17	August 27	7.6	1432	Sept. 17	Oct. 9	7.6
1131	August 18	August 31	7.7	1442	Sept. 18	Oct. 9	7.6
1142	August 19	August 31	7.7	1452	Sept. 19	Oct. 9	7.6
1152	August 20	August 31	7.6	1462	Sept. 20	Oct. 9	7.5
1162	August 21	August 31	7.6	1472	Sept. 21	Oct. 9	7.7
1172	August 22	Sept. 1	7.7	1482	Sept. 22	Oct. 9	7.7
1182	August 23	Sept. 1	7.7	1492	Sept. 23	Oct. 8	7.6
1192	August 24	Sept. 1	7.6	1502	Sept. 24	Oct. 7	7.6
1202	August 25	Sept. 1	7.6	1512	Sept. 25	Oct. 7	7.6
1212	August 26	Sept. 2	7.6	1522	Sept. 26	Oct. 7	7.7
1222	August 27	Sept. 15	7.7	1532	Sept. 27	Oct. 7	7.7
1232	August 28	Sept. 15	7.7	1542	Sept. 28	Oct. 7	7.6
1242	August 29	Sept. 16	7.7	1552	Sept. 29	Oct. 7	7.6
1252	August 30	Sept. 16	7.7	1562	Sept. 30	Oct. 7	7.7

The results for the season show that 81.65 percent of the determinations gave pH readings of 7.6 or above, and 18.35 percent, of 7.5 or below, with 81.65 percent from 7.6 to 7.7. The reaction of this plot appears to occupy an intermediate position between the two check plots, and the barley straw seems to have had little if any effect.

Table 6.—Hydrogen-ion Concentration in Soil Which Received Corn Fodder. All Dates Are 1925.

Sample No.	Date of Collection	Date of Examination	pH	Sample No.	Date of Collection	Date of Examination	pH
6	April 1	May 4	7.6	438	May 29	June 24	7.6
14	April 2	May 4	7.6	446	May 30	June 24	7.6
22	April 3	May 7	7.6	446A	May 31	June 24	7.7
30	April 4	May 7	7.5	454	June 1	June 25	7.6
38	April 5	May 8	7.6	462	June 2	June 25	7.6
46	April 6	May 8	7.6	470	June 3	June 25	7.6
54	April 7	May 8	7.6	478	June 4	June 25	7.6
62	April 8	May 8	7.6	486	June 5	June 25	7.6
70	April 9	May 9	7.6	494	June 6	June 25	7.7
78	April 10	May 9	7.6	510	June 8	June 25	7.7
86	April 11	May 13	7.5	518	June 9	June 26	7.7
94	April 12	May 18	7.5	526	June 10	June 26	7.5
102	April 13	May 18	7.5	534	June 11	June 26	7.6
110	April 14	May 18	7.5	542	June 12	June 26	7.6
118	April 15	May 19	7.4	550	June 13	June 27	7.6
126	April 17	April 29	7.7	558	June 14	June 27	7.7
134	April 18	April 29	7.6	566	June 15	June 27	7.6
142	April 19	April 30	7.6	574	June 16	July 8	7.6
150	April 20	May 1	7.6	582	June 17	July 8	7.6
158	April 21	May 15	7.5	591	June 18	July 8	7.6
166	April 22	May 18	7.6	600	June 19	July 9	7.6
174	April 23	May 18	7.5	609	June 20	July 10	7.6
182	April 24	May 18	7.6	619	June 22	July 10	7.6
190	April 25	May 15	7.4	628	June 23	July 11	7.6
198	April 26	May 14	7.3	637	June 24	July 11	7.6
206	April 27	May 14	7.3	646	June 25	July 13	7.6
214	April 28	May 14	7.4	656	June 26	July 13	7.6
222	April 29	May 15	7.5	666	June 27	July 13	7.6
230	April 30	May 13	7.5	676	June 28	July 13	7.6
238	May 1	May 12	7.5	686	June 29	July 16	7.6
246	May 2	May 12	7.5	696	June 30	July 16	7.6
254	May 3	May 11	7.5	706	July 2	July 16	7.6
262	May 4	May 11	7.5	716	July 3	July 16	7.5
270	May 5	May 19	7.5	726	July 5	July 16	7.6
278	May 6	May 19	7.4	736	July 6	July 16	7.6
286	May 7	May 19	7.5	746	July 7	July 17	7.6
294	May 8	May 19	7.4	756	July 8	July 24	7.6
302	May 9	June 17	7.5	766	July 9	July 24	7.6
310	May 13	June 17	7.6	776	July 10	July 24	7.6
318	May 14	June 17	7.6	786	July 11	July 24	7.6
326	May 15	June 17	7.7	796	July 12	July 24	7.6
334	May 16	June 17	7.6	806	July 13	July 24	7.6
342	May 17	June 17	7.6	816	July 14	July 24	7.6
350	May 18	June 17	7.6	826	July 15	July 24	7.7
358	May 19	June 17	7.6	836	July 16	July 25	7.7
366	May 20	June 17	7.7	846	July 17	August 6	7.7
374	May 21	June 17	7.7	856	July 18	August 6	7.7
382	May 22	June 20	7.7	866	July 20	August 6	7.7
390	May 23	June 22	7.6	886	July 21	August 6	7.7
398	May 24	June 22	7.6	896	July 22	August 19	7.7
406	May 25	June 24	7.7	906	July 23	August 19	7.8
414	May 26	June 24	7.6	916	July 24	August 22	7.8
422	May 27	June 24	7.7	926	July 25	August 22	7.7
430	May 28	June 24	7.7	936	July 26	August 22	7.7

Table 6.—Hydrogen-ion Concentration in Soil Which Received Corn Fodder. All Dates Are 1925.

Sample No.	Date of Collection	Date of Examination	pH	Sample No.	Date of Collection	Date of Examination	pH
946	July 27	August 24	7.6	1263	August 31	Sept. 16	7.7
956	July 28	No Sample		1273	Sept. 1	Sept. 17	7.7
966	July 29	August 24	7.7	1283	Sept. 2	Sept. 18	7.6
976	August 1	August 24	7.6	1293	Sept. 3	Sept. 18	7.7
986	August 2	August 25	7.7	1303	Sept. 4	Oct. 5	7.7
996	August 3	August 25	7.8	1313	Sept. 5	Oct. 5	7.7
1006	August 4	August 25	7.7	1323	Sept. 6	Oct. 5	7.7
1016	August 5	August 25	7.7	1333	Sept. 7	Oct. 2	7.6
1026	August 6	August 26	7.7	1343	Sept. 8	Oct. 2	7.6
1036	August 7	August 26	7.7	1353	Sept. 9	Oct. 2	7.7
1046	August 8	August 26	7.7	1363	Sept. 10	Oct. 2	7.7
1056	August 9	August 26	7.7	1373	Sept. 11	Oct. 2	7.6
1066	August 11	August 27	7.7	1383	Sept. 12	Oct. 2	7.7
1077	August 12	August 27	7.7	1393	Sept. 13	Oct. 15	7.7
1088	August 14	August 27	7.7	1403	Sept. 14	Oct. 15	7.7
1099	August 15	August 27	7.5	1413	Sept. 15	Oct. 15	7.7
1110	August 16	August 27	7.7	1423	Sept. 16	Oct. 15	7.6
1121	August 17	August 27	7.7	1433	Sept. 17	Oct. 9	7.7
1132	August 18	August 27	7.7	1453	Sept. 19	Oct. 9	7.7
1143	August 19	August 31	7.7	1463	Sept. 20	Oct. 9	7.6
1153	August 20	August 31	7.6	1473	Sept. 21	Oct. 9	7.7
1163	August 21	August 31	7.6	1483	Sept. 22	Oct. 9	7.7
1173	August 22	Sept. 1	7.7	1493	Sept. 23	Oct. 8	7.7
1183	August 23	Sept. 1	7.7	1503	Sept. 24	Oct. 8	7.7
1193	August 24	Sept. 1	7.6	1513	Sept. 25	Oct. 7	7.7
1203	August 25	Sept. 1	7.6	1523	Sept. 26	Oct. 7	7.7
1213	August 26	Sept. 2	7.6	1533	Sept. 27	Oct. 7	7.7
1223	August 27	Sept. 15	7.7	1543	Sept. 28	Oct. 7	7.7
1233	August 28	Sept. 15	7.7	1553	Sept. 29	Oct. 7	7.7
1243	August 29	Sept. 16	7.7	1563	Sept. 30	Oct. 9	7.7
1253	August 30	Sept. 16	7.7				

The results for the season show that 84.60 percent of the determinations gave pH readings of 7.6 or above, and 15.40 percent, of 7.5 or below, with 82.83 percent from 7.6 to 7.7. Here, as with the barley straw, the corn fodder has produced no change in the soil reaction.

Table 7.—Hydrogen-ion Concentration in Soil Which Received Superphosphate. All Dates Are 1925.

Sample No.	Date of Collection	Date of Examination	pH	Sample No.	Date of Collection	Date of Examination	pH
7	April 1	May 4	7.7	439	May 29	June 24	7.6
15	April 2	May 4	7.7	447	May 30	June 24	7.6
23	April 3	May 7	7.6	447A	May 31	June 24	7.7
31	April 4	May 7	7.5	455	June 1	June 25	7.7
39	April 5	May 8	7.6	463	June 2	June 25	7.6
47	April 6	May 8	7.6	471	June 3	June 25	7.5
55	April 7	May 8	7.6	479	June 4	June 25	7.7
63	April 8	May 8	7.6	487	June 5	June 25	7.6
71	April 9	May 9	7.6	495	June 6	June 26	7.7
79	April 10	May 9	7.6	511	June 8	June 26	7.7
87	April 11	May 13	7.5	519	June 9	June 26	7.6
95	April 12	May 18	7.5	527	June 10	June 26	7.7
103	April 13	May 18	7.5	535	June 11	June 26	7.6
111	April 14	May 18	7.5	543	June 12	June 26	7.7
119	April 15	May 19	7.5	551	June 13	June 27	7.7
127	April 17	April 29	7.6	559	June 14	June 27	7.7
135	April 18	April 29	7.6	567	June 15	June 27	7.6
143	April 19	April 30	7.6	575	June 16	July 8	7.6
151	April 20	May 1	7.6	583	June 17	July 8	7.6
159	April 21	May 15	7.6	592	June 18	July 9	7.6
167	April 22	May 18	7.6	601	June 19	July 7	7.6
175	April 23	May 18	7.6	610	June 20	July 10	7.7
183	April 24	May 18	7.6	620	June 22	July 10	7.6
191	April 25	May 15	7.3	629	June 23	July 11	7.6
199	April 26	May 14	7.5	638	June 24	July 13	7.6
207	April 27	May 14	7.3	647	June 25	July 13	7.6
215	April 28	May 14	7.4	657	June 26	July 13	7.6
223	April 29	May 15	7.5	667	June 27	July 13	7.6
231	April 30	May 13	7.4	677	June 28	July 16	7.6
239	May 1	May 12	7.5	687	June 29	July 16	7.6
241	May 2	May 12	7.5	697	June 30	July 16	7.6
255	May 3	May 11	7.5	707	July 2	July 16	7.6
263	May 4	May 11	7.5	717	July 3	July 16	7.6
271	May 5	May 19	7.5	727	July 5	July 16	7.6
279	May 6	May 19	7.4	737	July 6	July 16	7.6
287	May 7	May 19	7.5	747	July 7	July 17	7.7
295	May 8	May 19	7.6	757	July 8	July 24	7.7
303	May 9	June 17	7.6	767	July 9	July 24	7.6
311	May 13	June 17	7.6	777	July 10	July 24	7.7
319	May 14	June 17	7.7	787	July 11	July 24	7.6
327	May 15	June 15	7.7	797	July 12	July 24	7.6
335	May 16	June 17	7.7	807	July 13	July 24	7.6
343	May 17	June 17	7.7	817	July 14	July 24	7.6
351	May 18	June 17	7.7	827	July 15	July 24	7.7
359	May 19	June 17	7.6	837	July 16	July 25	7.7
367	May 20	June 17	7.7	847	July 17	August 6	7.7
375	May 21	June 17	7.7	857	July 18	August 6	7.7
383	May 22	June 20	7.7	867	July 20	August 6	7.7
391	May 23	June 22	7.6	887	July 21	August 6	7.7
399	May 24	June 22	7.6	897	July 22	August 19	7.7
407	May 25	June 24	7.7	907	July 23	August 19	7.7
415	May 26	June 24	7.6	917	July 24	August 22	7.7
423	May 27	June 24	7 7	927	July 25	August 22	7.7
431	May 28	June 24	7.7	937	July 26	August 22	7.7

Table 7.—Hydrogen-ion Concentration in Soil Which Received Superphosphate. All Dates Are 1925.

Sample No.	Date of Collection	Date of Examination	pH	Sample No.	Date of Collection	Date of Examination	pH
947	July 27	August 24	7.7	1264	August 31	Sept. 16	7.7
957	July 28	No Sample		1274	Sept. 1	Sept. 17	7.7
967	July 29	August 24	7.7	1284	Sept. 2	Sept. 18	7.7
977	August 1	August 24	7.6	1294	Sept. 3	Sept. 18	7.7
987	August 2	August 25	7.7	1304	Sept. 4	Oct. 5	7.7
997	August 3	August 25	7.7	1314	Sept. 5	Oct. 5	7.7
1007	August 4	August 25	7.7	1324	Sept. 6	Oct. 5	7.7
1017	August 5	August 26	7.7	1334	Sept. 7	Oct. 2	7.6
1027	August 6	August 26	7.7	1344	Sept. 8	Oct. 2	7.7
1037	August 7	August 26	7.7	1354	Sept. 9	Oct. 2	7.6
1047	August 8	August 26	7.7	1364	Sept. 10	Oct. 2	7.6
1057	August 9	August 26	7.7	1374	Sept. 11	Oct. 2	7.6
1067	August 11	August 27	7.7	1384	Sept. 12	Oct. 2	7.7
1078	August 12	August 27	7.7	1394	Sept.13	Oct. 15	7.6
1089	August 14	August 27	7.7	1404	Sept. 14	Oct. 15	7.7
1100	August 15	August 27	7.7	1414	Sept. 15	Oct. 15	7.7
1111	August 16	August 27	7.7	1424	Sept. 16	Oct. 15	7.6
1122	August 17	August 27	7.7	1434	Sept. 17	Oct. 9	7.6
1133	August 18	August 31	7.7	1444	Sept. 19	Oct. 9	7.7
1144	August 19	August 31	7.7	1454	Sept. 19	Oct. 9	7.7
1155	August 20	August 31	7.7	1464	Sept. 20	Oct. 9	7.6
1164	August 21	August 31	7.6	1474	Sept. 21	Oct. 9	7.7
1174	August 22	Sept. 1	7.7	1484	Sept. 22	Oct. 9	7.7
1184	August 23	Sept. 1	7.7	1494	Sept. 23	Oct. 9	7.7
1194	August 24	Sept. 1	7.7	1504	Sept. 24	Oct. 8	7.7
1204	August 25	Sept. 1	7.7	1514	Sept. 25	Oct. 8	7.7
1214	August 26	Sept. 2	7.7	1524	Sept. 26	Oct. 7	7.7
1224	August 27	Sept. 15	7.7	1534	Sept. 27	Oct. 7	7.7
1234	August 28	Sept. 15	7.7	1544	Sept. 28	Oct. 7	7.7
1244	August 29	Sept. 16	7.7	1554	Sept. 29	Oct. 7	7.7
1254	August 30	Sept. 16	7.7	1564	Sept. 30	Oct. 9	7.7

The results for the season show that 88.08 percent of the determinations gave pH readings of 7.6 or above, and 11.92 percent, of 7.5 or below, with 88.08 percent from 7.6 to 7.7. Here there is a suggestion of a slight increase in the alkalinity accompanying the use of superphosphate.

Table 8.—Hydrogen-ion Concentration in Soil Which Received Sulphur. All Dates Are 1925.

Sample No.	Date of Collection	Date of Examination	pH	Sample No.	Date of Collection	Date of Examination	pH
8	April 1	May 4	7.7	448	May 30	June 24	7.6
16	April 2	May 4	7.7	448A	May 31	June 25	7.7
24	April 3	May 7	7.6	456	June 1	June 25	7.7
32	April 4	May 7	7.6	464	June 2	June 25	7.5
48	April 6	May 8	7.6	472	June 3	June 25	7.6
56	April 7	May 8	7.6	480	June 4	June 25	7.6
64	April 8	May 8	7.6	488	June 5	June 25	7.6
72	April 9	May 9	7.6	496	June 6	June 26	7.7
80	April 10	May 9	7.6	512	June 8	June 26	7.7
88	April 11	May 13	7.5	520	June 9	June 26	7.6
96	April 12	May 18	7.5	528	June 10	June 26	7.6
104	April 13	May 18	7.5	536	June 11	June 26	7.6
112	April 14	May 18	7.5	544	June 12	June 26	7.6
120	April 15	May 19	7.5	552	June 13	June 27	7.6
128	April 17	April 29	7.7	560	June 14	June 27	7.5
136	April 18	April 30	7.6	568	June 15	June 27	7.6
144	April 19	April 30	7.6	576	June 16	July 8	7.6
152	April 20	May 1	7.7	584	June 17	July 8	7.6
160	April 21	May 15	7.4	593	June 18	July 9	7.6
168	April 22	May 18	7.5	602	June 19	July 10	7.6
176	April 23	May 18	7.6	611	June 20	July 10	7.6
184	April 24	May 18	7.6	621	June 22	July 11	7.6
192	April 25	May 15	7.4	630	June 23	July 11	7.5
200	April 26	May 14	7.5	639	June 24	July 11	7.5
208	April 27	May 14	7.2	648	June 25	July 13	7.6
216	April 28	May 14	7.3	658	June 26	July 13	7.6
224	April 29	May 15	7.3	668	June 27	July 13	7.6
232	April 30	May 13	7.5	678	June 28	July 13	7.5
240	May 1	May 12	7.5	688	June 29	July 16	7.6
248	May 2	May 12	7.5	698	June 30	July 16	7.6
256	May 3	May 11	7.5	708	July 2	July 16	7.6
264	May 4	May 11	7.5	718	July 3	July 16	7.6
272	May 5	May 19	7.4	728	July 5	July 16	7.5
280	May 6	May 19	7.4	738	July 6	July 16	7.5
288	May 7	May 19	7.5	748	July 7	July 17	7.5
296	May 8	May 19	7.4	758	July 8	July 24	7.6
304	May 9	June 17	7.5	768	July 9	July 24	7.6
312	May 13	June 17	7.6	778	July 10	July 24	7.6
320	May 14	June 17	7.7	788	July 11	July 24	7.6
328	May 15	June 17	7.7	798	July 12	July 24	7.6
336	May 16	June 17	7.6	808	July 13	July 24	7.6
344	May 17	June 17	7.6	818	July 14	July 24	7.6
352	May 18	June 17	7.6	828	July 15	July 24	7.6
360	May 19	June 17	7.6	838	July 16	July 25	7.6
368	May 20	June 17	7.7	848	July 17	August 6	7.7
376	May 21	June 17	7.7	858	July 18	August 6	7.7
384	May 22	June 20	7.7	868	July 20	August 6	7.7
392	May 23	June 22	7.5	888	July 21	August 6	7.5
400	May 24	June 22	7.6	898	July 22	August 19	7.6
408	May 25	June 24	7.6	908	July 23	August 19	7.7
416	May 26	June 24	7.6	918	July 24	August 22	7.6
424	May 27	June 24	7.7	928	July 25	August 22	7.6
432	May 28	June 24	7.7	938	July 26	August 22	7.6
440	May 29	June 24	7.6	948	July 27	August 24	7.6

Table 8.—Hydrogen-ion Concentration in Soil Which Received Sulphur. All Dates Are 1925.

Sample No.	Date of Collection	Date of Examination	pH	Sample No.	Date of Collection	Date of Examination	pH
958	July 28	No Sample		1275	Sept. 1	Sept. 17	7.6
968	July 29	August 24	7.6	1285	Sept. 2	Sept. 18	7.7
978	August 1	August 24	7.6	1295	Sept. 3	Sept. 18	7.6
988	August 2	August 25	7.7	1305	Sept. 4	Oct. 5	7.6
998	August 3	August 25	7.6	1315	Sept. 5	Oct. 5	7.7
1008	August 4	August 25	7.6	1325	Sept. 6	Oct. 5	7.7
1018	August 5	August 25	7.6	1335	Sept. 7	Oct. 2	7.6
1028	August 6	August 26	7.5	1345	Sept. 8	Oct. 2	7.6
1038	August 7	August 26	7.6	1355	Sept. 9	Oct. 2	7.6
1048	August 8	August 26	7.7	1365	Sept. 10	Oct. 2	7.6
1058	August 9	August 26	7.7	1375	Sept. 11	Oct. 2	7.6
1068	August 11	August 27	7.7	1385	Sept. 12	Oct. 2	7.6
1079	August 12	August 27	7.7	1395	Sept. 13	Oct. 15	7.6
1090	August 14	August 27	7.6	1405	Sept. 14	Oct. 15	7.7
1101	August 15	August 27	7.6	1415	Sept. 15	Oct. 15	7.7
1112	August 16	August 27	7.7	1425	Sept. 16	Oct. 15	7.6
1123	August 17	August 27	7.7	1435	Sept. 17	Oct. 9	7.6
1134	August 18	August 31	7.6	1445	Sept. 18	Oct. 9	7.6
1145	August 19	August 31	7.6	1455	Sept. 19	Oct. 9	7.6
1155	August 20	August 31	7.5	1465	Sept. 20	Oct. 9	7.6
1165	August 21	August 31	7.6	1475	Sept. 21	Oct. 9	7.6
1175	August 22	Sept. 1	7.7	1485	Sept. 22	Oct. 9	7.6
1185	August 23	Sept. 1	7.7	1495	Sept. 23	Oct. 8	7.6
1195	August 24	Sept. 1	7.7	1505	Sept. 24	Oct. 8	7.5
1205	August 25	Sept. 1	7.5	1515	Sept. 25	Oct. 7	7.7
1215	August 26	Sept. 2	7.6	1525	Sept. 26	Oct. 7	7.7
1225	August 27	Sept. 15	7.7	1535	Sept. 27	Oct. 7	7.6
1235	August 28	Sept. 15	7.7	1545	Sept. 28	Oct. 7	7.6
1245	August 29	Sept. 16	7.7	1555	Sept. 29	Oct. 7	7.6
1255	August 30	Sept. 16	7.7	1565	Sept. 30	Oct. 9	7.7
1265	August 31	Sept. 16	7.7				

The results for the season show that 78.69 percent of the determinations gave pH readings of 7.6 or above and 21.31 percent, of 7.5 or below, with 78.69 percent from 7.6 to 7.7. The sulphur appears to have produced practically no change in the reaction altho when compared with the south check there is a slight indication in the acid direction. The soil was distinctly alkaline at all times.

Table 9.—Hydrogen-ion Concentration in Soil in Which Green Barley Was Plowed Under. All Dates Are 1925.

Sample No.	Date of Collection	Date of Examination	pH	Sample No.	Date of Collection	Date of Examination	pH
585	June 17	July 8	7.5	1080	August 12	August 28	7.7
594	June 18	July 8	7.5	1091	August 14	August 28	7.7
603	June 19	July 8	7.6	1102	August 18	August 28	7.2
612	June 20	July 10	7.6	1113	August. 16	August 28	7.8
622	June 22	No Sample		1124	August 17	August 28	7.7
631	June 23	No Sample		1135	August 18	Sept. 2	7.7
640	June 24	No Sample		1146	August 19	Sept. 2	7.7
649	June 25	July 13	7.6	1156	August 20	Sept. 2	7.7
659	June 26	July 13	7.6	1166	August 21	Sept. 2	7.6
669	June 27	July 13	7.6	1176	August 22	Sept. 2	7.7
679	June 28	July 14	7.6	1186	August 23	Sept. 2	7.7
689	June 29	July 14	7.6	1196	August 24	Sept. 2	7.7
699	June 30	July 14	7.6	1206	August 25	Sept. 2	7.6
709	July 2	July 14	7.6	1216	August 26	Sept. 2	7.6
719	July 3	July 14	7.6	1226	August 27	Sept. 15	7.6
729	July 5	July 17	7.6	1236	August 28	Sept. 15	7.6
739	July 6	July 17	7.6	1246	August 29	Sept. 16	7.7
749	July 7	July 17	7.6	1256	August 30	Sept. 16	7.6
759	July 8	July 24	7.6	1266	August 31	Sept. 17	7.6
769	July 9	July 24	7.6	1276	Sept. 1	Sept. 17	7.6
779	July 10	July 25	7.6	1286	Sept. 2	Sept. 18	7.6
789	July 11	July 25	7.7	1296	Sept. 3	Sept. 18	7.7
799	July 12	July 24	7.6	1306	Sept. 4	Oct. 2	7.7
809	July 13	July 24	7.6	1316	Sept. 5	Oct. 2	7.7
819	July 14	July 24	7.6	1326	Sept. 6	Oct. 5	7.7
829	July 15	July 24	7.6	1336	Sept. 7	Oct. 2	7.7
839	July 16	July 25	7.6	1346	Sept. 8	Oct. 2	7.7
849	July 17	August 24	7.7	1356	Sept. 9	Oct. 2	7.7
859	July 18	August 24	7.7	1366	Sept. 10	Oct. 2	7.7
869	July 20	August 24	7.6	1376	Sept. 11	Oct. 2	7.7
889	July 21	August 24	7.6	1386	Sept. 12	Oct. 2	7.7
899	July 22	August 24	7.6	1396	Sept. 13	Oct. 2	7.7
909	July 23	August 24	7.6	1406	Sept. 14	Oct. 2	7.7
919	July 24	August 24	7.6	1416	Sept. 15	Oct. 13	7.7
929	July 25	August 24	7.6	1426	Sept. 16	Oct. 13	7.7
939	July 26	August 24	7.6	1436	Sept. 17	Oct. 13	7.6
949	July 27	August 24	7.6	1446	Sept. 18	Oct. 13	7.6
959	July 28	No Sample		1456	Sept. 19	Oct. 9	7.6
969	July 29	August 24	7.6	1466	Sept. 20	Oct. 9	7.6
979	August 1	August 24	7.6	1476	Sept. 21	Oct. 9	7.6
989	August 2	August 24	7.6	1486	Sept. 22	Oct. 9	7.7
999	August 3	August 25	7.6	1496	Sept. 23	Oct. 9	7.7
1009	August 4	August 26	7.7	1506	Sept. 24	Oct. 9	7.6
1019	August 5	August 26	7.7	1516	Sept. 25	Oct. 9	7.6
1029	August 6	August 26	7.7	1526	Sept. 26	Oct. 9	7.6
1039	August 7	August 26	7.6	1536	Sept. 27	Oct. 9	7.6
1049	August 8	August 26	7.7	1546	Sept. 28	Oct. 9	7.7
1059	August 9	August 28	7.7	1556	Sept. 29	Oct. 9	7.6
1069	August 11	August 28	7.7	1566	Sept. 30	Oct. 9	7.6

The results for the season show that 96.79 percent of the determinations gave pH readings of 7.6 or above and 3.21 percent, of 7.5 or below, with 95.73 percent from 7.6 to 7.7. It is evident from these figures that the green barley was able to maintain a higher alkalinity over a longer period than was found in the check plots.

Table 10.—Hydrogen-ion Concentration in Soil in Which Green Cane Was Plowed Under. All Dates Are 1925.

Sample No.	Date of Collection	Date of Examination	pH	Sample No.	Date of Collection	Date of Examination	pH
650	June 25	July 13	7.6	1114	August 16	August 28	7.7
660	June 26	July 13	7.6	1125	August 17	August 28	7.7
670	June 27	July 13	7.6	1136	August 18	Sept. 2	7.7
680	June 28	July 13	7.6	1147	August 19	Sept. 2	7.7
690	June 29	July 14	7.6	1157	August 20	Sept. 2	7.8
700	June 30	July 14	7.6	1167	August 21	Sept. 2	7.6
710	July 2	July 14	7.6	1177	August 22	Sept. 2	7.7
720	July 3	July 17	7.6	1187	August 23	Sept. 2	7.7
730	July 5	July 17	7.6	1197	August 24	Sept. 2	7.7
740	July 6	July 17	7.6	1207	August 26	Sept. 2	7.6
750	July 7	July 17	7.6	1217	August 26	Sept. 2	7.7
760	July 8	July 24	7.7	1227	August 27	Sept. 15	7.7
770	July 9	July 24	7.6	1237	August 28	Sept. 16	7.7
780	July 10	July 26	7.7	1247	August 29	Sept. 16	7.7
790	July 11	July 26	7.7	1257	August 30	Sept. 17	7.7
800	July 12	July 24	7.6	1267	August 31	Sept. 16	7.7
810	July 13	July 24	7.6	1277	Sept. 1	Sept. 17	7.7
820	July 14	July 24	7.6	1287	Sept. 2	Sept. 18	7.6
830	July 15	July 24	7.6	1297	Sept. 3	Sept. 18	7.7
840	July 16	July 25	7.6	1307	Sept. 4	Oct. 5	7.7
850	July 17	August 24	7.7	1317	Sept. 5	Oct. 5	7.7
860	July 18	August 24	7.7	1327	Sept. 6	Oct. 2	7.7
870	July 20	August 24	7.7	1337	Sept. 7	Oct. 2	7.7
880	July 19	August 24	7.7	1347	Sept. 8	Oct. 2	7.7
890	July 21	August 24	7.6	1357	Sept. 9	Oct. 2	7.7
900	July 22	August 24	7.6	1367	Sept. 10	Oct. 2	7.7
910	July 23	August 24	7.7	1377	Sept. 11	Oct. 2	7.7
920	July 24	August 24	7.6	1387	Sept. 12	Oct. 2	7.7
930	July 25	August 24	7.6	1397	Sept. 13	Oct. 2	7.7
940	July 26	August 24	7.6	1407	Sept. 14	Oct. 2	7.7
950	July 27	August 24	7.6	1417	Sept. 15	Oct. 13	7.7
960	July 28	No Sample		1427	Sept. 16	Oct. 13	7.7
970	July 29	August 24	7.6	1437	Sept. 17	Oct. 13	7.7
980	August 1	August 26	7.6	1447	Sept. 18	Oct. 13	7.7
990	August 2	August 26	7.7	1457	Sept. 19	Oct. 9	7.7
1000	August 3	August 26	7.7	1467	Sept. 20	Oct. 9	7.7
1010	August 4	August 26	7.7	1477	Sept. 21	Oct. 9	7.7
1020	August 5	August 26	7.7	1487	Sept. 22	Oct. 9	7.7
1030	August 6	August 26	7.7	1497	Sept. 23	Oct. 9	7.7
1040	August 7	August 26	7.7	1507	Sept. 24	Oct. 9	7.7
1050	August 8	August 26	7.7	1517	Sept. 25	Oct. 9	7.7
1060	August 9	August 28	7.7	1527	Sept. 26	Oct. 9	7.7
1070	August 11	August 28	7.7	1537	Sept. 27	Oct. 9	7.7
1081	August 12	August 28	7.8	1547	Sept. 28	Oct. 9	7.6
1092	August 14	August 28	7.7	1557	Sept. 29	Oct. 9	7.7
1103	August 15	August 28	7.8	1567	Sept. 30	Oct. 9	7.7

The results for the season show that 100 percent of the determinations gave pH readings of 7.6 or above and none of 7.5 or below, with 96.69 percent from 7.6 to 7.7. As was the case with the green barley, here also the green cane imparted to the soil a higher alkalinity over a longer period than was present in the check plots.

Table 11.—Summary, Showing Percentage Occurrence of pH Values With Different Treatments—Dry Soil.

Treatment	No. of Determinations	Percentage Occurrence of pH Values							
		7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8
North Check	169	.59	0.00	3.55	1.77	15.38	42.60	34.91	1.18
South Check	169	0.00	0.00	1.18	0.00	11.24	24.85	59.76	2.95
Blood Meal	168	1.19	2.38	4.76	6.54	21.42	53.57	9.52	.59
Alfalfa Meal	169	1.18	.59	4.73	3.55	18.34	52.07	18.93	.59
Barley Straw	169	.58	0.00	2.36	4.73	10.65	48.52	33.13	0.00
Corn Fodder	169	0.00	0.00	1.18	2.95	11.24	43.19	39.64	1.77
Phosphate	168	0.00	0.00	1.19	1.78	8.92	36.30	51.78	0.00
Sulphur	169	0.00	.59	1.18	2.95	16.56	53.84	24.85	0.00
Green Barley	94	0.00	1.06	0.00	0.00	2.12	57.44	38.29	1.06
Green Cane	91	0.00	0.00	0.00	0.00	0.00	31.86	64.83	3.29

It is clear from the results tabulated above, that not only did we fail to secure an appreciable increase in the hydrogen-ion concentration by the different treatments, but also that there was an actual increase in the alkalinity of the soil where the green manures were used. This should not be construed, however, as meaning that no acid was formed during the fermentation of the barley and cane, but rather that it may have reacted with other soil compounds in such a way as to have produced an increase in the alkalinity.

If we may be permitted to speculate on this point, we would suggest something like this: The organic acids formed, altho possessing low ionization constants, reacted with calcium carbonate to form unstable salts of calcium and the respective acid, setting free carbon dioxide and water. Due to their instability as compared with calcium carbonate, they have dissociated easily, setting free calcium ions which in turn have been hydrolyzed to form calcium hydroxide to which the increased alkalinity may be attributed.

Having anticipated at the beginning of the experiment that we should be able to demonstrate, locally at least, an appreciable increase in hydrogen-ion concentration from the fermentation of these organic materials, we were rather disappointed with the outcome of the investigation. It occured to us that possibly during the interval of drying the samples, certain chemical changes had taken place, and that the reaction of the original moist field samples might have been different from that of the air-dried ones. Again the results might have been different even with dried samples, had our soil not contained such a large excess of calcium carbonate. The thought occured to us, that, possibly, under the conditions of our experiment, bacterial action and the accompanying acid production may have ceased with drying, while the chemical action between the acid and the calcium carbonate continued.

MOIST SAMPLES

In order to ascertain whether any appreciable increase in hydrogen-ion concentration could be detected in this soil when the pH readings were made upon moist samples, a further investigation was carried on under laboratory conditions.

Three thousand grams of the same soil were used as the basis of each test. This was placed in a 10-inch crystallizing dish, and the different organic materials and fertilizers were added and thoroly mixed at the same rate as in the preceding field study. The moisture content was maintained at 18 percent with distilled water. Daily hydrogen-ion determinations were made over a period of 60 days, using 15 grams of the moist soil for each test.

The results are summarized in Table 12.

Table 12.—Summary, Showing Percentage Occurrence of pH Values With Different Treatments—Moist Soil.

Treatment	No. of Determinations	Percentage Occurrence of pH Values							
		7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8
Green Barley	60	0.00	0.00	3.30	26.00	56.00	11.60	11.60	0.00
Alfalfa Meal	60	0.00	0.00	0.00	0.00	0.00	0.00	1.60	98.00
Barley Straw	60	0.00	0.00	0.00	0.00	0.00	0.00	100.00	0.00
Corn Fodder	60	0.00	0.00	0.00	0.00	0.00	0.00	100.00	0.00
Acid Phosphate ..	60	0.00	0.00	0.00	0.00	0.00	0.00	100.00	0.00
Sulphur	60	0.00	0.00	0.00	0.00	0.00	0.00	100.00	0.00

Under the conditions of this experiment, the soil which received the green barley gave a pH reading of 7.4 in 26 percent of the determinations and 7.5 in 56 percent whereas in the preceeding series only 1.7 percent gave 7.4 and 15.38 percent 7.5. While the change in hydrogen-ion concentration was only slight and may have been due wholly or in part to the changed conditions of the experiment, the evidence, nevertheless, points to an increase in the hydrogen-ion concentration during the fermentation of the green manure. From this it would appear that it is possible to detect a slight increase in hydrogen-ion concentration even in the presence of excessive calcium carbonate if soil in a moist condition is examined.

The soils to which the other materials were added gave no further evidence of acid production than with the dried samples; in fact, the soil treated with the alfalfa meal showed an increased alkalinity which may be explained as suggested for the green manures in the preceding experiment. It is possible, of course, that this may have resulted from ammonification, pure and simple, but if this was the case, we are at a loss to explain the failure of the other residues to react likewise.

SUMMARY

Daily determinations of the hydrogen-ion concentration in a silt loam, containing 3.184 percent of calcium carbonate, were made from April 1 to October 1 to ascertain the effect of certain crop residues, green manures and commercial fertilizers upon the soil reaction.

The crop residues consisted of alfalfa meal, barley straw and corn fodder; the green manures were green barley and green cane; the commercial fertilizers were acid phosphate, dried blood and sulphur.

The determinations were made upon soil which was in a moist condition and upon that which had been air dried.

The readings were made by the colorimetric method and were checked electrometrically.

CONCLUSION

Altho it has been possible to increase the hydrogen-ion concentration of this soil slightly by means of the green barley, the reaction remained at all times easily within the optimum range for both the fixation of nitrogen and the growth of Azotobacter.

In the light of our results, we must conclude that the green manures, crop residues and commercial fertilizers used in this experiment have no value as a source of acid for increasing the hydrogen-ion concentration of a soil rich in calcium carbonate where it is necessary to increase that concentration from pH 7.7 to 6.0 in order to limit the growth of Azotobacter, and consequently are of no benefit in the control of nitrogen fixation by Azotobacter.

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