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MICROBIOLOGICAL STUDIES AT THE OSAGE SITE, 1970

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ABSTRACT

A review is given of the 1970 microbiological investigations at the Osage Site. Data is presented covering microbial biomass measurements by the plate count and direct microscopic measurement of bacteria, actinomycetes, and fungi decomposition rates of buried filter paper and standard litter samples, and respiratory activity by carbon dioxide release and oxygen uptake measurements.

Osage Site. Early counts done with both poured and spread samples showed the latter yielded useful data in less than ¼ the plates prepared. Secondly, plates were counted after 5 days incubation at 30°C, since two-week incubation gave no higher colony counts.

The results of the plate count data for the 0-5 cm depth in the ungrazed area are shown in Fig. 1, while comparable data from samples at the 10-20 cm zone are shown in Fig. 2. The mean values are plotted with maximum and minimum counts indicated for each date. As with all plate count data, considerable variation can be seen in the determinations. Population fluctuations throughout the season are more apparent at the surface of the soil than at the 10 cm level. This would be expected since moisture, temperature, and food supply would fluctuate more at the surface. Comparisons with the grazed areas show that populations of the soil, as determined by plate counts, appear to be slightly higher than in the ungrazed section. This has not yet been subjected to statistical analysis.

The vertical distribution of the microbial population is indicated in Table 1, showing mean plate count values on September 30 for a sample from the grazed and ungrazed areas. Although the soil at the Osage Site is rather heavy with considerable clay, it is apparent that the bacteria are growing in considerable numbers even at the lower depths of sampling. It will be most interesting to compare the root biomass data with microbial populations at various depths, since the most obvious food source for these organisms would be slough-off material from living roots and the decomposition of dead roots.

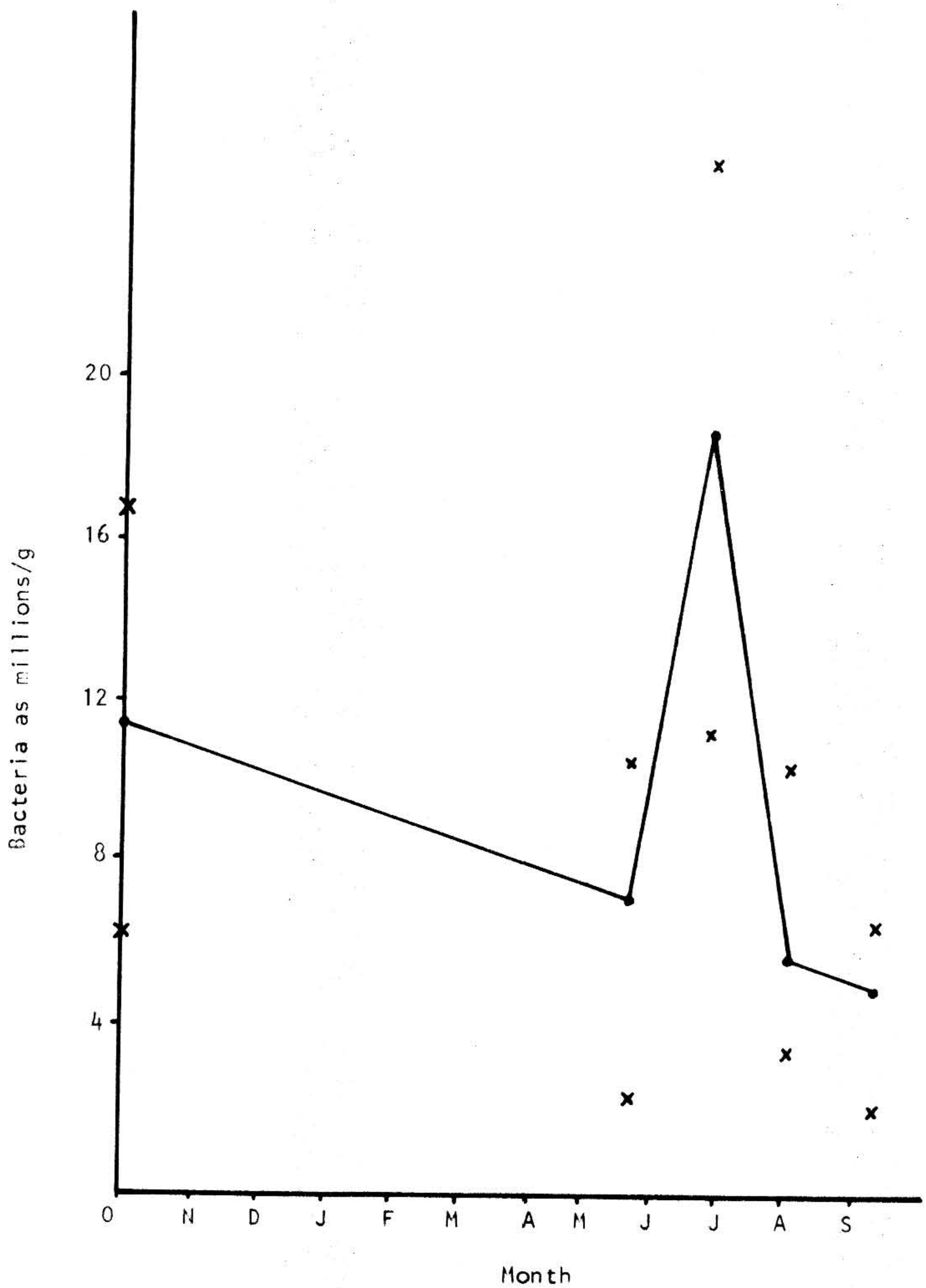

Fig. 1. Plate counts of the 0 to 5 cm depth ungrazed soil.

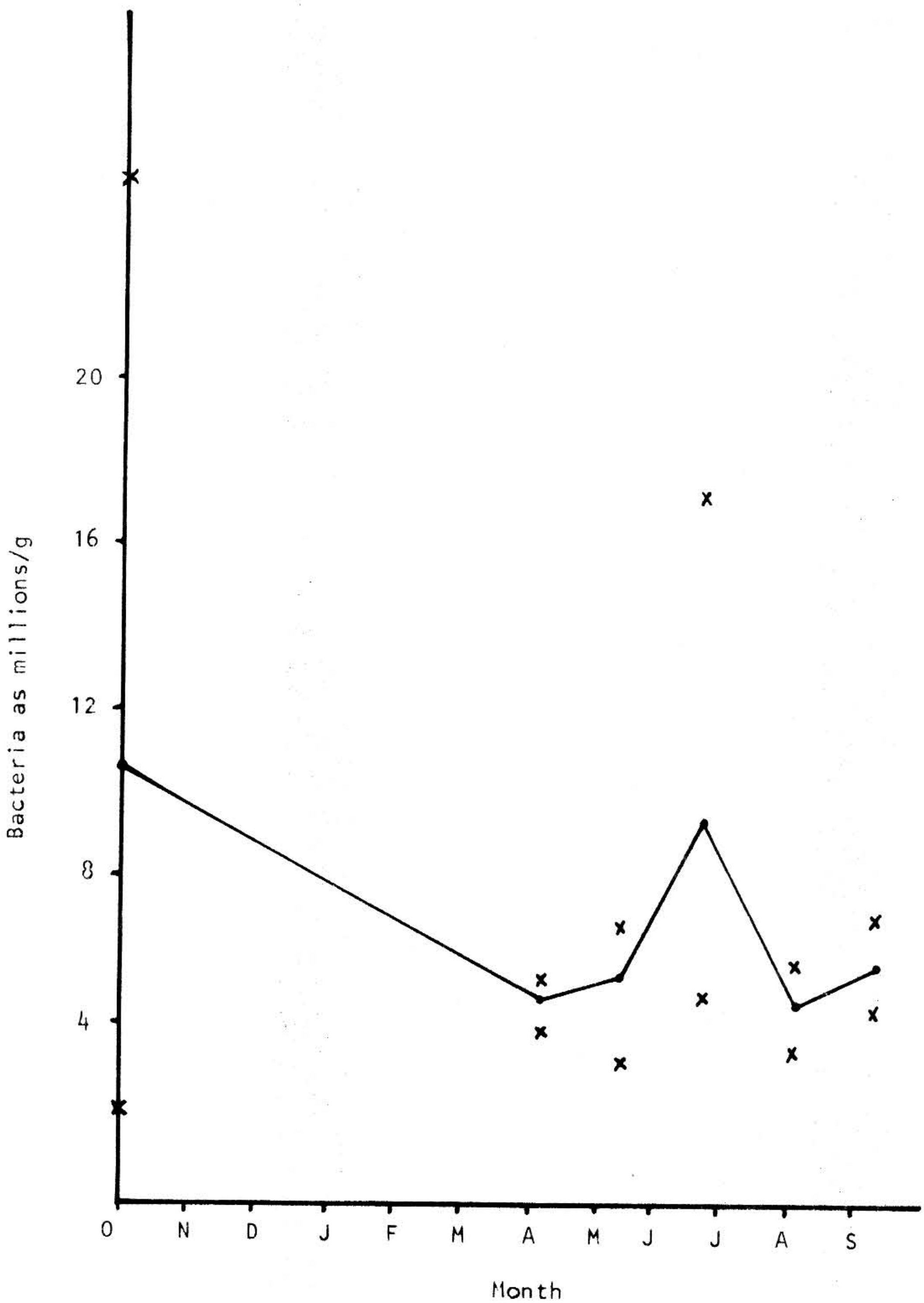

Fig. 2. Plate counts of 10 to 20 cm depth ungrazed soil.

Table 1. Total bacterial numbers (plate count) at different depths in ungrazed and grazed sections, September 30, 1970.

	0-5 cm	5-10 cm	10-20 cm	20-30 cm	30-50 cm
Ungrazed					
1	13.77	10.97	7.00	5.80	4.40
2	10.97	4.80	3.80	15.35	8.82
Grazed					
1	5.65	3.97	5.57	2.77	.925
2	5.12	6.97	3.87	14.00	3.95

The bacterial populations at the Osage Site are somewhat lower than soils of comparable cultivated areas in the Oklahoma-Kansas region. The low pH of the soil may be one major reason for this, but the vertical distribution of these organisms suggests a major difference in microbial activities in the cultivated zone of farmland and the root area of grasslands. Further investigation of this is desirable.

Bacillus spores. Comparisons of the usual plate count data and spore counts obtained by heating the soil-dilution fluid suspension for 10 minutes at 80°C show that most of the *Bacillus* species were present as endospores in the soil. Table 2 shows results for two samples from the ungrazed area samples at three depths. The total numbers of *Bacillus* endospores exceeds the so-called "total" count which would include the spores as well as the vegetative cells of all types. The explanation for this anomaly is simply that many sproes do not germinate in ordinary plating procedures but do germinate following the heat-shock treatment. Limited study of the species present in germinating *Bacillus* spores showed about half or more to be *Bacillus cereus*, while the remainder were *B. subtilus*, *B. megaterum*, and other species. Since these bacteria are predominant among the starch, hemicellulose, and protein decomposers, it is apparent that a high zymogenous population of *Bacillus* species exists at the Osage Site.

Table 2. Plate count data comparing numbers of bacteria and spore counts from heat shocked soil-water dilutions. Ungrazed area, April 13, 1970.

Sample	Depth in cm	Counts in millions/g	
		Total	Spores
3	0- 5	7.37	8.20
	5-10	7.20	7.18
	10-20	7.20	11.00
4	0- 5	8.97	8.92
	5-10	4.10	5.58
	10-20	4.36	9.10

Actinomycetes from plate count data. Colonies of typical members of the actinomycete group were counted on plates used for estimating bacterial populations. The criteria for this group were conidia formation, colonial morphology, and pigmentation. The raw data show much variation in individual plates, though the numbers are in the range of hundreds of thousands per gram or about 10% of "total" counts. The method of despersing the soil by using a Waring type blender effectively destroys all non-sporulating propagules of this group of microorganisms. Thus, the counts reported in all the plate counts should be considered as inactive conidia. On the microscopic examinations for mold mycelia (discussed later), there was scant evidence of vegetative hyphal masses of these organisms. The effects of the blending treatment are shown in Table 3 from a study of a pure culture of *Streptomyces* sp. isolated from these soils. Clearly, blending over three minutes greatly reduces viable propagules in non-sporulating cultures.

Table 3. Plate count data showing the destructive effect of blender treatment on vegetative propagules of *Streptomyces* sp.

Time in Blender	Plate count of:	
	Vegetative Cells	Conidia
0 sec	9.46 million	7.23 million
15 sec	11.81 million	7.21 million
60 sec	8.33 million	7.18 million
120 sec	5.20 million	7.28 million
180 sec	1.76 million	7.19 million
240 sec	0.80 million	7.20 million

Just as the bacterial numbers are lower than those in cultivated soils, the counts of the actinomycetes show only about one-fourth to one-tenth the levels seen in cultivated soils. Factors causing this are likely those mentioned for bacteria. No unique features were apparent as far as the distribution of the common genera of this group encountered at the Osage

Site. *Streptomyces* was the most common, Nocardia was often seen, while *Micromonospora* was seldom encountered.

Random isolation, digestive capability, and antibiotic sensitivity. In order to secure some sampling of the types of bacteria present without making a detailed taxonomic study, several hundred bacterial colonies were picked from the plates used for the population estimates. Streaked plate isolation gave pure cultures. Gram's stain, microscopic morphology, and digestive action on starch and protein (casein) were determined plus sensitivity to various antibiotics. The antibiotic tests were done using Bacto-Sensidisco and results of inhibition recorded in mm of the diameter of growth inhibition zone. Results are given in Appendix A. While this information, per se, gives little information regarding those isolates, comparisons with similar studies in future years or other sites will furnish a tool for indicating population fluctuations both from a quantitative and qualitative point of view.

Fungal Hyphae Measurements

Since the blendor treatment was shown to be disruptive of actinomycete vegetative cells, all data reported on the fungal hypha were from soil samples dispersed by hand shaking. These were measured into 0.5% agar, and 1 × 1 cm smears were prepared. Following heat fixing, these were stained 15 seconds with 0.2% methylene blue, washed, and air dried. Hyphal strands were measured using a camera lucida with oil immersion objectives and a map-measuring device for length. Statistical analysis has not been carried out on the raw data, but it appears that this measurement of the fungal biomass may be the least variable of the methods used the past year. In Table 4, mean values are shown for fungal hyphal length for two samples from grazed and ungrazed areas of the Osage Site. There are no marked differences between the grazed and ungrazed but, as stated above, statistical studies have not been made. The depth distribution of hyphae follows the same general pattern as the plate counts for bacteria and the actinomycetes with numerous fungi, even at the 30-50 cm level. These indications of bacterial, actinomycete, and fungal populations throughout the profile suggest aerobic conditions at considerable depths even in the heavy clay soil of the Osage Site. Since organic matter of these soils is relatively high for this region, one might conclude that soil acidity may be the factor limiting humus decomposition. Furthermore, these data emphasize the importance of attempting to learn the pathways of food penetration into the upper and lower levels of the soil.

Table 4. Total length of fungal hyphae (m/g soil) at different depths in ungrazed and grazed sections, June 19, 1970.

	0-5 cm	5-10 cm	10-20 cm	20-30 cm	30-50 cm
Ungrazed					
1	1000	1132	678	1560	1211
2	996	1372	2650	1229	993
3	1181	1300	1618	2030	1010
Grazed					
1	1022	925	1754	1041	1811
2	3003	2150	1635	1251	1383
3	1378	814	1300	2530	1843

Bacteria by Direct Microscopic Counts

Smeared slides prepared from various dilutions were made at the time of plate counts. Raw data from these are incomplete and are not being submitted at this time. Although an estimated 800 hours have been spent on these counts, we have only a small part of the samples counted. The apparent variations in counting, between fields, between smears, and between samples, lead us to conclude that this method will be unsatisfactory. The slides are being retained and the data held, should we wish to make future use of these.

DECOMPOSITION OF BURIED MATERIAL

Three types of organic matter were buried during the past year, removed, and decomposition rates estimated. Most data were obtained using filter paper (Whatman No. 1) in 14 × 14 cm squares. These were sandwiched between nylon mesh of approximately 2 mm mesh and buried at 5 cm below the surface, with as little disturbance as possible. Raw data are presented on the standard report forms. A summary of means of three replicates showing rates of decomposition of both filter paper and the standard hay sample are shown in Table 5. During the winter, as would be expected, cellulose decomposition was slow. Only about 1/3 decomposed during the 141 days prior to April 13. Samples removed May 5 showed about ½ decomposition in slightly over a month's burial. Variability in these tests was great, due to several factors. For instance, seven of the samples were completely removed by termite and ant action before the May 5 sampling date. Field mice or other small animals caused the loss of a number of other samples simply by digging them out of the soil. We could not determine what attracted the animals to the buried material.

Table 5. Rate of decomposition of buried cellulose and standard prairie hay.

Date Removed	Days Buried	Percent Decomposed	
		Ungrazed	Grazed
	Cellulose		
April 13	141	39	
May 5	176	79	
May 5	35	55	
June 19	79	97	96
July 16	60	94	91
Sept. 30	77	100	100
	Standard Prairie Hay		
June 19	33	29	37
July 16	60	72	49
Sept. 30	137	82	84

Data from the buried hay (both the standard prairie hay sample and material clipped on the site) were fewer in number and subject to greater variation. It was most difficult to retain the chopped dried grass within the mesh bags, and variable losses occurred in this way before burial. The dimensions of the mesh bag and the compactness of the buried hay gave further variations. Finally, recovery of the buried material was only partially successful. However, this type of investigation has considerable merit and, if continued, should allow comparisons of decomposition rates at various grassland sites. In our limited studies, we could see the cellulose degraded more rapidly than the native plant material. There are a number of these tests continuing on both grazed and ungrazed sections of the Osage Site.

RESPIRATION STUDIES

Carbon Dioxide Measurements

Attempts were made to measure CO_2 released as the result of decomposition and respiration in the soil. We attempted to simplify the method using readily available materials so, if desired, similar studies could be done at other sites. For the measurements in the field, one pound coffee cans were driven into the ground after cutting off the bottom. Only about 5 cm of the cans projected above the soil surface. Care was taken in placement of cans to include only about one crown of a little blue stem plant and to disturb the plants as little as possible. These cores were in place throughout the growing season. To measure CO_2 evolved, 100 ml beakers of standard KOH (10 ml of 1.0 M) were placed in the can. Heavy polyethylene bags were then placed over all plants and fastened tightly about the lip of the can. As plants grew, it was necessary to bend the grasses to accomodate them within the enclosure. After 24 hours, the alkali was removed, carbonate precipitated with barium chloride, and the remaining alkali titrated with standard acid using phenolphthalein as indicator. The results include carbon dioxide measurements for four replicates in grazed and ungrazed areas on three days during the 1970 season. These values of CO_2 represent the total gaseous exchange during the 24 hour period. Except for the June date, shading was not necessary to prevent solar heating, as the surrounding vegetation was high enough to shield the experimental plastic enclosed can from the sun. We have done a few measurements on areas with top growth, with and without surface litter removed. Differences seemed to be within experimental error. Likewise, photosynthetic removal of carbon dioxide would decrease CO_2 values. Future studies should include enough determinations so that a statistical evaluation could be used.

We have been following carbon dioxide release in the laboratory under controlled moisture and temperature conditions. Fig. 3 shows CO_2 evolved during the week, following removal from the site by comparable weights of soil, but after different physical treatment. Sample A was a coffee can core, disturbed only at the bottom and sides, but with plants clipped and litter removed. Sample B was screened through a 10 mm mesh screen and piled loosely in a closed container with an alkali absorbing vessel. In both instances, the atmosphere was allowed to equilibrate with the room atmosphere for 30 minutes daily. Moisture in the two samples was the same. As seen in Fig. 3, both showed an initial burst of CO_2 release. The core sample gave more variation throughout the following week than did the screened soil. These and similar data from other tests indicate that it may be useful to use "disturbed" soils for critical evaluation of such things as root and plant respiration, and to perhaps gain some measurement of the soil micro-faunal respiration.

Oxygen Uptake by Warburg Method

Encouraged by the carbon dioxide experiments cited above, a series of respirometer tests were started using screened soil samples from the Osage Site. Because moisture relations represent a major controlling environmental factor not only on decomposition, but also on all biological activity, O_2

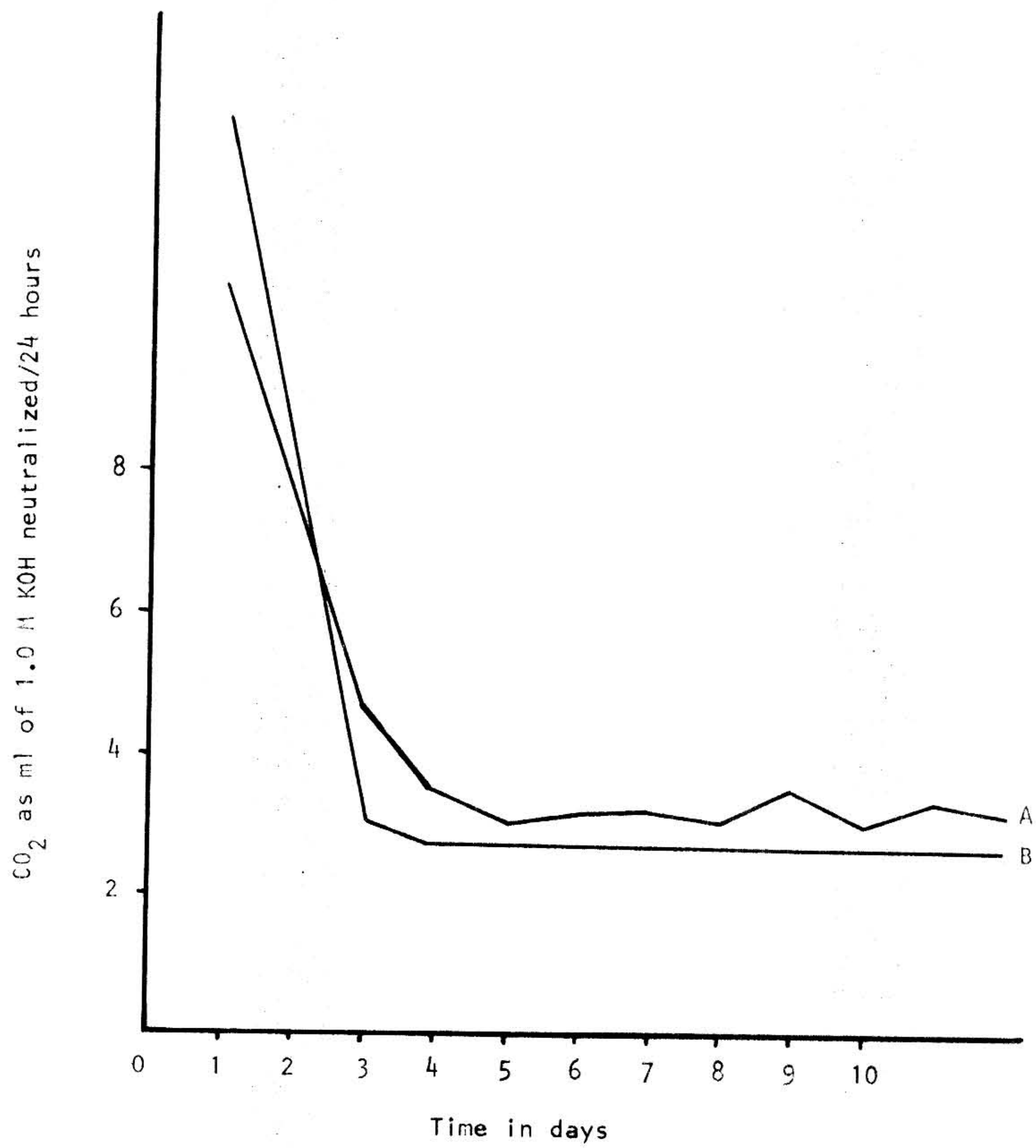

Fig. 3. Carbon dioxide released by 2000 g soil core (A) and same soil sieved loose (B).

uptake at different water contents of soil were determined. Values for soil from ungrazed sections are shown in Fig. 4, while similar data for grazed soil is shown in Fig. 5. As would be expected, low water content shows decreased respiratory activity, and too much water does not allow adequate gas exchange so that oxygen uptake is again depressed. In both grazed and ungrazed samples, the optimum water content is about 45% of the water holding capacity of the soil. This is considerably lower than the often quoted 55% to 60% optimum for microbial activity. This probably reflects the fine texture of these soils.

Respiration studies have shown good reproducibility, and other investigations have shown that soils may be stored under refrigeration for over six months and still show unimpaired respiratory capacity (Funke and Harris 1968). Studies are currently in progress investigating further aspects of this technique which can be used in future research.

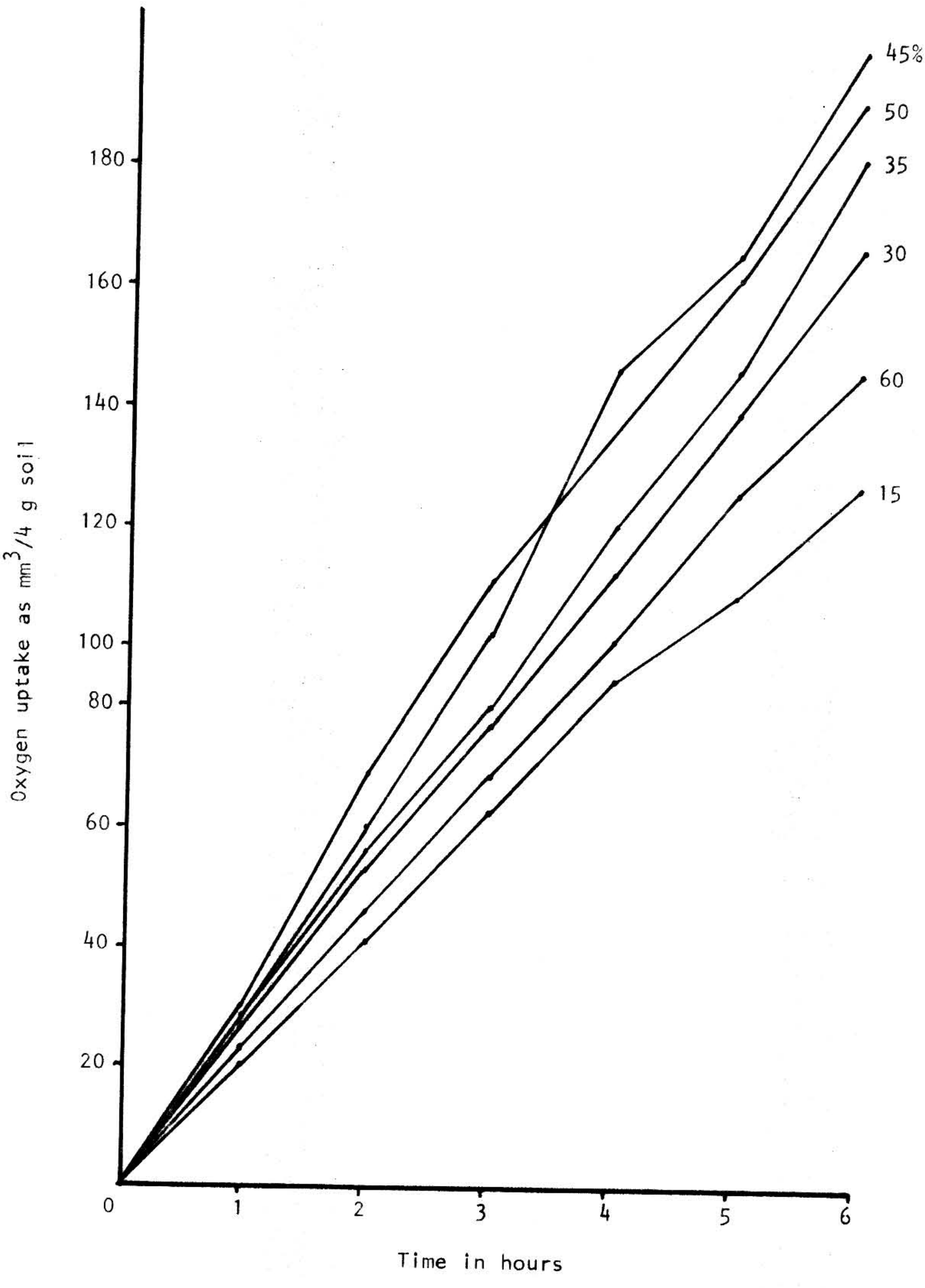

Fig. 4. Respiratory activity of ungrazed soil at different moisture levels.

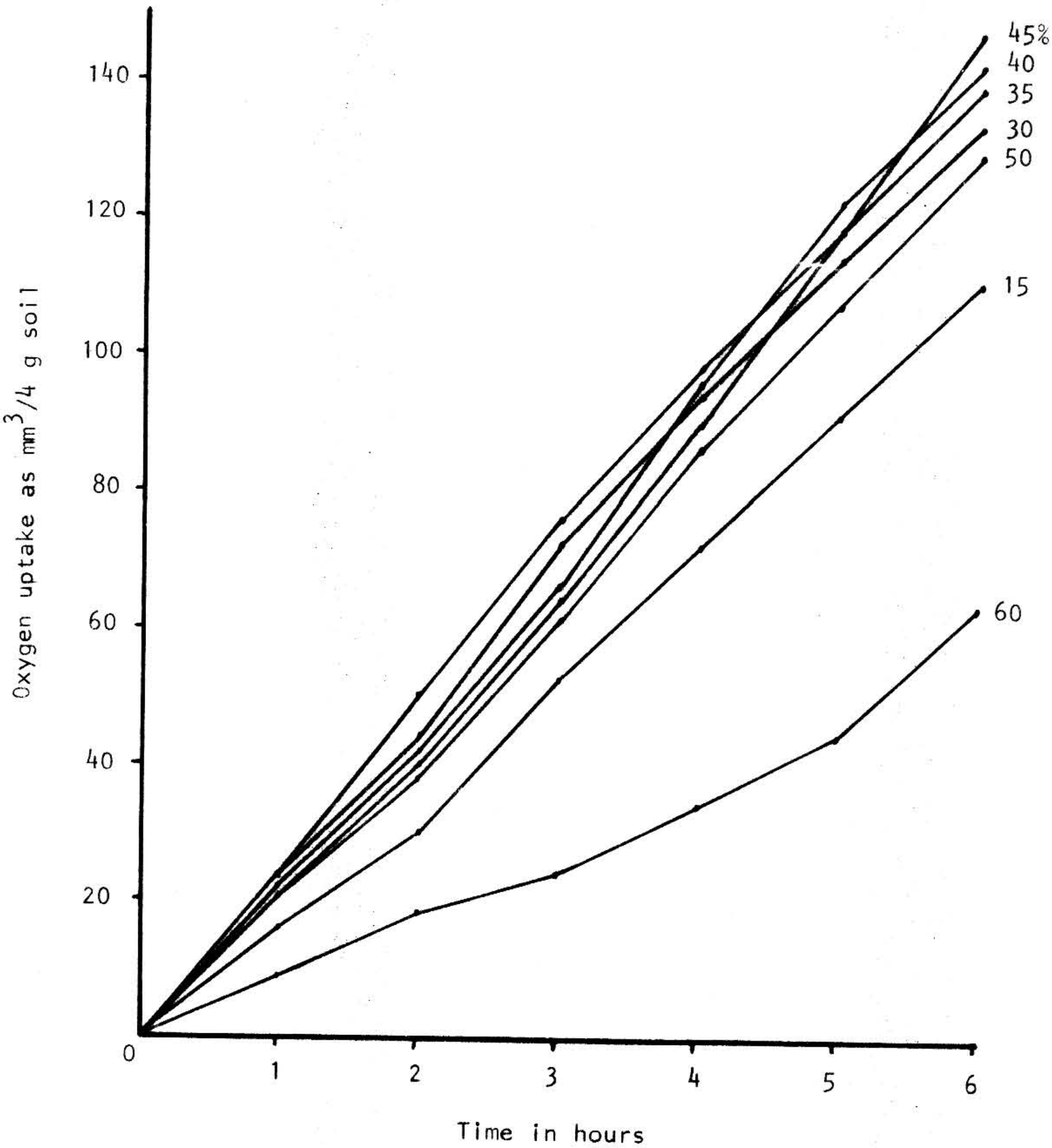

Fig. 5. Respiratory activity of grazed soil at different moisture levels.

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APPENDIX A

CHARACTERISTICS OF INDIVIDUAL RANDOM ISOLATES OF BACTERIA

Code Index

Gram Reaction	+	Positive
	-	Negative
Morphology	C	Chains
	S	Single
	G	Groups
	P	Pairs
	Ss	Very small rods
Starch and Protein Hydrolysis	+	Hydrolysis
	-	Nonhydrolysis
Antibiotic Sensitivity (measured in mm)		
0 Completely resistant	P	Penicillin
1 1-5 mm	B	Bacitracin
2 5-10 mm	E	Erythromycin
3 10-15 mm	N	Neomycin
4 15-20 mm	Ch	Chloromycetin
5 20-25 mm	Au	Auromycin
	M	Magnamycin
	T	Terramycin
	Tt	Tetracycline
	Ol	Oleandomycin
	Nb	Novobiocin
	K	Kanamycin
	St	Streptomycin

Antibiotic Sensitivity of the General Bacterial Population

Culture Number	Gram Reaction	Morphology	Starch Hydrology	Protein Hydrology	Antibiotic Sensitivity
		Group I--Freshly Isolated Cultures			
1	+-	Rod C	-	-	P1 B1 E1 N2 Ch2 Au1
2	-	Rod C	-	+	P1 B0 E3 N1 Ch2 Au1
3					
4	-	Rod S	-	-	-------No Growth--------
5	-	Rod S	-	-	P2 B0 E0 N2 Ch3 Au3
6	-	Rod S	+	-	-------No Growth--------
7	-	Rod S	-	-	-------No Growth--------
8	-	Rod C	+	+	P1 B2 E2 N1 Ch2 Au2
9	+-	Rod CS	-	-	P3 B2 E3 N1 Ch2 Au3
10	+-	Rod G	+	-	P5 B5 E4 N2 Ch3 Au4
11	-	Rod SP	+	-	P4 B3 E4 N1 Ch2 Au3
12	+-	Rod C	+	-	P4 B2 E4 N2 Ch3 Au3
13	+-	Rod SP	-	-	-------No Growth--------
14	-	Rod GP	+	+	P0 B0 E3 N2 Ch1 Au1
15	-	Rod C	-	+	P2 B2 E3 N1 Ch1 Au1
16	-	Rod G	-	+	P2 B2 E3 N1 Ch2 Au2
17	-	Rod S	-	-	P4 B4 E4 N2 Ch3 Au3
18	-	Rod S	-	-	-------No Growth--------
19	-	Rod G	+		P3 B2 E3 N1 Ch2 Au3
20	-	Rod C	-	-	P1 B0 E2 N2 Ch3 Au3
21	-	Rod C	-	-	P5 B5 E4 N2 Ch3 Au4
22	-	Rod S	-	-	--Complete Inhibition---
23	-	Rod S	+	-	P5 B3 E4 N2 Ch3 Au3
24	+	Rod G	+	+	P0 B1 E3 N1 Ch2 Au1
25	-	Rod C	-	+	P3 B1 E2 N1 Ch2 Au2
26	-	Rod S	+	+	P2 B2 E3 N1 Ch2 Au2
27	-	Rod C	+	+	P4 B2 E4 N2 Ch3 Au3
28			-	+	P2 B2 E3 N1 Ch2 Au2
29	-	Rod C	-	+	P2 B2 E3 N1 Ch2 Au2

Culture Number	Gram Reaction	Morphology	Starch Hydrology	Protein Hydrology	Antibiotic Sensitivity
30	+	Rod G	+	+	P0 B1 E3 N1 Ch2 Au1
31	+	Rod G	+	+	P3 B2 E3 N1 Ch2 Au3
32	+-	Rod C	-		-------No Growth--------
33	-	Rod SP	-	-	-------No Growth--------
34	-	Rod P	-	+	P3 B2 E3 N1 Ch3 Au2
35	-	Rod G	+	+	P3 B2 E3 N1 Ch3 Au3
36	-	Rod G	+	+	P2 B2 E3 N1 Ch2 Au2
37	+-	Rod G	-	+	P1 B2 E2 N2 Ch1 Au2
38	-	Rod G	+	+	P2 B2 E2 N1 Ch2 Au2
39	-	Rod S	-	-	--Complete Inhibition---
40	-	Rod S	+	+	P4 B3 E3 M2 Ch3 Au4
41	-	Rod S	-	+	P2 B3 E3 M2 Ch2 Au2
42	-	Rod C	+	+	P3 B2 E3 M2 Ch3 Au3
43	-	Rod G	-	-	P4 B2 E4 M4 Ch2 Au2
44	-	Rod G	+	-	P5 B5 E5 M3 Ch1 Au5
45	-	Rod SG	-	+	P2 B2 E2 M2 Ch2 Au2
46	+	Rod S	-	-	
47	-	Rod SG	+	+	P1 B2 E2 M2 St2 Au2
48	-	Rod G	+	-	P4 B3 E4 M3 St[illegible] Au4
49	-	Rod S	-	+	P0 B0 E1 M0 St2 Au2
50	-	Rod C	-	-	--Complete Inhibition---
51	+-	Rod SG	+	+	P4 B2 E3 M3 St2 Au3
52	+	Rod G	+	+	P0 B1 Tt1 M2 St2 Au1
53	-	Rod C	-	+	P0 B2 M1 N1 Ch2 Au2
54	-	Rod C	+	+	P1 B2 M2 N1 Ch2 Au1
55	-	Rod S	-	-	P5 B2 E3 M3 St2 Au3
56	-	Rod S	-	-	P0 B0 E0 M0 St0 Au0
57	-	Rod G	+	+	P0 B2 M1 N1 Ch2 Au2
58	+	Rod C	-	+	P1 B1 M1 N1 Ch2 Au2
59	+	Rod SP	+	+	P0 B1 E2 M2 St2 Au2

Culture Number	Gram Reaction	Morphology	Starch Hydrology	Protein Hydrology	Antibiotic Sensitivity
60	-	Rod S	-		
61	-	Rod C	-	+	P0 B1 M2 N1 Ch1 Au1
62	+	Rod C	+	+	P0 B1 E3 M3 St2 Au2
63	-	Rod S	-	-	P0 B1 M3 N1 Ch2 Au2
64	-	Cocci	-	-	P0 B2 E2 M2 St1 Au2
65	+	Rod C	+	+	P3 B1 Tt3 M3 St2 Au3
66	-	Rod C	+		
67	-	Rod S	-	-	P0 B1 M2 N1 Ch1 Au1
68	+	Rod C	-	+	P3 B2 Tt2 M2 St2 Au2
69	-	Rod C	+	+	P1 B2 M1 N1 Ch2 Au1
70	-	Rod C	+	+	P1 B2 M2 N1 Ch2 Au2
71	+	Rod C	+	+	P0 B1 M2 N1 Ch1 Au1
72	+-	Rod C	+	+	P0 B2 M2 N1 Ch2 Au2
73	-	Rod G	-	+	P2 B2 Tt2 M2 St1 Au2
74	-	Rod C	+	+	P0 B1 Tt1 M2 St2 Au1
75	-	Rod C	-		
76	-	Rod C	+	+	P3 B1 Tt2 M3 St1 Au2
77	-	Rod S	-	-	P0 B0 E1 M0 St0 Au2
78	+	Rod SC	+	+	P0 B1 M2 N1 Ch1 Au1
79	+-	Rod C	+	-	P2 B1 M2 N1 Ch2 Au2
80	-	Rod S	-	-	P0 B0 M0 N1 Ch1 Au1
81	-	Rod SP			
82	+	Rod C	-	+	P2 B1 M2 N1 Ch2 Au2
83	+	Rod C	+	+	P0 B1 M3 N1 Ch1 Au1
84	+	Rod G	+	+	P0 B1 M2 N1 Ch2 Au0
85	-	Rod C	+	+	P1 B1 M2 N1 Ch2 Au2
86	+	Rod C	+	+	P0 B1 M2 N1 Ch1 Au1
87	-	Rod C	+	+	P1 B2 M1 N1 Ch2 Au2
88	-	Rod C	+	-	P1 B2 M2 N1 Ch2 Au2
89	+-	Rod C	+	+	P0 B2 M2 N1 Ch2 Au2

Culture Number	Gram Reaction	Morphology	Starch Hydrology	Protein Hydrology	Antibiotic Sensitivity
90	-	Rod C	+	+	P0 B2 M2 N1 Ch2 Au2
91	-	Rod PS	+		P0 B2 M2 N2 Ch3 Au2
92	-	Rod C	-	-	P0 B0 M2 N1 Ch1 Au1
93	+-	Rod C	-	+	P0 B1 M2 N1 Ch2 Au2
94	+	Rod C	-	+	P1 B1 M2 N1 Ch2 Au2
95	+	Rod C	+	+	P1 B2 M3 N2 Ch3 Au3
96	-	Rod S	-	-	P0 B0 M0 N1 Ch1 Au1
97	-	Rod S	-	-	P0 B1 M0 N1 Ch0 Au1
98	-	Rod	+	+	P0 B1 M2 N1 Ch2 Au2
99	-	Rod C	+	-	P2 B2 M3 N2 Ch3 Au3
100	-	Rod S	+	-	St2 B2 M2 N1 Ch2 Tt2
101	-	Rod C	-	+	-------No Growth--------
102	-	Rod C	-	+	St2 B2 M3 N1 Ch2 Tt3
103	+	Rod S	+	+	St1 B0 M1 N1 Ch2 Tt1
104	-	Rod SP	+	-	St2 B3 M3 N2 Ch3 Tt3
105	+-	Rod C	-	+	St1 B1 M2 N1 Ch2 Tt2
106	+-	Rod PS	+	+	St1 B1 M1 N1 Ch1 Tt1
107	+-	Rod C			P0 B2 M2 N1 Ch2 Au1
108	-	Rod C			P0 B2 M2 N1 Ch2 Au2
109	-	Rod C			P0 B2 M2 N2 Ch2 Au2
110	+	Rod C	+	+	P0 B0 M2 N1 Ch1 Au3
111	-	Rod S	+	+	P0 B2 M2 N1 Ch2 Au2
112	-	Rod C	-	+	St1 B1 M1 N1 Ch2 Tt2
113	-	Rod SP	+	+	St2 B1 M1 N1 Ch1 Tt1
114	-	Rod P	-		-------No Growth--------
115	+	Rod C	-	-	St1 B1 M2 N1 Ch2 Tt2
116	-	Rod S			P0 B0 M0 N0 Ch1 Au1
117	+	Rod			P1 B2 M3 N2 Ch3 Au3
118	-	Rod SP	+	-	St0 B2 M2 N1 Ch2 Tt2
119	-	Rod SP	-	-	B0 Ch1 M2 T3 Tt3 ol2

Culture Number	Gram Reaction	Morphology	Starch Hydrology	Protein Hydrology	Antibiotic Sensitivity
120	-	Rod C	-	+	B2 Ch2 M2 T1 Tt2 ol2
121	+-	Rod PS	+	+	B1 Ch2 M2 T1 Tt2 ol2
122	-	Rod C	-	-	-------No Growth--------
123	-	Rod PS	-	-	-------No Growth--------
124	+-	Rod SP	-	-	B1 Ch3 M2 T3 Tt3 ol2
125	-	Rod C	-	-	-------No Growth--------
126	-	Rod C	+	+	B1 Ch2 M1 T2 Tt2 ol1
127	-	Rod CP	-	+	B1 Ch2 M2 T2 Tt2 ol2
128	-	Rod C	+	+	B2 Ch2 M1 T2 Tt2 ol3
129	-	Rod C	-	+	B2 Ch2 M3 T3 Tt3 ol3
130	-	Rod S	-	+	B1 Ch2 M2 T2 Tt2 ol3
131	+-	Rod G	+	+	B2 Ch2 M2 T2 Tt2 ol2
132	+-	Rod C	-	+	B3 Ch2 M2 T2 Tt2 ol2
133	-	Rod C	-	+	B2 Ch2 M2 T2 Tt2 ol2
134	-	Rod C	+	-	B3 Ch3 M3 T4 Tt4 ol3
135	+-	Rod C	-	+	B1 Ch2 M2 T2 Tt2 ol2
136	+-	Rod C	-	+	B2 Ch2 M2 T2 Tt2 ol2
137	-	Rod C	-	-	-------No Growth--------
138	+	Rod G	+	+	B2 Ch2 M2 T2 Tt3 ol2
139	-	Rod C	+	+	B2 Ch2 M2 T2 Tt2 ol2
140	+-	Rod C	+	+	B2 Ch2 M2 T2 Tt2 ol2
141	-	Rod C	+	+	B2 Ch3 M2 T2 Tt2 ol2
142	+	Rod C	+	+	St1 B0 M2 T1 Tt2 ol1
143	-	Rod C	-	+	St1 B0 M2 N1 Ch2 Tt1
144	-	Rod C	-	-	St1 B1 M2 N1 Ch2 Tt2
145	+-	Rod G	+	+	St1 B1 M2 N1 Ch2 Tt2
146	+-	Rod G	+	+	St2 B1 M2 N1 Ch2 Tt3
147	+-	Rod C	+	+	St2 B2 M2 N2 Ch2 Tt2
148	-	Rod C	-	-	St1 B1 M0 N1 Ch0 Tt1
149	+	Rod P	+	+	St1 B1 M2 N1 Ch1 Tt2

Culture Number	Gram Reaction	Morphology	Starch Hydrology	Protein Hydrology	Antibiotic Sensitivity
150					
151	+-	Rod C	-	-	St2 B2 M2 N1 Ch1 Tt2
152	+-	Rod C		-	St2 B2 M2 N2 Ch2 Tt3
153	+-	Rod PS	+	-	B1 Ch1 M2 T3 Tt3 ol2
154	+	Rod C		+	B1 Ch1 M2 T1 Tt1 ol2
155	+	Rod C	-	-	St2 B2 M2 N2 Ch2 Tt3
156	-	Rod C	+	+	St1 B2 M2 N1 Ch2 Tt2
157	+	Rod C	-	-	St2 B3 M3 N2 Ch3 Tt3
158	-	Rod C	+	-	St1 B2 M2 N1 Ch2 Tt2
159	+	Rod G	+	-	
160	-	Rod GS	+	-	B3 Ch2 M2 T3 Tt3 ol3
161	-	Rod C	-	-	B1 Ch2 M2 T2 Tt2 ol2
162	-	Rod C	-	-	St1 B1 M0 N1 Ch0 Tt1
163	-	Rod G	-	+	
164	+	Rod C	+	-	St2 B2 M2 N2 Ch2 Tt3
165	+-	Rod G	-	+	St2 B1 M2 N1 Ch2 Tt2
166	-	Rod C	-	-	-------No Growth--------
167	+-	Rod P	-		St2 B4 M3 N2 Ch3 Tt3
168	+	Rod C	+	+	St1 B0 M2 N2 Ch1 Tt1
169					
170	+-	Rod GP	-	-	St1 B1 M2 N1 Ch2 Tt2
171	+-	Rod C	-	-	St2 B3 M2 N2 Ch2 Tt3
172	+	Rod C	+	+	St1 B2 M2 N2 Ch2 Tt2

Group I - Old Cultures

004	-	Rod Ss	-	+	B1 Ch2 M2 T2 Tt2 ol1
012	-	Rod	-	-	-------No Growth--------
014	-	Rod G	-		-------No Growth--------
018	-	Rod S	+	+	B3 Ch2 M2 T3 Tt3 ol3
020	-	Rod C	+		B2 Ch2 M2 T2 Tt3 ol2

Culture Number	Gram Reaction	Morphology	Starch Hydrology	Protein Hydrology	Antibiotic Sensitivity
032	-	Rod C	-	+	B2 Ch2 M1 T2 Tt2 ol2
028	-	Rod Ss	-	-	-------No Growth--------
027	+-	Rod CS	-	-	-------No Growth--------
036	+-	Rod CG	+		B2 Ch2 M2 T2 Tt2 ol2
037	-	Rod Ss		+	
056	-	Rod G	+	+	B2 Ch2 M2 T3 Tt2 ol2
057	-	Rod S	+	+	B2 Ch2 M2 T2 Tt2 ol2
064	-	Rod S	-	+	B2 Ch2 M2 T2 Tt2 ol2
084	-	Rod S			
			Group II		
220	-	Rod C	+	+	P2 T2 M2 ol2 B2 K1
221	+-	Rod C	+	+	P0 T0 M0 ol0 B0 K0
224	-	Rod G	+	+	
227	+-	Rod C	+	+	P1 T2 M2 ol1 B2 K2
229	+-	Rod Ps	+	+	
230	+-	Rod C	+	+	P4 T4 M3 ol3 B3 K3
231	+-	Rod C	+	+	P2 T2 M2 ol1 B1 K2
232	+	Rod C	+	-	P4 T4 M3 ol2 B3 K3
234	+-	Rod C	-	+	P2 T2 M1 ol1 B2 K2
236	+-	Rod C	-	+	P2 T2 M2 ol2 B2 K2
237			-	-	
238	+-	Rod C	+	+	P2 T3 M2 ol2 B2 K2
239	+	Rod S	+	+	P2 T3 M2 ol2 B2 K2
240	-	Rod S	+	-	P2 T2 M2 ol2 B2 K2
242	-	Rod S	+	+	P1 T2 M1 ol1 B1 K1
243	+-	Rod C	+	+	P0 T0 M0 ol0 B0 K0
244	-	Rod S	-	+	P2 T2 M2 ol1 B2 K2
246	-	Rod Ss	-	-	-------No Growth--------
248	+-	Rod C	+	+	P1 T2 M2 ol2 B2 K2
249	+	Rod C	+	+	

Culture Number	Gram Reaction	Morphology	Starch Hydrology	Protein Hydrology	Antibiotic Sensitivity
252	-	Rod C	+	+	P2 T2 M2 ol2 B2 K2
256	-	Rod C	+	+	P2 T2 M2 ol1 B2 K2
257	+-	Rod C	+	+	P0 T1 M2 ol2 B0 K2
258	+	Rod C	-	+	P1 T2 M2 ol2 B2 K2
259	-	Rod C	+	+	P1 T2 M2 ol2 B2 K2
261	-	Rod S	-	+	P0 T0 M0 ol0 B0 K2
262	+-	Rod SP	+	-	P2 T1 M2 ol1 B1 K2
263	+-	Rod CS	-	+	P4 T4 M3 ol2 B1 K2
264	-	Rod C	+	+	P2 T2 M2 ol1 B2 K1
266	-	Rod Ss	-	+	P1 T2 M1 ol1 B1 K1
268	+	Cocci G	-	-	P1 T1 M1 ol0 B1 K1
269	+	Rod C	+	+	P0 T1 M1 ol1 B0 K1
270	+	Rod C	+	+	P2 T2 M2 ol2 B2 K2
271	+	Rod C	+	-	P2 T3 M2 ol2 B1 K2
272	+-	Rod C	+	-	P3 T4 M3 ol3 B1 K0
273	-	Rod SG	-	+	P0 T0 M0 ol0 B0 K0
275	+	Rod C	-	-	P2 T3 M2 ol2 B1 K2
276	+	Rod C	+	+	-------No Growth--------
277	+-	Rod C	+	+	P2 T2 M2 ol1 B2 K2
279	-	Rod Ss	-	-	-------No Growth--------
280	+	Rod C	+	+	P0 T2 M1 ol1 B0 K1
281	+	Rod	+	-	P2 T3 M2 ol2 B1 K2
283	-	Rod P	+	+	
285	+-	Rod C	+	+	--Complete Inhibition---
286	-	Rod G	-	+	P0 T0 M0 ol0 B0 K0
287	-	Rod G	+	-	P0 T2 B0 ol0 St1 M2
289	-	Rod C	-	+	P0 T2 M2 ol1 B2 K2
290	+-	Rod C	+	+	P3 T3 B2 ol2 St2 M2
292	+	Rod P	+	+	P0 T2 B0 ol2 St2 M2
293	+-	Rod C	+	+	P2 T2 B2 ol2 St1 M2

Culture Number	Gram Reaction	Morphology	Starch Hydrology	Protein Hydrology	Antibiotic Sensitivity
296	+	Rod C	+	+	P0 T2 B1 ol1 St2 M2
297	+-	Rod C	+	+	P2 T2 M2 ol1 B2 K2
298	+-	Rod G	+	-	P4 T3 B1 ol1 St2 M2
299	-	Rod S	+	+	P3 T3 B2 ol2 St2 M2
301	-	Rod P	+	+	P2 T2 M2 ol1 B2 K2
302	+	Rod C	+	-	P3 T1 B1 ol0 St2 M2
303	-	Rod P	-		P2 T3 B2 ol2 St2 K2
304	-	Rod C	+	+	-------No Growth--------
305	+	Rod P	+	+	P3 T3 B2 ol2 St2 M2
306	-	Rod C	-	-	-------No Growth--------
307	-	Rod C	+	+	P2 T3 B2 ol2 St2 M2
308	-	Rod C	-	-	P3 T3 B1 ol2 St0 M3
309	+-	Rod C	+	+	P1 T3 B2 ol2 St2 M2
310	-	Rod P	-	-	P3 T3 B1 ol3 St3 M3
311	+-	Rod G	+	+	P3 T3 B2 ol2 St2 M2
312	+	Rod C	-	-	-------No Growth--------
314	-	Rod S	-	-	P2 T1 B0 ol2 Nb3 Tt2
315	-	Rod S	-	-	P1 T3 B0 ol0 St0 M0
318	-	Rod C	+	+	P4 T3 B2 ol2 St2 M2
322	-	Rod C	+	+	
323	-	Rod S	+	-	P4 T4 B2 ol3 St3 M3
324	-	Rod P	+	-	P5 T4 B3 ol3 St3 M4
326	-	Rod S	-	-	P1 T2 B0 ol0 Nb1 Tt2
327	-	Cocci G	-	-	P0 T1 B1 ol0 St1 M0
329	-	Cocci G	-	-	P0 T2 B0 ol1 St0 M0
331	+	Rod C	-	-	-------No Growth--------
332	-	Rod Ss	-	-	-------No Growth--------
333	-	Rod Ss	+	-	P3 T3 B2 ol2 Mb3 Tt3
334	+	Rod C	-	-	-------No Growth--------
335	-+	Rods & Cocci	+	+	
336	+-	Rods SP	-	-	P4 T3 B1 ol2 St0 M3

Culture Number	Gram Reaction	Morphology	Starch Hydrology	Protein Hydrology	Antibiotic Sensitivity
337	-	Rod Ss	-	-	-------No Growth--------
338	+	Rod C	+	+	P0 T1 B1 ol2 St2 M2
339	-	Rod P	+	+	P3 T3 B2 ol2 St2 M2
340	+-	Rod C	+	+	P3 T3 B2 ol2 St2 M3
341	-	Rod C	+	+	P3 T3 B2 ol2 St2 M2
342	-	Rod C	+	+	P3 T3 B2 ol2 St2 M2
343	-	Rod C	+	-	P3 T4 B1 ol2 St3 M3
344	-	Rod	-	-	-------No Growth--------
345	+-	Rod C	+	+	P3 T3 B3 ol2 Nb3 Tt3
346	-	Rod C	+		P2 T3 B2 ol2 Nb2 Tt2
347	-	Rod	-	-	P2 T3 B1 ol2 Nb3 Tt3
349	+	Rod C	+	+	P0 T2 B1 ol1 Nb2 Tt2
350	+	Rod C	+	+	P3 T2 B2 ol2 Nb2 Tt2
351	-	Rod C	+	+	P3 T3 B2 ol2 Nb1 Tt2
352	+	Rod C	+	-	P5 T4 B1 ol2 Nb3 Tt4
353	-	Rod S	-	-	P2 T4 B0 ol0 Nb1 Tt4
354	-	Rod S	+	-	P2 T3 B3 ol2 Nb2 Tt3
356	-	Rod C	+	+	P3 T3 B3 ol2 Nb2 Tt3
357	-	Rod C	+	+	P3 T3 B3 ol2 Nb2 Tt3
360	-	Rod C	+	+	P0 T3 B2 ol1 Nb2 Tt2
361	-	Rod S	-	-	P0 T2 B0 ol2 Nb2 Tt2
362	+	Cocci	-	-	P2 T0 B2 ol2 Nb3 Tt1
363	+-	Rod C	+	+	P4 T3 B3 ol2 Nb3 Tt3
364	+-	Rod C	+		
366	-	Rod P	+	+	P3 T2 St1 ol2 N1 M2
367	-	Rod P	+		P2 T3 B2 ol2 Nb2 Tt3
368	-	Rod C	+	+	P3 T3 B2 ol2 Nb2 Tt3
369	-	Rod C	+	+	P3 T3 St2 ol2 N2 Tt2
370	-	Rod C	+	+	P3 T3 B3 ol2 Nb2 Tt3
372	-	Rod C	+	+	P3 T2 B3 ol2 Nb2 Tt3
373	+-	Rod C	+	+	P3 T3 B3 ol2 Nb2 Tt3
374	-	Rod C	+	+	P4 T4 B3 ol3 Nb3 Tt4

Culture Number	Gram Reaction	Morphology	Starch Hydrology	Protein Hydrology	Antibiotic Sensitivity
375	+	Rod Ss	+	+	P0 T1 B1 ol2 Nb1 Tt0
376	-	Rod C	+	+	P5 T5 St5 ol3 N2 Tt3
379	+-	Rod C	+	-	P4 T2 B2 ol2 Nb2 Tt3
380	+-	Rod C	+	-	-------No Growth--------
381	-	Rod C	-		
387	-	Rod C	+	+	P4 T4 B3 ol3 Nb2 Tt4
388	-	Rod Ss	+	+	P0 T1 B0 ol0 Nb0 Tt0
389	-	Rod Ss	+	+	P2 T2 B1 ol2 Nb1 Tt2
392	+	Rod S	+	+	P0 T1 B0 ol2 Nb2 Tt1
393	-	Rod Ss	-	-	P0 T0 B0 ol0 Nb1 Tt0
394	+	Rod PC	+	+	P0 T2 B1 ol2 Nb2 Tt2
396	-	Rod Ss G	-	-	P0 T1 St1 ol0 N0 M0
397	-	Rod C	-	-	--Complete Inhibition---
400	+	Rod C	-	-	-------No Growth--------
401	+	Rod G	-	-	-------No Growth--------
402	-	Rod C	-	-	-------No Growth--------
406	+-	Rod G	+	+	-------No Growth--------
407	-	Rod C	+	+	P4 T3 B3 ol2 Nb2 Tt3
408	-	Rod C	+	+	P3 T2 St1 ol2 N1 M2
409	+	Rod P	+	+	P0 T0 B1 ol1 Nb2 Tt1
412	-	Rod Ss	-	-	-------No Growth--------
413	-	Rod Ss	+	+	P0 T3 B2 ol2 Nb2 Tt3
414	-	Rod Ss	-	-	P0 T0 B0 ol0 Nb0 Tt0
416	-	Rod G	+	-	-------No Growth--------
419	-	Rod C	+	-	P1 T3 B2 ol2 Nb1 Tt2
420	+-	Rod SP	+	+	P2 T2 B2 ol2 Nb2 Tt2
429	+-	Rod Ps	+	+	P5 T4 B2 ol3 Nb2 Tt5
430	+	Rod C	-	+	-------No Growth--------
431	-	Rod C	+	-	--Complete Inhibition---
432	+	Rod C	-	-	-------No Growth--------
433	+-	Rod Ps	+	+	P2 T2 B1 ol3 Nb2 Tt3

Culture Number	Gram Reaction	Morphology	Starch Hydrology	Protein Hydrology	Antibiotic Sensitivity
434	+	Rod SP	+	+	P0 T2 B1 ol2 Nb2 Tt1
435	-	Rod C	+	-	P2 T2 B1 ol1 Nb2 Tt2
437	-	Rod SP	-	-	
440	+	Rod PS	+	-	P2 T2 B2 ol2 Nb2 Tt2
442	+-	Rod S	+	-	-------No Growth--------
447	-	Rod Ss P	-	-	-------No Growth--------
448	-	Rod	+	+	P2 T3 B2 ol2 Nb2 Tt2
449	-	Rod S	+	+	P3 T3 B2 ol2 Nb2 Tt2
454	-	Rod S	-	-	P3 T2 B0 ol0 Nb3 Tt2
458	+-	Rod SP	+	+	P0 T2 B0 ol1 Nb2 Tt1
463	-	Rod C	-	-	P2 T2 B1 ol2 Nb2 Tt2

APPENDIX B

FIELD DATA

Microbiology--Biomass

Microbiology--biomass data collected in 1970 at the Osage Site is Grassland Biome data set A2U4029. Data were collected on form NREL-42. A sample data form and a sample of the data follow.

IBP

GRASSLAND BIOME

U.S. INTERNATIONAL BIOLOGICAL PROGRAM

FIELD DATA SHEET - MICROBIOLOGY - BIOMASS

DATA TYPE	SITE	INITIALS	DATE			TREATMENT	REPLICATE	PLOT SIZE	HORIZON	DEPTH. TOP	DEPTH, BOTTOM	CORE WT.	SAMPLE WT.	TYPE	COUNT-LENGTH	TYPE	COUNT-LENGTH	
			Day	Mo	Yr													
1-2	3-4	5-7	8-9	10-11	12-13	14	15	16-19	21	23-25	27-29	31-35	37-40	42	44-46	48	50-52	

DATA TYPE
01 Aboveground Biomass
02 Litter
03 Belowground Biomass
10 Vertebrate - Live Trapping
11 Vertebrate - Snap Trapping
12 Vertebrate - Collection
20 Avian Flush Census
21 Avian Road Count
22 Avian Road Count Summary
23 Avian Collection - Internal
24 Avian Collection - External
25 Avian Collection - Plumage
30 Invertebrate
40 Microbiology - Decomposition
41 Microbiology - Nitrogen
42 Microbiology - Biomass
43 Microbiology - Root Decomposition
Microbiology - Respiration

SITE
01 Ale
02 Bison
03 Bridger
04 Cottonwood
05 Dickinson
06 Hays
07 Hopland
08 Jornada
09 Osage
10 Pantex
11 Pawnee

TREATMENT
1 Ungrazed
2 Lightly grazed
3 Moderately grazed
4 Heavily grazed
5 Grazed 1969, ungrazed 1970
6
7
8
9

TYPE
Bacteria
2 Bacterial spore
3
4
5 Fungus

HORIZON
1 AO
2 A
3 B
4 C

+++ EXAMPLE OF DATA +++

```
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

4209JOH03067011        00  05      0004 5  81
                       00  05      0004 5 163
                       00  05      0004 5 215
                       00  05      0004 5 208
                       00  05      0004 5 348
                       05  10      0004 5 273
                       05  10      0004 5 271
                       05  10      0004 5 204
                       05  10      0004 5 349
                       05  10      0004 5 443
                       10  20      0004 5  83
                       10  20      0004 5  83
                       10  20      0004 5  26
                       10  20      0004 5 129
                       10  20      0004 5  93
                       10  20      0004 5  25
4209JOH03067012        10  20      0075 5 357
                       10  20      0075 5 361
                       10  20      0075 5 376
                       10  20      0075 5 136
                       10  20      0075 5 287
4209JOH03067013        00  05      0004 5 205
                       00  05      0004 5 299
                       00  05      0004 5 292
                       00  05      0004 5 257
                       00  05      0004 5 360
                       05  10      0004 5 240
                       05  10      0004 5 270
                       05  10      0004 5 299
                       05  10      0004 5 204
                       05  10      0004 5 242
                       10  20      0080 5 449
                       10  20      0080 5 303
                       10  20      0080 5 253
                       10  20      0080 5 537
                       10  20      0080 5 190
4209JOH03067031        00  05      0004 5 302
                       00  05      0004 5 511
                       00  05      0004 5 411
                       00  05      0004 5 317
                       00  05      0004 5 361
                       05  10      0004 5 132
                       05  10      0004 5 254
                       05  10      0004 5  86
                       05  10      0004 5 113
                       05  10      0004 5 121
                       10  20      0086 5 227
                       10  20      0086 5 341
                       10  20      0086 5 398
                       10  20      0086 5 348
                       10  20      0086 5 326
```

4209J0H03067032	00	05	0004 5 141
	00	05	0004 5 88
	00	05	0004 5 220
	00	05	0004 5 205
	00	05	0004 5 210
	05	10	0004 5 201
	05	10	0004 5 232
	05	10	0004 5 299
	05	10	0004 5 229
	05	10	0004 5 299
	10	20	0086 5 335
	10	20	0086 5 470
	10	20	0086 5 353
	10	20	0086 5 357
	10	20	0086 5 412
4209J0H03067033	00	05	0004 5 133
	00	05	0004 5 107
	00	05	0004 5 230
	00	05	0004 5 192
	00	05	0004 5 300
	05	10	0004 5 141
	05	10	0004 5 103
	05	10	0004 5 163
	05	10	0004 5 224
	05	10	0004 5 393
	10	20	0076 5 459
	10	20	0076 5 511
	10	20	0076 5 450
	10	20	0076 5 512
	10	20	0076 5 190

Microbiology--Decomposition

Microbiology--decomposition data collected in 1970 at the Osage Site is Grassland Biome data set A2U4009. Data were collected on form NREL-40. A sample data form and a listing of the data follow.

IBP

GRASSLAND BIOME

U.S. INTERNATIONAL BIOLOGICAL PROGRAM

FIELD DATA SHEET - MICROBIOLOGY - DECOMPOSITION

DATA TYPE	SITE	INITIALS	DATE			TREATMENT	REPLICATE	PLOT SIZE	MATERIAL	DEPTH	DATE BURIED			NO. DAYS	WT. ORIGINAL	WT. RETRIEV.	WT. IGNITION	SOIL WT.	SOIL IGNIT.
			Day	Mo	Yr						Day	Mo	Yr						
1-2	3-4	5-7	8-9	10-11	12-13	14	15	16-19	21	23-24	26-27	28-29	30-31	33-35	37-41	43-47	49-53	55-59	61-65

DATA TYPE

01 Aboveground Biomass
02 Litter
03 Belowground Biomass
10 Vertebrate - Live Trapping
11 Vertebrate - Snap Trapping
12 Vertebrate - Collection
20 Avian Flush Census
21 Avian Road Count
22 Avian Road Count Summary
23 Avian Collection - Internal
24 Avian Collection - External
25 Avian Collection - Plumage
30 Invertebrate
40 Microbiology - Decomposition
41 Microbiology - Nitrogen
42 Microbiology - Biomass
Microbiology - Root Decomposition
Microbiology - Respiration

SITE

01 Ale
02 Bison
03 Bridger
04 Cottonwood
05 Dickinson
06 Hays
07 Hopland
08 Jornada
09 Osage
10 Pantex
11 Pawnee

TREATMENT

1 Ungrazed
2 Lightly grazed
3 Moderately grazed
4 Heavily grazed
5 Grazed 1969, ungrazed 1970
6
7
8
9

SAMPLE MATERIAL

Cellulose
2 Litter
3 Standing dead
4
5

+++ FIELD DATA +++

```
                  1         2         3         4         5         6         7         8
         12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

4009JOH13047011	1	05	112369	141	04.00	05.13	02.95	05.00	04.75
	1	05	112369	141	04.00	06.10	03.18	05.00	04.75
	1	05	112369	141	04.00	05.23	03.01	05.00	04.75
4009JOH18057011	1	05	112369	176	04.00	01.10	00.16	05.00	04.75
	1	05	112369	176	04.00	00.96	00.10	05.00	04.75
	1	05	112369	176	04.00	01.72	00.97	05.00	04.75
	1	05	130470	035	04.00	05.17	03.16	05.00	04.75
	1	05	130470	035	04.00	04.78	02.66	05.00	04.75
	1	05	130470	035	04.00	04.41	03.13	05.00	04.75
4009JOH19067011	1	05	130470	079	04.00	02.17	02.01	05.00	04.75
	1	05	130470	079	04.00	01.77	01.60	05.00	04.75
	1	05	130470	079	04.00	03.41	03.36	05.00	04.75
4009JOH19067021	1	05	130470	079	04.00	01.86	01.72	05.00	04.76
	1	05	130470	079	04.00	02.13	02.07	05.00	04.76
	1	05	130470	079	04.00	03.31	03.00	05.00	04.76
4009JOH19067011	2	05	180570	032	10.00	09.16	01.10	05.00	04.75
	2	05	180570	032	10.00	08.07	02.11	05.00	04.75
	2	05	180570	032	10.00	09.01	01.83	05.00	04.75
4009JOH19067021	2	05	180570	032	10.00	09.46	02.37	05.00	04.75
	2	05	180570	032	10.00	08.82	03.90	05.00	04.75
	2	05	180570	032	10.00	08.18	02.46	05.00	04.75
4009JOH19067011	4	05	180570	032	10.00	08.51	01.26	05.00	04.75
	4	05	180570	032	10.00	07.72	02.11	05.00	04.75
	4	05	180570	032	10.00	09.39	03.16	05.00	04.75
4009JOH19067021	4	05	180570	032	10.00	09.61	03.36	05.00	04.75
	4	05	180570	032	10.00	08.81	02.62	05.00	04.75
	4	05	180570	032	10.00	08.13	01.77	05.00	04.75
4009JOH16077011	1	05	180570	060	04.00	01.29	01.01	05.00	04.75
	1	05	180570	060	04.00	00.86	00.80	05.00	04.75
	1	05	180570	060	04.00	01.81	01.32	05.00	04.75
4009JOH16077021	1	05	180570	060	04.00	01.16	00.94	05.00	04.75
	1	05	180570	060	04.00	02.64	01.91	05.00	04.75
	1	05	180570	060	04.00	01.09	00.97	05.00	04.75
4009JOH16077011	2	05	180570	060	10.00	06.85	04.42	05.00	04.75
	2	05	180570	060	10.00	08.12	05.12	05.00	04.75
	2	05	180570	060	10.00	07.73	04.66	05.00	04.75
4009JOH16077021	2	05	180570	060	10.00	07.47	03.12	05.00	04.75
	2	05	180570	060	10.00	07.13	02.16	05.00	04.75
	2	05	180570	060	10.00	08.42	02.51	05.00	04.75
4009JOH16077011	4	05	180570	060	10.00	06.96	03.61	05.00	04.75
	4	05	180570	060	10.00	07.21	04.83	05.00	04.75
	4	05	180570	060	10.00	07.71	01.29	05.00	04.75
4009JOH16077021	4	05	180570	060	10.00	08.40	04.11	05.00	04.75
	4	05	180570	060	10.00	05.12	03.86	05.00	04.75
	4	05	180570	060	10.00	06.64	03.17	05.00	04.75

4009JOH30097011	2	05	180570	137	10.00	04.14	02.16	05.00	04.75
	2	05	180570	137	10.00	06.32	04.33	05.00	04.75
	2	05	180570	137	10.00	04.58	03.14	05.00	04.75
4009JOH30097021	2	05	180570	137	10.00	03.37	01.17	05.00	04.75
	2	05	180570	137	10.00	05.51	04.40	05.00	04.75
	2	05	180570	137	10.00	06.73	05.18	05.00	04.75
4009JOH30097011	4	05	180570	137	10.00	04.72	01.86	05.00	04.75
	4	05	180570	137	10.00	03.80	02.26	05.00	04.75
	4	05	180570	137	10.00	05.15	04.32	05.00	04.75
4009JOH30097021	4	05	180570	137	10.00	01.64	00.83	05.00	04.75
	4	05	180570	137	10.00	04.92	01.71	05.00	04.75
	4	05	180570	137	10.00	03.77	02.85	05.00	04.75