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^{131}I LEVELS IN COW'S MILK FOLLOWING INGESTION OF CONTAMINATED ALFALFA OR SUDAN GRASS

S. C. Black, R. E. Stanley, and D. S. Barth

Monitoring Systems Research and Development Division

Environmental Monitoring and Support Laboratory

U.S. Environmental Protection Agency

Las Vegas, Nevada 89114

Published August 1975

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U.S. Energy Research and Development Administration

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Effective June 29, 1975, the National Environmental Research Center-Las Vegas (NERC-LV) was designated the Environmental Monitoring and Support Laboratory-Las Vegas (EMSL-LV). This Laboratory is one of three Environmental Monitoring and Support Laboratories of the Office of Monitoring and Technical Support in the U.S. Environmental Protection Agency's Office of Research and Development.

ABSTRACT

A dry aerosol, consisting of submicrometer diatomaceous earth particles tagged with ^{131}I, was released over two different types of growing forage (alfalfa and Sudan grass) at the Experimental Dairy Farm on the Nevada Test Site. Following deposition of the aerosol, the two forage types were chopped and fed to different groups of lactating dairy cows. The dual objectives of the study were to evaluate the relationship of ^{131}I secretion in milk to the ingestion of different types of contaminated forage and to obtain a further indication of the possible influence on milk radioiodine levels of changing the particle size of the contaminant.

The ratios of the peak activity concentrations measured in the milk to the peak activity concentrations in the forage were computed to be 0.0145 for the cows fed contaminated alfalfa and 0.0082 for those fed contaminated Sudan grass. Comparison of the results from this study with those from earlier studies indicates the major effect on activity levels in the milk can be related to forage type. Ingestion of Sudan grass by the cow reduces the transfer of radioiodine to milk by one half compared to ingestion of alfalfa.

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I. INTRODUCTION

In five previous experiments using various types of synthetic aerosols the air-forage-cow milk system for ^{131}I transport has been studied, giving particular attention to those parameters which may be significant in determining the ^{131}I concentration in milk.[1-5] Many of the parameters in those experiments appeared to follow a pattern with the exception of two important measurements obtained during Project Hayseed,[1] the first experiment in the series. The peak milk to peak forage ratio (pCi/l: pCi/kg) for Hayseed was less than the ratio measured in the other experiments where a particulate aerosol was used and the percent recovered in milk was smaller.[2, 3] A comparison of some of the measurements obtained during these experiments is shown in Table 1.

Table 1 - Comparison of Some Results from Previous Studies

Parameter	Hayseed	Alfalfa	S1P
Total ^{131}I Released (mCi)	22	40	52
Count Median Diameter of Aerosol (μm)	23	2	0.13
Deposition (μCi/m^2)	3.13	4.66	1.63
^{131}I Integrated Air Concentration (μCi-sec/m^3)	322	333	157
Wind Speed (km/h)	4.83	2.22	4.83
Ambient Temperature (^{o}F)	51	58	39
Relative Humidity (%)	35	40	59
Type of Forage Fed	Sudan	Alfalfa	Alfalfa
Peak Forage Level (μCi/kg)	2.7	3.4	1.1
Peak Milk Level (nCi/l)	22	109	70
Milk/Forage Ratio	0.0081	0.032	0.062
Percent Recovered in Milk	2.1	12.5	7.6

An examination of the various parameters listed in Table 1 indicated two possible causes for the large variation in the milk/forage ratio and percent in milk among these experiments. These causes are the different count median diameter (CMD) of the aerosols used and the different types of forage used. Other factors, acting singly or in concert, may contribute to the observed variation in the milk/forage ratio. However, their contributions are not as obvious, from these data, as are the differences in the CMD of the aerosols and the forage types.

Since it was impossible to attribute the difference between the two experiments solely to one of the possible causes, a new experiment was conducted to resolve the problem. The experiment, described herein, was called Project HARE (for Hayseed-Alfalfa Repeat Experiment). The experimental procedure included the release of a dry aerosol of a known particle size ($0.13 < CMD < 2.0$) over plots of both Sudan grass and alfalfa forage with subsequent assessment of all the parameters listed in Table 1.

II. PROCEDURE

An area on the experimental dairy farm (Area 15, Nevada Test Site) was divided into two plots. One plot was planted with Sudan grass while the other had alfalfa already established. When the crops had grown sufficiently, the plots were instrumented with planchets, glass slides, planchet racks and various air samplers as shown in Figure 1.

The aerosol was prepared by sieving bulk diatomaceous earth (DE) through a 400-mesh screen, slurrying 150g in a flask with an alcohol solution containing ^{131}I, and vacuum drying the slurry. Thirty-two flasks containing the tagged aerosol were prepared and used to contaminate the plot by forcing the DE out of nozzles with compressed air. The release occurred at 0058 hours on 18 September 68. During a generation time of 11 minutes, 54.1 mCi was released. The amount of activity released was determined from weight differences in the flasks. Complete aerosol generation procedures and detailed results were published previously.[6]

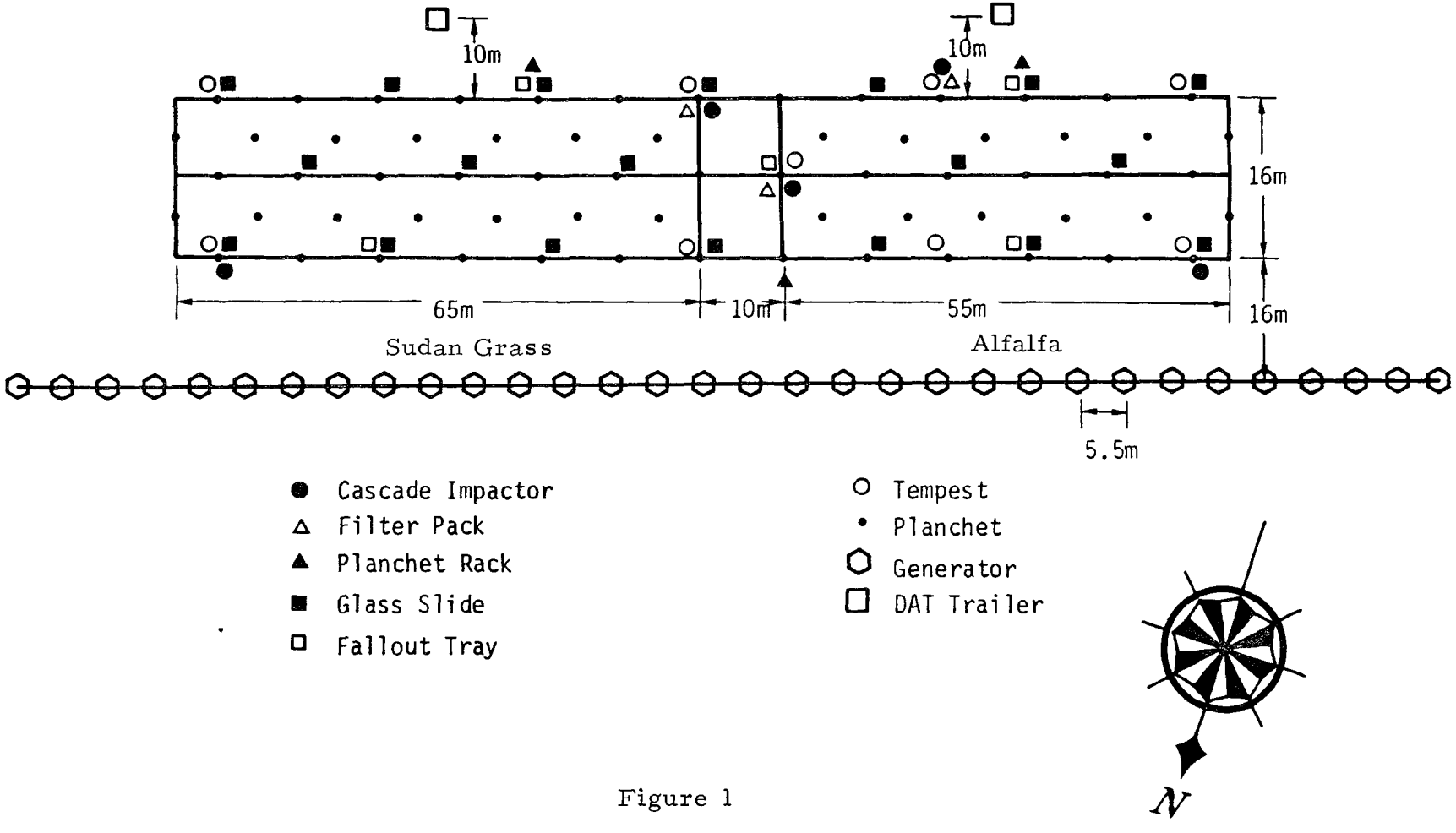

Figure 1

Experimental forage plots and instrumentation

The lactating cows in the dairy herd were divided into four groups and fed chopped fresh forage (green-chop) according to the schedule shown in Table 2. The amount of forage obtained with one pass of the chopper through each contaminated plot was divided into thirds for each cow group. Each experimental cow was then offered a measured amount of contaminated forage, chopped fresh daily, and any residue was weighed to determine the quantity actually consumed. Grain and uncontaminated forage were used to supply the balance of the cows' ration. All of the cows except those assigned to Group IV were milked twice daily and the milk analyzed for ^{131}I. The Group IV cows were used in a special metabolism experiment. The sampling and analytical procedures are included in the previous reports.[2-5]

Subplots in the plots of Sudan grass and alfalfa were used to determine the effective half-life (T_{eff}) of ^{131}I on the two types of forage. The subplots were divided into 70 sections and randomly selected sections sampled. Each sample consisted of all the forage cut from a $0.075 m^2$ circle in the selected section. This sampling was continued for 20 days post-release.

The samples were gamma counted on a system consisting of a NaI (TI) crystal and 200-channel analyzer. The ^{131}I activity in the samples was determined by computer analysis of the gamma spectra obtained from counting.

Table 2. Milk Production and Feeding Regime for Cows Assigned to Project HARE.

Group No.	Cow	Daily Milk Production (liters)	Group Average Daily Milk Production (liters)	Type of Forage	Daily Feed Consumption (kg)	Remarks
I	16 45 47	29.9 22.0 23.3	25.1	Contaminated Sudan	10	Feed gradually increased to 20kg. (Fed uncontaminated Sudan grass for 4 days prior to release)
II	2 13 39	18.4 29.9 22.0	23.4	Contaminated Alfalfa	10	Feed gradually increased to 20kg.
III	21, 27 43, 46 84, 85 87		21.4	Uncontaminated Alfalfa		Control group. Fed only uncontaminated forage
IV	35 36 62	23.7 18.4 16.4	19.5	Contaminated Alfalfa	20	Metabolism group. Fed 10 kg twice daily. Last two days, fed 20 kg twice daily.

III. RESULTS

The average deposition on the Sudan grass, as estimated from the deposition on 35 planchets, was 1.25 $\mu Ci/m^2$. The average deposition on the alfalfa, similarly estimated, was 1.43 $\mu Ci/m^2$. From these data, it was then estimated that 4.7% of the activity released was deposited on the test plots. The air sampler data in Table 3 indicate an average integrated air concentration of 87.5 $\mu Ci\text{-}sec/m^3$ with a prefilter to charcoal activity ratio of 1.08. The average deposition velocity as calculated from planchet data adjacent to the air samplers was 1.6 cm/sec.

Approximately 500 particles on each of 19 glass slides were sized, using the Feret diameter measurement. These data indicated a 0.64 μm count median diameter for the aerosol deposited on the test plots.

The average wind speed during the aerosol release was 4.5 km/h, from 326° true, with a temperature of $51^{\circ}F$ and a relative humidity of 51%.

The analysis of milk from control cows (Group III) and of water, grain, and uncontaminated forage fed to all groups indicated that the deliberately contaminated forage was the only significant source of ^{131}I in the experimental cow groups.

The peak ^{131}I activity concentration in the Sudan forage was 5.75 nCi/kg,

Table 3. Air Sampler Data for Project HARE.

Sampler Number*	Whatman nCi	Charcoal nCi	Microsorban nCi	Total nCi	Whatman / Charcoal Ratio	Integrated Air Concentration μCi-sec/m^3	Deposition Velocity cm/sec
1	349	363	00.925	713	0.961	161	0.86
2	166	208	02.91	377	0.798	82.0	1.4
3	178	242	03.58	424	0.735	86.9	2.1
4	249	202	02.30	453	1.23	98.5	1.4
5	201	171	02.81	375	1.18	76.8	2.3
6	237	219	02.20	458	1.08	93.8	1.3
7	29.2	77.8	00.949	108	0.375	22.1	2.1
8	291	117	00.724	409	2.49	92.1	1.2
9	169	192	03.29	364	0.880	74.6	1.7
			Average		1.08	87.5	1.6

*In Fig. 1, air samplers were numbered left to right and front to rear starting from the side of the plots nearest the generators.

measured on the first feeding offered the Group I cows following the release (Appendix 1-3). The effective half-life for the ^{131}I in the Sudan over the 8-day feeding period was 4.1 ± 0.14 days. With a measured peak milk activity concentration of 47.1 nCi/liter, the calculated milk to forage ratio for Group I was 0.0082. Similar measurements and calculations on the feed and milk of the Group II cows (fed contaminated alfalfa) gave a peak forage activity concentration of 2.28 nCi/kg, an effective half-life in the forage of 6.8 ± 0.73 days, an initial peak milk activity concentration of 32.8 nCi/liter, and a milk to forage ratio of 0.0145 (approximately 2 times greater than that for Group I). The initial peak concentration in milk occurred at 1.25 days in both groups. A second peak activity of 52.6 nCi/liter occurred at 6.25 days in the group fed contaminated alfalfa. The effective half-lives of ^{131}I in milk after the cows' rations were changed to uncontaminated feed were 0.85 and 0.74 days, respectively, for the groups fed Sudan grass or alfalfa. The ^{131}I activity ingested with the forage and the concentration secreted in the milk of the cows in Group I and II are shown in Figure 2 and Appendices 1-1, 1-2 and 1-3. Similar data for the metabolism cows (Group IV) are shown in Figure 3 and Appendices 1-3 and 1-4.

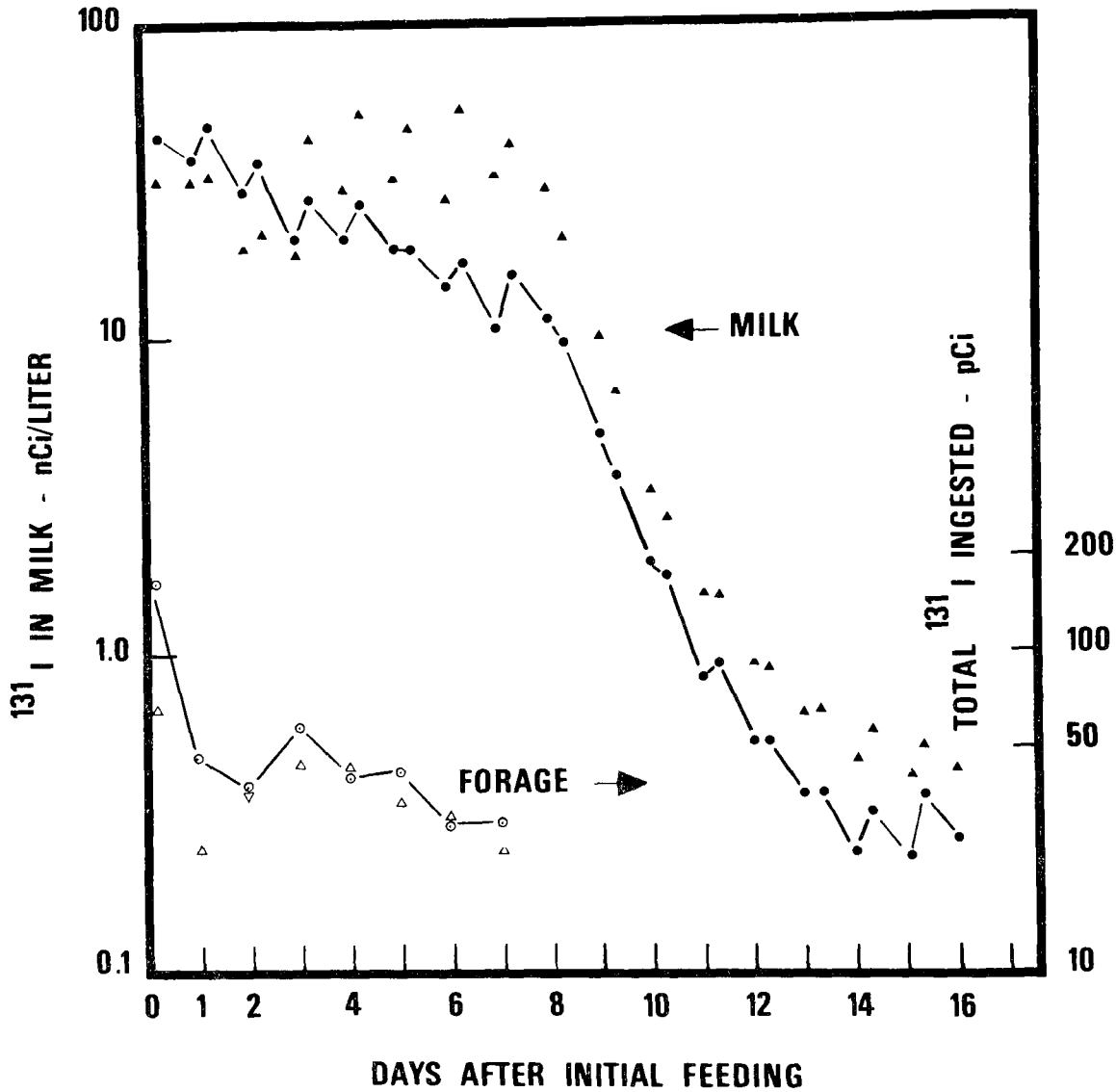

Fig. 2. ^{131}I concentration in milk from cows fed Sudan grass (●–●) or alfalfa (▲ ▲) and total iodine-131 ingested with Sudan grass (o–o) or alfalfa (△ △).

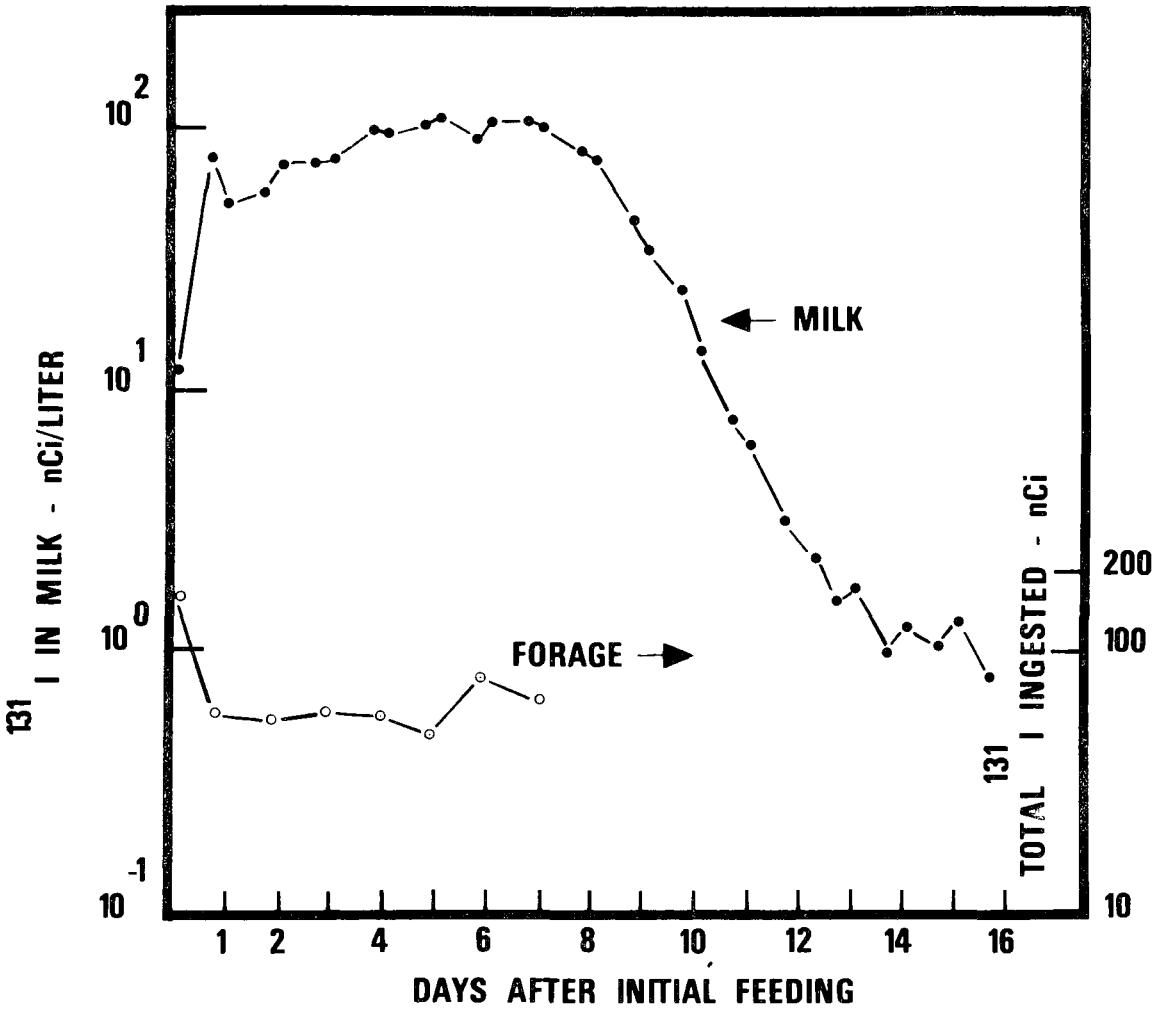

Fig. 3. Average ^{131}I concentration in milk (●—●) and total ingested with alfalfa green chop (o—o) for the metabolism cows.

IV. DISCUSSION

Changing weather introduced an element of complexity in this study. Tests on the crops prior to the experiment indicated that one swath through the experimental plots by the chopper would provide 10 kg/day for each of the three cows in the groups; however, warm weather occuring after the start of the experiment increased the yield to 20 kg/day per cow even though the plots were not irrigated during that period. The principal effect of this increased feed was a positive slope in the ^{131}I concentration in milk during feeding of the cows fed alfalfa green chop (Figure 2). For the cows fed Sudan grass, the effective half-life for iodine-131 in milk during feeding was about 4 days rather than 3 days noted during the Hayseed experiment, possibly a result of the increasing amounts fed.

The results of this experiment, though, indicate that radioiodine is not secreted in milk to the same extent when cows are fed Sudan grass as when they are fed alfalfa. There are three observations that confirm this conclusion. First, even though the total intake was smaller with the alfalfa feed (Figure 2), the iodine-131 in milk was higher than with Sudan grass feeding. Secondly, using only the first peak concentration in milk after start of feeding, the ratio of peak concentration in milk to peak forage concentration was 0.0082 for the Sudan grass feeding and 0.0145 for the alfalfa feeding, almost 2 times higher. Thirdly, the percent of ingested iodine-131 secreted in milk was only 3.6 for the cows fed Sudan grass while it was 7.2 for the cows fed alfalfa, in agreement with the milk/forage ratios.

The data for the metabolism cows (Group IV, alfalfa feed) shown in Appendices 1-3 and 1-4 indicate a milk/forage ratio of 0.029 and a percent in milk of 6.2. These data agree with the Group II data. The milk/forage ratio was twice that for Group II, because the Group IV cows ingested double the amount of feed that Group II ingested.

A similar study conducted by another laboratory [7] showed that feeding Sudan grass to cows after oral doses of radioiodine decreased the percent of radioiodine transferred to milk by half compared to feeding bromegrass. Those authors suggest some chemical compound in the Sudan grass affected the mammary gland, and that the nitrate and cyanide constituents were not the responsible agents. A milk/forage ratio could not be calculated from that report, because oral dosing was used. The decreased percentage excretion, though, confirms the results reported herein.

A change in milk production rate may be excluded as a cause of decreased iodine-131 secretion in this study. The Group I cows (Sudan grass) averaged 25.8 liters/day compared to 25.1 for the month before the experiment while Group II cows (alfalfa) averaged 21.5 liters/day during the experiment as compared to a prior 23.4 liters/day.

Selected parameters summarized from the results of four different studies, in which ^{131}I-labeled DE was used to contaminate growing forage, are shown in Table 4. In both instances where Sudan grass was the source of

iodine-131, the milk to forage ratio and the percent secreted in milk was less than in the three experiments where alfalfa was used as forage.

There are two apparent anomalies in Table 4, the relatively low deposition velocity measured for the Hayseed experiment and the high percent secreted in milk in the Alfalfa experiment. However, the diatomaceous earth used as the carrier aerosol in these experiments has a relatively low bulk density because of the porous nature of the material so the CMD of 23μm measured for Hayseed would indicate an average surface area about 120 times that for the aerosol used for Alfalfa. It was therefore probable that air bouyancy lowered the deposition velocity. Furthermore, one of the four cows used in the Alfalfa experiment consistently secreted 20-30% of ingested radio-iodine in her milk in various experiments and secreted 24% during Alfalfa while the average for the other three cows in that group was only 8.7%.

It is probable that the factor of two difference in the secretion of iodine-131 into milk is a minimum difference as a relatively simple correction of the milk secretion curves for a consistent amount of forage intake (rather than the increasing amount of intake that occurred) suggests a factor of three difference. This difference in the milk/forage ratio can also be obtained if the highest milk concentration in the cows fed alfalfa is used, i.e., 0.0526 μCi/liter ÷ 2.28 μCi/kg is 0.023 versus the 0.0082 for the Sudan grass group. . . .

Table 4. Summary of Parameters for Four Experiments with particulate aerosols*

Experiment	Aerosol CMD (μm)	Average Deposition (μCi/m^2)	Deposition Velocity (cm/sec)	Type of Forage	Peak Forage (μCi/kg)	Peak Milk (μCi/liter)	Milk/ Forage Ratio	Percent in Milk
HARE	0.64	1.25	1.6	Sudan	5.74	0.0471	0.0082	3.6
		1.43	1.6	Alfalfa	2.28	0.033	0.014	7.2
Hayseed	23	3.13	1.3	Sudan	2.7	0.022	0.0081	2.
Alfalfa	2	4.66	2.4	Alfalfa	3.4	0.109	0.032	12.5
SIP	0.13	1.63	0.92	Alfalfa	1.13	0.0695	0.062	7.5

*Milk data based on cows fed fresh green-chop daily.

CONCLUSIONS

Based on the conditions of this experiment, the following conclusions may be derived from the results.

1. Cows fed ^{131}I-contaminated Sudan grass secrete half as much of the iodine in their milk as do cows fed similarly contaminated alfalfa.

2. Both the ratio of peak concentration in milk to peak concentration in ingested forage and the total percent recovered in milk in 16 days are reduced by half if Sudan grass rather than alfalfa is the source of radioiodine.

3. The cause of this effect of Sudan grass on milk secretion of iodine is speculative at this time. There are several possibilities, e.g., comparative digestibility of the forages, chemical binding of the iodine, and chemical blocking of the mammary secretory process are likely candidates.

4. The particle size of the ^{131}I-labeled aerosols used in these experiments appears to exert some influence on the milk/forage ratio, but its effect is not as conclusive as is the species of forage.

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Appendix 1-1. ^{131}I Concentration in Milk, Cows fed Sudan grass (Group I)

	Cow 16		Cow 45		Cow 47		Weighted Average
Time*	nCi/liter	liters	nCi/liter	liters	nCi/liter	liters	nCi/liter
0.27	55.7	13.6	33.4	8.8	37.6	12.7	43.5
0.93	42.6	20.2	26.9	14.9	41.1	14.5	37.4
1.27	62.3	11.4	32.2	9.2	44.4	12.7	47.1
1.94	34.9	18.9	19.2	13.2	31.3	18.0	29.4
2.27	39.7	11.0	20.2	7.0	43.3	9.7	36.0
2.95	24.0	21.9	14.1	13.6	22.8	16.7	21.0
3.28	34.6	10.5	18.9	9.2	29.2	14.0	28.0
3.96	23.2	21.1	12.0	13.6	23.5	14.5	20.1
4.27	26.9	10.5	20.8	7.0	31.0	10.0	26.9
4.97	19.7	20.2	12.4	14.9	25.5	15.4	19.3
5.28	23.2	11.4	11.9	7.9	20.5	9.2	19.1
5.92	17.0	17.1	9.3	14.0	17.1	18.0	14.8
6.29	20.5	13.6	12.7	7.9	17.0	10.1	17.4
6.94	12.1	18.4	6.6	13.2	13.1	15.8	10.9
7.29	19.3	9.7	11.2	8.8	17.0	11.4	16.0
7.94	13.1	19.8	6.5	13.2	13.5	15.8	11.4
8.27	10.3	13.2	6.1	7.5	12.1	8.8	9.8
8.95	4.9	16.2	2.3	12.7	7.2	15.8	5.0
9.28	3.5	11.0	1.7	7.0	5.5	8.3	3.6
9.94	1.7	18.0	0.78	13.6	3.3	14.5	1.9
10.29	1.4	11.4	0.82	6.1	2.7	11.0	1.8
10.94	0.64	19.3	0.42	11.9	1.5	14.0	0.84
11.29	0.71	11.0	0.55	7.9	1.4	10.5	0.93
11.93	0.39	21.9	0.30	11.9	0.99	15.8	0.56
12.29	0.44	11.9	0.30	6.6	0.79	9.2	0.52
12.93	0.32	21.9	0.24	11.0	0.49	16.2	0.36
13.3	0.26	11.4	0.28	6.1	0.50	11.0	0.36
13.94	0.15	18.0	0.19	11.4	0.35	15.8	0.23
14.28	0.22	11.0	0.21	4.0	0.45	10.5	0.32
15.06	0.27	19.3	0.24	13.6	0.15	14.9	0.22
15.28	0.22	7.9	0.23	5.3	0.53	8.8	0.34
15.94	0.18	18.4	0.23	11.0	0.37	14.5	0.26

Total in Milk 16.5 μCi

* Days after initial feeding.

Appendix 1-2. ^{131}I Concentration in Milk, Cows fed Alfalfa (Group II)

Time*	Cow 2		Cow 13		Cow 39		Weighted Average
	nCi/liter	liters	nCi/liter	liters	nCi/liter	liters	nCi/liter
0.26	33.3	6.6	18.9	15.8	51.0	9.7	31.5
0.92	29.1	12.7	20.4	22.4	51.0	14.9	31.7
1.28	29.8	7.5	20.1	13.2	56.0	8.3	32.8
1.93	17.8	12.7	12.1	19.8	30.2	15.8	19.5
2.26	23.4	6.6	12.9	12.7	33.1	8.8	21.6
2.94	16.1	13.6	11.9	22.8	31.4	15.8	18.8
3.26	36.9	6.6	23.2	12.7	74.1	9.7	43.3
3.94	26.7	13.6	19.1	25.5	47.6	17.6	29.7
4.26	37.0	5.7	32.9	12.3	90.8	7.9	51.4
4.94	23.1	14.0	26.2	20.2	48.5	15.8	32.3
5.26	34.0	6.1	26.0	12.7	81.8	9.2	46.0
5.91	23.1	10.5	16.5	19.8	45.7	14.9	27.6
6.28	35.4	7.0	31.1	12.7	91.7	10.1	52.6
6.92	32.0	12.3	22.7	20.6	45.9	15.4	32.4
7.28	37.9	7.5	23.8	12.3	65.4	8.8	40.2
7.94	29.2	11.4	17.9	21.9	47.9	14.9	29.8
8.27	21.1	5.3	14.0	11.0	29.9	8.8	21.0
8.95	9.8	12.3	7.9	19.8	13.5	14.0	10.0
9.28	6.4	7.0	5.6	12.7	8.8	8.8	6.8
9.94	2.3	10.5	3.3	19.8	3.8	15.4	3.3
10.29	1.7	4.8	3.0	10.1	2.9	6.6	2.7
10.94	0.96	12.3	1.6	20.2	2.0	15.4	1.6
11.29	0.74	6.6	1.3	7.0	2.4	7.9	1.5
11.93	0.43	12.3	1.0	16.7	1.2	14.9	0.93
12.29	0.42	5.7	0.82	6.6	1.3	8.8	0.90
12.93	0.38	14.0	0.61	21.1	0.89	18.4	0.64
13.30	0.28	7.0	0.44	7.9	1.2	7.9	0.65
13.94	0.21	10.1	0.32	17.1	0.80	14.0	0.46
14.28	0.28	6.1	0.29	9.7	1.0	9.7	0.56
15.06	0.23	12.7	0.20	20.6	0.81	16.7	0.41
15.28	0.29	4.8	0.25	6.1	1.2	6.6	0.60
15.94	0.19	11.9	0.26	19.8	0.84	14.9	0.42

Total in Milk 21.9 μCi

*Days after initial feeding.

Appendix 1-3. ^{131}I in Cow Feed

Time hours	kg	nCi/kg	kg	nCi/kg	kg	nCi/kg	Daily Intake µCi
			Group I - Sudan grass				
	Cow 16		Cow 45		Cow 47		
0	10	7.78	9.5	4.95	10	4.47	16.90
23	12	1.32	12	1.42	8.3	1.78	47.6
47	15	1.10	15	0.88	9.3	1.0	38.9
71	20	0.85	20	1.04	18	1.21	59.5
95	20	0.45	20	0.56	18	1.16	41.1
119	20	0.84	20	0.65	18	0.72	42.7
142	20	0.55	20	0.44	18	0.52	29.1
166	20	0.44	20	0.51	18	0.59	29.6
					Total Intake		458 µCi
			Group II - Alfalfa				
	Cow 2		Cow 13		Cow 39		
0	10	2.73	9.8	2.52	9.7	2.11	67.4
23	12	0.60	12	0.75	12	0.67	24.1
47	11.5	0.93	12	0.91	13.8	1.07	36.3
71	18	0.92	20	0.94	20	0.49	45.0
95	19	0.76	19	0.84	20	0.69	44.1
119	20	0.65	19	0.33	20	0.70	33.3
142	19	0.46	20	0.52	20	0.55	30.0
166	19	0.49	19	0.35	20	0.38	23.5
					Total Intake		304 µCi

Appendix 1-3. ^{131}I in Cow Feed - Cont'd

Time hours	kg	nCi/kg	kg	nCi/kg	kg	nCi/kg	Daily Intake µCi
			Group IV (Metabolism) - Alfalfa				
	Cow 35		Cow 36		Cow 62		
0	10	3.23	10	2.78	9.3	2.51	
25	10	3.31	10	2.80	10	1.93	164
18.6	10	0.84	10	1.07	9.2	1.25	
22.7	10	0.93	10	0.94	10	0.82	58.2
42.9	12	0.97	11.6	0.70	7.7	0.92	
48.9	12.4	0.78	11.6	0.72	12.1	0.84	54.9
67.4	12	0.88	11.5	0.86	10	0.85	
72.9	12	0.85	11.5	0.96	10	0.92	59.2
92.4	11.5	0.76	10.5	0.93	10.5	0.79	
98.2	11.5	0.85	10.5	0.94	10.5	0.98	56.8
115.6	9	0.86	10.5	0.92	8.5	0.89	
118.8	9	0.76	10.5	0.93	8.5	0.74	47.8
138.8	20	0.72	20	0.49	20	0.81	
144.3	20	0.54	20	0.65	20	0.84	80.7
163.8	20	0.53	20	0.56	20	0.67	
167.3	20	0.58	20	0.52	20	0.41	64.8
					Total Intake		585 µCi

Appendix 1-4. ^{131}I Concentration in Milk, Cows fed Alfalfa (Group IV)

Time*	Cow 35		Cow 36		Cow 62		Weighted Avg.
	nCi/liter	Liters	nCi/liter	Liters	nCi/liter	Liters	nCi/liter
0.1	10.1	4.2	16.3	4.8	9.7	4.0	12.2
0.76	73.7	10.5	100	10.9	62.3	10.2	79.1
1.10	69.8	8.6	95.8	7.8	54.5	4.9	52.4
1.76	46.2	16.1	74.0	15.4	48.6	13.2	58.0
2.10	99.6	7.4	70.4	8.8	41.5	4.3	74.8
2.76	89.6	9.1	77.7	1.3	64.4	10.8	76.0
3.10	68.5	3.0	98.3	5.0	61.7	3.1	79.9
3.76	121	10.4	104	11.3	77.7	10.0	100.8
4.08	93.5	3.8	-	-	110	2.7	98.8
4.82	77.4	10.1	118	12.0	115	9.5	104
5.10	80.2	4.5	142	5.0	115	3.2	113
5.82	65.7	10.1	126	10.2	91.6	11.0	94.0
6.11	75.0	5.0	160	4.0	103	4.2	110
6.80	80.6	10.2	143	11.0	105	11.5	110
7.10	86.3	5.4	128	5.1	105	4.7	103
7.82	63.1	11.0	107	11.2	89.7	10.8	86.4
8.10	52.1	4.3	96.7	4.5	87.4	4.0	78.8
8.82	29.5	10.0	54.3	11.0	53.0	10.5	46.0
9.10	20.8	4.5	48.0	5.0	-	-	35.1
9.76	15.3	11.0	28.0	11.4	30.9	11.9	24.9
10.10	7.0	5.3	14.0	7.0	21.7	5.7	14.3
10.72	3.5	12.3	9.7	11.9	10.3	13.2	7.8
11.10	3.1	6.6	7.3	7.9	8.6	5.7	6.3
11.72	1.3	13.2	3.4	12.7	5.1	13.2	3.3
12.01	1.5	9.7	3.1	6.6	2.8	6.1	2.3
12.72	0.92	13.2	1.6	13.2	2.3	11.4	1.6
13.10	1.4	7.0	1.8	6.6	2.0	7.9	1.7
13.72	0.64	12.3	1.1	11.9	1.2	11.9	0.98
14.10	0.87	5.3	1.1	7.9	1.6	7.5	1.2
14.72	0.79	13.6	1.3	13.2	1.0	13.2	1.0
15.10	1.1	4.4	1.3	5.7	1.5	4.8	1.3
15.72	0.82	11.9	0.80	11.9	0.76	12.7	0.79

Total in Milk 36.5 μCi

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