CH PROGRAMME NO. 54
STUDY OF MATERIAL DETERIORATION)

sponsored by
ADVANCED RESEARCH PROJECTS AGENCY (ARPA), U.S. DEPARTMENT OF DEFENSE

conducted by
APPLIED SCIENTIFIC RESEARCH CORPORATION OF THAILAND
under U.S. Army Contract DAJB 29-70-C-0086

with the cooperation of
MILITARY RESEARCH AND DEVELOPMENT CENTER (MRDC)

PRESERVED FOOD SERIES

REPORT NO. 5
COMBAT AND SURVIVAL RATIONS

BY
KAEW NUALCHAWEE
WILLIAM G. PREWETT
ENVIRONMENTAL AND ECOLOGICAL RESEARCH INSTITUTE

ASRCT, BANGKOK 1974
not for publication

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EXPOSURE TESTING (STUDY OF MATERIAL DETERIORATION)

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F O R E W O R D

The work reported herein is part of a research programme called "Exposure Testing", or "Study of Material Deterioration". This programme is sponsored by the Advanced Research Projects Agency (ARPA) under ARPA Contract number DAJB 29-7-C-0086 and modification number DAJB 29-70-C-0086-P00003. The establishment of exposure testing facilities and performing of the programme by the Applied Scientific Research Corporation of Thailand (ASRCT) is done in cooperation with Military Research and Development Center (MRDC). MRDC acts as the medium in determining the Royal Thai Armed Services requirements and establishing test priorities in consonance with ARPA to develop MRDC R & D management capability. Under this cooperation, the Royal Thai Government agencies will supply ASRCT with test materials along with their test requirements. According to priorities ASRCT then perform the exposure test on the selected materials within its own capability. This will open a valuable link to the knowledge of material degradation in South-East Asian tropics.

The project has set out with 8 catagories of test materials. They are:

1. Textiles, natural fibres,
2. textiles, synthetic fibres,
3. paints,
4. leather and leather products,
5. preserved foods,
6. timbers and timber products,
7. ropes, natural and synthetics,
8. pharmaceuticals.

Material under the mentioned catagories is exposed at the exposure site with several withdrawal dates. Reports of this kind will be written at each withdrawal, and a final one will then be written following the final withdrawal.

COMBAT AND SURVIVAL RATIONS

By Kaew Nualchawee* and William G. Prewett*

SUMMARY

A number of different kinds of preserved foods was supplied to us for use as test specimens for the Exposure Testing Programme by the Preserved Food Organization. These preserved foods were put on shelves prepared to simulate actual storage, as supposed to be exercized by the Armed Forces, to determine the shelf life of each kind of food under the prevailing conditions.

Physical examinations of food containers, weighing, and microorganism tests were conducted before exposure in the same way as they were carried out after exposure.

Microbiological test, included total aerobic count, mold count, coliform test, and anaerobic test. Total aerobic count and mold count were mostly positive but coliform test and anaerobic test were negative or non-detectable before exposure. Others were only slight increases in mold count, and total anaerobic test detected in the tests carried out after exposure.

Physical examinations showed that most preserved foods in bags are likely to be attacked by insects, especially ants, and rodents, such as mice. In most cases weight increases were observed, only a few specimens showed decrease in weight.

INTRODUCTION

The Armed Forces have learned by experience over a long period of time that degradation and deterioration of materials under natural environmental exposure create problems for equipment and material designers. Much is still unknown about the characteristic of material deterioration and degradation under prevailing conditions in the tropics.

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The governments of the United States, the United Kingdom, and Australia have operated for sometime establishments for the study of material deterioration in the natural environment. Although laboratory test centres are designed to duplicate the so-called typical tropical environment, the South-East Asian environment continues to prove itself unique in many ways, and material failure and deterioration remain a problem.

By contract with the U.S. Advanced Research Projects Agency (ARPA), ASRCT has employed Sakaerat Experiment Station to serve as an exposure test centre to back up its laboratory test facilities in Bangkok. Exposure of materials and laboratory results should provide information needed to detect and control or prevent undesirable loss of function and effectiveness of military end items.

Through the Military Research and Development Center (MRDC), the Preserved Food Organization of Thailand has asked ASRCT to subject preserved foods to exposure testing. The purpose of this test was primarily for shelf life testing. Therefore different conditions have been provided for storage of test items, namely, a shelter in the cleared site, a shelter in the jungle site, and an air-conditioned room. Test samples were supplied by the Preserved Food Organization, and the list of the test samples is shown under the Materials and Methods of Exposure.

This report covers the results of tests carried out before exposure, and after the first withdrawal. The period of exposure, up until the first withdrawal, was from 17 July 1971-17 October 1971.

MATERIALS AND METHODS OF EXPOSURE

Preserved foods used as test specimens were supplied by the Preserved Food Organization. They came under 3 different catagories, as:

1. Canned food,
2. combat rations, and
3. survival rations.

Test items were delivered to ASRCT on 3 June 1971. Part of these foods was delivered to MRDC and stored there for some 3 months before they arrived at ASRCT. It is obvious, then, that the gap between delivery date and exposure date is of some three months or more, without taking into account how long the preserved foods were stored at the Preserved Food Organization after the date of manufacture. For this particular withdrawal, "exposure period 17 July-17 October 1971", the preserved foods consist of:

1. Dehydrated cooked rice
2. Banana jam
3. Survival ration # 1 in bar type
4. Survival ration # 2 in bar type
5. Survival ration # 2 in powder type
6. Survival ration # 3 in bar type
7. Survival ration # 3 in powder type
8. Survival ration # 4 in bar type
9. Survival ration # 4 in powder type

All test items are packaged in separate sealed containers according to types. The types of packages are as follows: laminated paper for dehydrated cooked rice, plastic bags for banana jam, and aluminum foil for all survival rations.

METHODS OF EXPOSURE

The purpose of determining shelf life of preserved food dictates the method of exposure. Each package of test items was labelled according to type, replicate number, location of exposure withdrawal number and put in cardboard boxes for storage in shelters simulating field depots, i.e. a depot in a clearing, a depot in a jungle, and one with an air-conditioned room (this air-conditioned room being used to store control samples). The storage facilities were designed and constructed to duplicate army field storage conditions. Temperature and humidity are recorded simultaneously in each storage depot. Rainfall, sunshine duration, temperature, and humidity are recorded outside the shelters.

METHOD OF TESTS AND RESULTS

The preserved foods in general were tested for:

1. Visual changes
2. Weight changes
3. Microbiological growth
4. pH test.

All types of preserved foods were subjected to the first 3 tests. Only those in liquid or partially liquid form, such as canned foods, were subjected to all 4 tests.

Visual observations were made in order to check for physical defects of food containers. This was done before and after exposure. Only test items believed to have been protected with good containers were exposed. They were re-examined at the end of the exposure period to assess defects of containers that might have been caused during the exposure period through attack by insects and rodents, or in the course of delivery to and from the exposure site. The defects in containers, once occurred, could be expected to admit microorganisms into the rations, lead to changes in the rations' properties.

Every test item was labelled and weighed before exposure. They were weighed again after exposure to determine weight changes. Physical conditions of food containers and weight changes together could be used as means to evaluate the causes of deterioration of preserved foods.

Microbiological growth test is a direct means to check if the food is contaminated by microorganisms. The tests included aerobic count and mold count which show the density of population of aerobic bacteria and mold in the test sample. Qualitative tests for anaerobic and coliform bacteria were made.

No pH tests were made on the combat and survival rations. Rations which we have withdrawn for this test are listed below. The results of tests follow.

TABLE 1. WEIGHT CHANGES

Code number	Description	Original weight (14 July 71)	Final weight (19 Oct. 71)	Weight change	%
5-2-1-aA1	Dehydrated cooked rice	213.60	215.52	+ 1.92	0.89
aA2	"	206.42	207.75	+ 1.33	0.64
aA3	"	207.24	208.43	+ 1.19	0.57
aA4	"	215.21	217.95	+ 2.75	1.27
5-2-1-IuaA1	Dehydrated cooked rice	236.17	239.34	+ 3.17	1.34
IuaA2	"	222.10	224.53	+ 2.43	1.09
IuaA3	"	224.13	227.18	+ 3.05	1.36
IuaA4	"	229.34	231.92	+ 2.58	1.12
5-2-1-ILaA1	Dehydrated cooked rice	219.19	222.00	+ 2.81	1.28
ILaA2	"	217.58	219.83	+ 2.25	1.03
ILaA3	"	225.90	227.98	+ 2.08	0.92
ILaA4	"	220.79	223.21	+ 2.42	1.09
5-2-1-IIuaA1	Dehydrated cooked rice	217.17	222.81	+ 5.64	2.59
IIuaA2	"	222.66	225.71	+ 3.05	1.37
IIuaA3	"	208.40	213.15	+ 4.75	2.28
IIuaA4	"	216.36	219.58	+ 3.22	1.50
5-2-1-IILaA1	Dehydrated cooked rice	205.85	209.43	+ 3.58	1.74
IILaA2	"	206.05	210.12	+ 4.07	1.97
IILaA3	"	234.62	241.80	+ 7.18	3.06
IILaA4	"	223.95	231.37	+ 7.42	3.31
5-2-4-aA1	Banana jam	30.10	30.13	+ 0.03	0.09
aA2	"	30.05	30.10	+ 0.05	0.16
aA3	"	31.60	31.64	+ 0.04	0.13
aA4	"	23.31	23.55	+ 0.24	2.03
5-2-4-IuaA1	Banana jam	27.90	29.32	+ 1.42	5.08
IuaA2	"	25.62	27.01	+ 1.39	5.42
IuaA3	"	28.61	29.07	+ 0.46	1.61
IuaA4	"	28.60	29.27	+ 0.67	2.34
5-2-4-ILaA1	Banana jam	30.60	30.97	+ 0.37	1.21
ILaA2	"	30.54	30.93	+ 0.39	1.27
ILaA3	"	29.18	29.71	+ 0.53	1.82
ILaA4	"	29.26	30.01	+ 0.75	2.56

TABLE 1. continued.

Code number	Description	Original weight (14 July 71)	Final weight (19 Oct. 71)	Weight change	%
5-2-4-IIuaA1	Banana jam	29.10	29.51	+ 0.41	1.41
IIuaA2	"	26.55	27.14	+ 0.59	2.22
IIuaA3	"	22.17	23.01	+ 0.84	3.78
IIuaA4	"	33.90	36.90	+ 3.00	8.85
5-2-4-IILaA1	Banana jam	28.35	28.87	+ 0.52	1.83
IILaA2	"	27.48	28.61	+ 1.13	4.11
IILaA3	"	37.00	37.54	+ 0.54	1.46
IILaA4	"	27.65	28.20	+ 0.55	1.98
5-3-1-aA1	Survival ration # 1 (bar)	69.35	69.77	+ 0.62	0.89
aA2	"	61.59	62.15	+ 0.56	0.81
aA3	"	60.70	61.19	+ 0.49	0.81
aA4	"	65.32	65.97	+ 0.65	0.99
5-3-1-IuaA1	Survival ration # 1 (bar)	62.92	64.20	+ 1.28	2.03
IuaA2	"	57.21	58.48	+ 1.27	2.22
IuaA3	"	57.40	58.46	+ 1.06	1.85
IuaA4	"	65.37	65.69	+ 0.32	0.50
5-3-1-ILaA1	Survival ration # 1 (bar)	67.00	68.51	+ 1.51	2.25
ILaA1	"	58.65	59.52	+ 0.87	1.48
ILaA3	"	59.14	59.87	+ 0.73	1.23
ILaA4	"	57.50	58.39	+ 0.89	1.55
5-3-1-IIuaA1	Survival ration # 1 (bar)	59.04	60.18	+ 1.14	1.93
IIuaA2	"	61.27	62.68	+ 1.41	2.30
IIuaA3	"	61.47	62.50	+ 1.03	1.67
IIuaA4	"	57.90	59.35	+ 1.45	2.50
5-3-1-IILaA1	Survival ration # 1 (bar)	63.94	64.93	+ 0.99	1.55
IILaA2	"	60.70	61.75	+ 1.05	1.73
IILaA3	"	61.39	62.90	+ 0.51	0.83
IILaA4	"	60.42	62.07	+ 1.65	2.73
5-3-2-aA1	Survival ration # 2 (bar)	61.67	62.35	+ 0.68	1.10
aA2	"	58.32	58.32	+ 0.0	0.0
aA3	"	60.82	61.00	+ 0.18	0.29
aA4	"	67.20	67.78	+ 0.58	0.86

TABLE 1. continued.

Code number	Description	Original weight (14 July 71)	Final weight (19 Oct. 71)	Weight change	%
5-3-2-IuaA1	Survival ration # 2 (bar)	62.31	62.61	+ 0.30	0.48
IuaA2	"	64.30	64.62	+ 0.32	0.49
IuaA3	"	66.73	67.81	+ 1.08	1.62
IuaA4	"	62.11	62.41	+ 0.30	0.48
5-3-2-ILaA1	Survival ration # 2 (bar)	64.45	64.56	+ 0.11	0.17
ILaA2	"	60.50	60.70	+ 0.20	0.33
ILaA3	"	63.62	63.70	+ 0.08	0.12
ILaA4	"	71.07	71.88	+ 0.81	1.14
5-3-2-IIuaA1	Survival ration # 2 (bar)	54.69	55.18	+ 0.49	0.89
IIuaA2	"	60.36	60.50	+ 0.14	0.23
IIuaA3	"	60.83	60.90	+ 0.07	0.01
IIuaA4	"	58.38	58.40	+ 0.02	0.03
5-3-3-IILaA1	Survival ration # 2 (bar)	59.76	60.31	+ 0.55	0.92
IILaA2	"	65.38	65.56	+ 0.18	0.27
IILaA3	"	58.00	58.10	+ 0.10	0.17
IILaA4	"	60.66	60.96	+ 0.30	0.49
5-3-3-aA1	Survival ration # 2 (powder)	58.89	59.19	+ 0.30	0.51
aA2	"	54.98	54.99	+ 0.01	0.018
aA3	"	53.53	53.55	+ 0.02	0.037
aA4	"	56.64	56.90	+ 0.26	0.46
5-3-3-IuaA1	Survival ration # 2 (powder)	54.39	54.47	+ 0.06	0.11
IuaA2	"	57.14	57.23	+ 0.09	0.15
IuaA3	"	58.20	58.69	+ 0.49	0.84
IuaA4	"	55.33	55.36	+ 0.03	0.05
5-3-3-ILaA1	Survival ration # 2 (powder)	56.08	56.92	+ 0.84	1.49
ILaA2	"	55.40	55.60	+ 0.20	0.36
ILaA3	"	64.49	64.43	- 0.06	- 0.09
ILaA4	"	55.87	56.40	+ 0.53	0.95
5-3-3-IIuaA1	Survival ration # 2 (powder)	54.48	54.62	+ 0.14	0.25
IIuaA2	"	57.19	57.75	+ 0.56	0.98
IIuaA3	"	58.52	58.73	+ 0.21	0.36
IIuaA4	"	55.00	55.07	+ 0.07	0.13

TABLE 1. continued.

Code number	Description	Original weight (14 July 71)	Final weight (19 Oct. 71)	Weight change	%
5-3-3-IILaA1	Survival ration # 2 (powder)	59.19	59.20	+ 0.01	0.017
IILaA2	"	58.38	58.60	+ 0.22	0.37
IILaA3	"	58.44	59.00	+ 0.56	0.96
IILaA4	"	56.00	56.40	+ 0.40	0.71
5-3-4-aA1	Survival ration # 3 (bar)	54.50	54.56	+ 0.06	0.11
aA2	"	62.28	62.22	- 0.06	- 0.09
aA3	"	65.56	65.62	+ 0.06	0.09
aA4	"	57.05	57.08	+ 0.03	0.05
5-3-4-IuaA1	Survival ration # 3 (bar)	62.56	63.30	+ 0.74	1.18
IuaA2	"	55.60	55.63	+ 0.03	0.05
IuaA3	"	55.78	55.79	+ 0.01	0.02
IuaA4	"	58.01	58.20	+ 0.19	0.33
5-3-4-ILaA1	Survival ration # 3 (bar)	55.40	55.61	+ 0.21	0.38
ILaA2	"	58.72	58.85	+ 0.13	0.22
ILaA3	"	61.84	62.10	+ 0.26	0.42
ILaA4	"	55.07	55.35	+ 0.28	0.51
5-3-4-IIuaA1	Survival ration # 3 (bar)	59.84	60.03	+ 0.19	0.32
IIuaA2	"	56.16	56.40	+ 0.24	0.43
IIuaA3	"	55.45	56.00	+ 0.55	0.99
IIuaA4	"	54.70	55.00	+ 0.30	0.55
5-3-4-IILaA1	Survival ration # 3 (bar)	55.17	55.40	+ 0.23	0.42
IILaA2	"	56.49	57.03	+ 0.54	0.95
IILaA3	"	55.80	56.23	+ 0.43	0.77
IILaA4	"	68.72	69.28	+ 0.56	0.81
5-3-5-aA1	Survival ration # 3 (powder)	56.52	Missing	-	-
aA2	"	58.92	58.90	- 0.02	- 0.03
aA3	"	61.43	61.40	- 0.03	- 0.05
aA4	"	57.91	58.08	+ 0.17	0.29
5-3-5-IuaA1	Survival ration # 3 (powder)	57.81	57.91	+ 0.10	0.17
IuaA2	"	59.43	59.96	+ 0.53	0.89
IuaA3	"	60.78	60.98	+ 0.20	- 0.33
IuaA4	"	63.48	63.42	- 0.06	- 0.09

TABLE 1. continued.

Code number	Description	Original weight (14 July 71)	Final weight (19 Oct. 71)	Weight change	%
5-3-5-ILaA1	Survival ration # 3 (powder)	63.02	63.02	0.0	0.0
ILaA2	"	58.92	59.29	+ 0.37	0.63
ILaA3	"	59.92	59.97	+ 0.05	0.83
ILaA4	"	55.09	55.88	+ 0.79	1.43
5-3-5-IIuaA1	Survival ration # 3 (powder)	57.45	57.52	+ 0.07	0.12
IIuaA2	"	64.87	64.94	+ 0.07	0.11
IIuaA3	"	61.00	61.40	+ 0.40	0.66
IIuaA4	"	63.46	63.50	+ 0.04	0.06
5-3-5-IILaA1	Survival ration # 3 (powder)	57.62	57.76	+ 0.14	0.24
IILaA2	"	59.45	59.52	+ 0.07	0.12
IILaA3	"	58.78	58.97	+ 0.19	0.32
IILaA4	"	56.59	56.78	+ 0.19	0.33
5-3-6-aA1	Survival ration # 4 (bar)	64.90	64.90	+ 0.0	0.0
aA2	"	62.92	63.80	+ 0.88	1.40
aA3	"	62.76	Missing	-	-
aA4	"	60.70	61.25	+ 0.55	0.91
5-3-6-IuaA1	Survival ration # 4 (bar)	62.89	65.70	+ 2.81	4.47
IuaA2	"	60.55	61.71	+ 1.16	1.91
IuaA3	"	60.70	61.60	+ 0.90	1.48
IuaA4	"	59.18	60.27	+ 1.09	1.84
5-3-6-ILaA1	Survival ration # 4 (bar)	62.72	63.38	+ 0.66	1.05
ILaA2	"	60.91	61.87	+ 0.96	1.58
ILaA3	"	62.20	63.07	+ 0.87	1.40
ILaA4	"	58.42	59.45	+ 1.03	1.76
5-3-6-IIuaA1	Survival ration # 4 (bar)	59.89	62.38	+ 2.49	4.15
IIuaA2	"	57.81	59.09	+ 1.28	2.21
IIuaA3	"	61.81	63.60	+ 1.79	2.89
IIuaA4	"	60.20	61.68	+ 1.48	2.45
5-3-6-IILaA1	Survival ration # 4 (bar)	67.25	70.11	+ 2.86	4.25
IILaA2	"	64.40	64.49	+ 0.09	0.14
IILaA3	"	58.11	59.31	+ 1.20	2.06
IILaA4	"	67.20	68.60	+ 1.40	2.08

TABLE 1. continued.

Code number	Description	Original weight (14 July 71)	Final weight (19 Oct. 71)	Weight change	%
5-3-7-aA1	Survival ration # 4 (powder)	61.50	62.21	+ 0.71	1.14
aA2	"	61.61	62.60	+ 0.99	1.61
aA3	"	68.11	69.12	+ 1.01	1.48
aA4	"	63.30	63.89	+ 0.59	0.93
5-3-7-IuaA1	Survival ration # 4 (powder)	56.70	57.19	+ 0.49	0.86
IuaA2	"	54.31	54.53	+ 0.42	0.40
IuaA3	"	55.36	56.20	+ 0.84	1.51
IuaA4	"	56.67	56.81	+ 0.14	0.25
5-3-7-ILaA1	Survival ration # 4 (powder)	55.08	55.12	+ 0.04	0.07
ILaA2	"	53.50	53.80	+ 0.30	0.54
ILaA3	"	55.01	55.07	+ 0.06	0.11
ILaA4	"	59.92	60.00	+ 0.08	0.13
5-3-7-IIuaA1	Survival ration # 4 (powder)	64.18	65.69	+ 1.51	2.35
IIuaA2	"	64.69	66.79	+ 2.10	3.25
IIuaA3	"	67.70	70.18	+ 2.48	3.66
IIuaA4	"	63.82	65.99	+ 2.17	3.40
5-3-7-IILaA1	Survival ration # 4 (powder)	61.76	64.71	+ 2.95	4.77
IILaA2	"	67.17	68.68	+ 1.51	2.25
IILaA3	"	65.40	66.45	+ 1.05	1.60
IILaA4	"	61.38	63.18	+ 1.80	2.93

TABLE 2. VISUAL OBSERVATIONS

Code number	Description	Type of material	Type of packaging	Defect of package
5-2-1-1	Dehydrated cooked rice	Food	Paper bag	-
2	"	"	"	-
3	"	"	"	-
4	"	"	"	-
5-2-4-1	Banana jam (bag)	Dessert	Plastic bag	-
2	"	"	"	-
3	"	"	"	-
4	"	"	"	-
5-3-1-1	Survival ration # 1 (bar)	Food	Aluminum foil	Ant attacked
2	"	"	"	-
3	"	"	"	-
4	"	"	"	-
5-3-2-1	Survival ration # 2 (bar)	Food	Aluminum foil	-
2	"	"	"	Ant attacked
3	"	"	"	"
4	"	"	"	-
5-3-3-1	Survival ration # 2 (powder)	Food	Aluminum foil	-
2	"	"	"	-
3	"	"	"	-
4	"	"	"	-
5-3-4-1	Survival ration # 3 (bar)	Food	Aluminum foil	-
2	"	"	"	-
3	"	"	"	Ant attacked
4	"	"	"	Ant attacked
5-3-5-1	Survival ration # 3 (powder)	Food	Aluminum foil	-
2	"	"	"	-
3	"	"	"	-
4	"	"	"	-
5-3-6-1	Survival ration # 4 (bar)	Food	Aluminum foil	Ant attacked
2	"	"	"	-
3	"	"	"	-
4	"	"	"	Ant attacked

TABLE 2. continued.

Code number	Description	Type of material	Type of packaging	Defect of package
5-3-7-1	Survival ration # 4 (powder)	Food	Aluminum foil	Ant attacked
2	"	"	"	-
3	"	"	"	Ant attacked
4	"	"	"	-
5-2-1-IuaA1	Dehydrated cooked rice	Food	Paper bag	-
IuaA2	"	"	"	-
IuaA3	"	"	"	-
IuaA4	"	"	"	-
5-2-1-ILaA1	Dehydrated cooked rice	Food	Paper bag	Ant attacked
ILaA2	"	"	"	-
ILaA3	"	"	"	-
ILaA4	"	"	"	Ant attacked
5-2-1-IIuaA1	Dehydrated cooked rice	Food	Paper bag	Ant attacked
IIuaA2	"	"	"	-
IIuaA3	"	"	"	-
IIuaA4	"	"	"	-
5-2-1-IILaA1	Dehydrated cooked rice	Food	Paper bag	Ant attacked
IILaA2	"	"	"	-
IILaA3	"	"	"	-
IILaA4	"	"	"	-
5-2-1-aA1	Dehydrated cooked rice	Food	Paper bag	-
aA2	"	"	"	-
aA3	"	"	"	-
aA4	"	"	"	-
5-2-4-IuaA1	Banana jam	Dessert	Plastic bag	-
IuaA2	"	"	"	-
IuaA3	"	"	"	-
IuaA4	"	"	"	-
5-2-4-ILaA1	Banana jam	Dessert	Plastic bag	-
ILaA2	"	"	"	-
ILaA3	"	"	"	-
ILaA4	"	"	"	-

TABLE 2. continued.

Code number	Description	Type of material	Type of packaging	Defect of package
5-2-4-IIuaA1	Banana jam	Dessert	Plastic bag	-
IIuaA2	"	"	"	-
IIuaA3	"	"	"	Broken bag & ant attacked
5-2-4-IILaA1	Banana jam	Dessert	Plastic bag	-
IILaA2	"	"	"	-
IILaA3	"	"	"	-
IILaA4	"	"	"	-
5-2-4-aA1	Banana jam	Dessert	Plastic bag	-
aA2	"	"	"	-
aA3	"	"	"	-
aA4	"	"	"	-
5-3-1-IuaA1	Survival ration # 1 (bar)	Food	Green aluminum foil	Ant attacked
IuaA2	"	"	"	"
IuaA3	"	"	"	"
IuaA4	"	"	"	-
5-3-1-ILaA1	Survival ration # 1 (bar)	Food	Green aluminum foil	-
ILaA2	"	"	"	-
ILaA3	"	"	"	-
ILaA4	"	"	"	-
5-3-1-IIuaA1	Survival ration # 1 (bar)	Food	Green aluminum foil	Ant attacked
IIuaA2	"	"	"	"
IIuaA3	"	"	"	-
IIuaA4	"	"	"	Ant attacked
5-3-1-IILaA1	Survival ration # 1 (bar)	Food	Green aluminum foil	Ant attacked
IILaA2	"	"	"	-
IILaA3	"	"	"	Ant attacked
IILaA4	"	"	"	"
5-3-1-aA1	Survival ration # 1 (bar)	Food	Green aluminum foil	-
aA2	"	"	"	-
aA3	"	"	"	Ant attacked
aA4	"	"	"	"

TABLE 2. continued.

Code number	Description	Type of material	Type of packaging	Defect of package
5-3-2-IuaA1	Survival ration # 2 (bar)	Food	Aluminum foil	-
IuaA2	"	"	"	-
IuaA3	"	"	"	Ant attacked
IuaA4	"	"	"	"
5-3-2-ILaA1	Survival ration # 2 (bar)	Food	Aluminum foil	-
ILaA2	"	"	"	Ant attacked
ILaA3	"	"	"	-
ILaA4	"	"	"	Ant attacked
5-3-2-IIuaA1	Survival ration # 2 (bar)	Food	Aluminum foil	Ant attacked
IIuaA2	"	"	"	-
IIuaA3	"	"	"	-
IIuaA4	"	"	"	-
5-3-2-IILaA1	Survival ration # 2 (bar)	Food	Aluminum foil	Ant attacked
IILaA2	"	"	"	-
IILaA3	"	"	"	-
IILaA4	"	"	"	-
5-3-2-aA1	Survival ration # 2 (bar)	Food	Aluminum foil	Ant attacked
aA2	"	"	"	-
aA3	"	"	"	Ant attacked
aA4	"	"	"	"
5-3-3-IuaA1	Survival ration # 2 (powder)	Food	Aluminum foil	-
IuaA2	"	"	"	-
IuaA3	"	"	"	-
IuaA4	"	"	"	-
5-3-3-ILaA1	Survival ration # 2 (powder)	Food	Aluminum foil	Ant attacked
ILaA2	"	"	"	-
ILaA3	"	"	"	-
ILaA4	"	"	"	Ant attacked
5-3-3-IIuaA1	Survival ration # 2 (powder)	Food	Aluminum foil	Ant attacked
IIuaA2	"	"	"	"
IIuaA3	"	"	"	"
IIuaA4	"	"	"	-

TABLE 2. continued.

Code number	Description	Type of material	Type of packaging	Defect of package
5-3-3-IILaA1	Survival ration # 2 (powder)	Food	Aluminum foil	-
IILaA2	"	"	"	-
IILaA3	"	"	"	-
IILaA4	"	"	"	Ant attacked
5-3-3-aA1	Survival ration # 2 (powder)	Food	Aluminum foil	-
aA2	"	"	"	-
aA3	"	"	"	-
aA4	"	"	"	Ant attacked
5-3-4-IuaA1	Survival ration # 3 (bar)	Food	Aluminum foil	Ant attacked
IuaA2	"	"	"	-
IuaA3	"	"	"	-
IuaA4	"	"	"	Ant attacked
5-3-4-ILaA1	Survival ration # 3 (bar)	Food	Aluminum foil	-
ILaA2	"	"	"	-
ILaA3	"	"	"	-
ILaA4	"	"	"	-
5-3-4-IIuaA1	Survival ration # 3 (bar)	Food	Aluminum foil	Ant attacked
IIuaA2	"	"	"	-
IIuaA3	"	"	"	-
IIuaA4	"	"	"	Ant attacked
5-3-4-IILaA1	Survival ration # 3 (bar)	Food	Aluminum foil	-
IILaA2	"	"	"	Ant attacked
IILaA3	"	"	"	"
IILaA4	"	"	"	"
5-3-4-aA1	Survival ration # 3 (bar)	Food	Aluminum foil	Ant attacked
aA2	"	"	"	"
aA3	"	"	"	"
aA4	"	"	"	-
5-3-5-IuaA1	Survival ration # 3 (powder)	Food	Aluminum foil	-
IuaA2	"	"	"	-
IuaA3	"	"	"	-
IuaA4	"	"	"	Wet label

TABLE 2. continued.

Code number	Description	Type of material	Type of packaging	Defect of package
5-3-5-ILaA1	Survival ration # 3 (powder)	Food	Aluminum foil	-
ILaA2	"	"	"	Ant attacked
ILaA3	"	"	"	-
ILaA4	"	"	"	Worm seen outside package
5-3-5-IIuaA1	Survival ration # 3 (powder)	Food	Aluminum foil	-
IIuaA2	"	"	"	-
IIuaA3	"	"	"	-
IIuaA4	"	"	"	-
5-3-5-IILaA1	Survival ration # 3 (powder)	Food	Aluminum foil	-
IILaA2	"	"	"	-
IILaA3	"	"	"	-
IILaA4	"	"	"	-
5-3-5-aA1	Survival ration # 3 (powder)	Food	Aluminum foil	Missing
aA2	"	"	"	-
aA3	"	"	"	-
aA4	"	"	"	-
5-3-6-IuaA1	Survival ration # 4 (bar)	Food	Green aluminum foil	Ant attacked
IuaA2	"	"	"	"
IuaA3	"	"	"	-
IuaA4	"	"	"	Ant attacked
5-3-6-ILaA1	Survival ration # 4 (bar)	Food	Green aluminum foil	-
ILaA2	"	"	"	-
ILaA3	"	"	"	-
ILaA4	"	"	"	Ant attacked
5-3-6-IIuaA1	Survival ration # 4 (bar)	Food	Green aluminum foil	-
IIuaA2	"	"	"	Ant attacked
IIuaA3	"	"	"	-
IIuaA4	"	"	"	-
5-3-6-IILaA1	Survival ration # 4 (bar)	Food	Green aluminum foil	Ant attacked
IILaA2	"	"	"	-
IILaA3	"	"	"	Ant attacked
IILaA4	"	"	"	"

TABLE 2. continued.

Code number	Description	Type of material	Type of packaging	Defect of package
5-3-6-aA1	Survival ration # 4 (bar)	Food	Green aluminum foil	Ant attacked
aA2	"	"	"	"
aA3	"	"	"	Missing
aA4	"	"	"	Ant attacked
5-3-7-IuaA1	Survival ration # 4 (powder)	Food	Green aluminum foil	-
IuaA2	"	"	"	-
IuaA3	"	"	"	Ant attacked
IuaA4	"	"	"	-
5-3-7-ILaA1	Survival ration # 4 (powder)	Food	Green aluminum foil	-
ILaA2	"	"	"	-
ILaA3	"	"	"	-
ILaA4	"	"	"	-
5-3-7-IIuaA1	Survival ration # 4 (bar)	Food	Green aluminum foil	Ant attacked
IIuaA2	"	"	"	"
IIuaA3	"	"	"	"
IIuaA4	"	"	"	-
5-3-7-IILaA1	Survival ration # 4 (bar)	Food	Green aluminum foil	Ant attacked
IILaA2	"	"	"	"
IILaA3	"	"	"	-
IILaA4	"	"	"	Ant attacked
5-3-7-aA1	Survival ration # 4 (bar)	Food	Green aluminum foil	Ant attacked
aA2	"	"	"	"
aA3	"	"	"	"
aA4	"	"	"	"

TABLE 3. MICROBIOLOGICAL OBSERVATIONS

Code number	Description	Total aerobic count (colonies/g)	Mold count (colonies/g)	Total anaerobic count	Coliform test
5-2-1-1	Dehydrated cooked rice	5.2×10^2	Negative	Negative	Negative
2	"	8.5×10^2	"	"	"
3	"	3.5×10^2	"	"	"
4	"	5.1×10^2	"	"	"
5-2-4-1	Banana jam	1.0×10	Negative	Negative	Negative
2	"	2.0×10	0.5×10	"	"
3	"	1.0×10	Negative	"	"
4	"	6.0×10	"	"	"
5-3-1-1 [1/]	Survival ration # 1 (bar)	300×10^3	1.5×10	Negative	Non-detectable
2	"	300×10^3	2.0×10	"	"
3	"	300×10^3	Negative	"	"
4	"	300×10^3	"	"	"
5-3-2-1 [1/]	Survival ration # 1 (bar)	300×10^3	Negative	Negative	Non-detectable
2	"	300×10^3	1.6×10^5	"	"
3	"	300×10^3	Negative	"	"
4	"	300×10^3	"	"	"
5-3-3-1	Survival ration # 2 (powder)	3.0×10	0.4×10	Negative	Non-detectable
2	"	7.0×10	0.4×10	"	"
3	"	1.0×10	0.5×10	"	"
4	"	6.0×10	0.5×10	"	"
5-3-4-1 [1/]	Survival ration # 3 (bar)	300×10^3	1.0×10^3	Negative	Non-detectable
2	"	300×10^3	1.5×10^3	"	"
3	"	7.0×10	300×10^3	"	"
4	"	8.0×10	Negative	"	"
5-3-5-1	Survival ration # 3 (powder)	1.3×10^2	0.1×10	Negative	Non-detectable
2	"	2.1×10^2	0.2×10	"	"
3	"	4.0×10^2	0.1×10	"	"
4	"	1.6×10^2	0.2×10	"	"

[1/] Sample prepared and left over for one day.

TABLE 3. continued.

Code number	Description	Total aerobic count (colonies/g)	Mold count (colonies/g)	Total anaerobic count	Coliform test
5-3-6-1 [1/]	Survival ration # 4 (bar)	300×10^3	2.0×10^3	Negative	Non-detectable
2	"	300×10^3	1.4×10^3	"	"
3	"	300×10^3	7.0×10^3	"	"
4	"	300×10^3	1.3×10^3	"	"
5-3-7-1	Survival ration # 4 (powder)	2.0×10^2	9.0×10	Negative	Negative
2	"	1.0×10^2	5.5×10	"	"
3	"	0.5×10^2	7.5×10	"	"
4	"	2.5×10^2	9.0×10	"	"
5-2-1-aA1	Dehydrated cooked rice	6×10^2	-	-	-
aA2	"	7×10^2	6×10^2	-	-
aA3	"	10×10^2	-	-	-
aA4	"	-	-	-	-
5-2-1-IUaA1	Dehydrated cooked rice	11×10^2	1×10^2	-	-
IUaA2	"	2×10^2	1×10^2	-	-
IUaA3	"	-	-	-	-
IUaA4	"	-	-	-	-
5-2-1-ILaA1	Dehydrated cooked rice	10×10^2	-	-	-
ILaA2	"	8×10^2	-	-	-
ILaA3	"	-	-	-	-
ILaA4	"	-	-	-	-
5-2-1-IIUaA1	Dehydrated cooked rice	1×10^2	1×10^2	-	-
IIUaA2	"	13×10^2	3×10^2	-	-
IIUaA3	"	-	-	-	-
IIUaA4	"	-	-	-	-
5-2-1-IILaA1	Dehydrated cooked rice	10×10^2	10×10^2	-	-
IILaA2	"	6×10^2	6×10^2	-	-
IILaA3	"	-	-	-	-
IILaA4	"	-	-	-	-

[1/] Sample prepared and left over for one day.

* Concentration: $1:10^2$ & $1:10^3$

\+ = positive (detectable)

\- = negative (non-detectable)

TABLE 3. continued.

Code number	Description	Total aerobic count (colonies/g)	Mold count (colonies/g)	Total anaerobic count	Coliform test
5-2-4-aA1	Banana jam	1×10^1	-	-	-
aA2	"	$>3 \times 10^3$	-	+	-
aA3	"	8×10^1	-	+	-
aA4	"	3×10^1	-	+	-
5-2-4-IUaA1	Banana jam	6×10^1	5×10^1	-	-
IUaA2	"	9×10^1	5×10^1	-	-
IUaA3	"	6×10^1	11×10^1	-	-
IUaA4	"	-	1×10^1	-	-
5-2-4-ILaA1	Banana jam	9×10^1	-	-	-
ILaA2	"	1×10^1	2×10^1	-	-
ILaA3	"	2×10^1	-	-	-
ILaA4	"	2×10^1	-	-	-
5-2-4-IIUaA1	Banana jam	2×10^1	5×10^1	-	-
IIUaA2	"	1×10^1	-	-	-
IIUaA3	"	7×10^1	11×10^1	-	-
IIUaA4	"	6×10^1	-	-	-
5-2-4-IILaA1	Banana jam	1×10^1	-	-	-
IILaA2	"	-	-	-	-
IILaA3	"	-	1×10^1	-	-
IILaA4	"	10×10^1	5×10^1	-	+
5-3-1-aA1	Survival ration # 1 (bar)	-	10×10^2	-	-
aA2	"	10×10^2	10×10^2	-	-
aA3	"	2×10^2	10×10^2	-	-
aA4	"	-	-	+	-
5-3-1-IUaA1	Survival ration # 1 (bar)	-	-	-	-
IUaA2	"	-	-	-	-
IUaA3	"	-	-	-	-
IUaA4	"	-	-	-	-

*Concentration: $1:10^2$ & $1:10^3$

+ = positive (detectable)

- = negative (non-detectable)

TABLE 3. continued.

Code number	Description	Total aerobic count (colonies/g)	Mold count (colonies/g)	Total anaerobic count	Coliform test
5-3-1-ILaA1	Survival ration # 1 (bar)	-	10×10^2	-	-
ILaA2	"	2×10^2	-	-	-
ILaA3	"	4×10^2	10×10^2	-	-
ILaA4	"	3×10^2	-	-	-
5-3-1-IIUaA1	Survival ration # 1 (bar)	-	-	-	-
IIUaA2	"	1×10^2	-	-	-
IIUaA3	"	1×10^2	10×10^2	-	-
IIUaA4	"	-	-	-	-
5-3-1-IILaA1	Survival ration # 1 (bar)	10×10^2	-	-	-
IILaA2	"	1×10^2	-	-	-
IILaA3	"	1×10^2	-	-	-
IILaA4	"	-	-	-	-
5-3-2-aA1	Survival ration # 1 (bar)	$> 30 \times 10^3$	5×10^2	+	-
aA2	"	3×10^2	3×10^2	-	-
aA3	"	5×10^2	-	+	-
aA4	"	2×10^2	-	-	-
5-3-2-IUaA1	Survival ration # 2 (bar)	2×10^2	-	+	-
IUaA2	"	7×10^2	-	-	-
IUaA3	"	7×10^2	5×10^2	-	-
IUaA4	"	7×10^2	-	-	-
5-3-2-ILaA1	Survival ration # 2 (bar)	2×10^2	-	-	-
ILaA2	"	- - -	- - -	- - -	- - -
ILaA3	"	1×10^2	- - -	- - -	- - -
ILaA4	"	2×10^2	- - -	- - -	- - -
5-3-2-IIUaA1	Survival ration # 2 (bar)	8×10^2	-	-	-
IIUaA2	"	- - -	1×10^2	-	-
IIUaA3	"	1×10^2	1×10^2	-	-
IIUaA4	"	1×10^2	1×10^2	-	-

*Concentrations: $1:10^2$ & $1:10^3$

+ = positive (detectable)

- = negative (non-detectable)

- - - = missing value

TABLE 3. continued.

Code number	Description	Total aerobic count (colonies/g)	Mold count (colonies/g)	Total anaerobic count	Coliform test
5-3-2-IILaA1	Survival ration # 2 (bar)	34×10^2	1×10^2	-	-
IILaA2	"	- - -	5×10^2	+	-
IILaA3	"	16×10^2	-	-	-
IILaA4	"	2×10^2	-	-	-
5-3-3-aA1	Survival ration # 2 (powder)	2×10^2	12×10^2	-	-
aA2	"	2×10^2	10×10^2	-	-
aA3	"	1×10^2	-	-	-
aA4	"	-	1×10^2	-	-
5-3-3-IUaA1	Survival ration # 2 (powder)	2×10^2	15×10^2	-	-
IUaA2	"	-	6×10^2	+	-
IUaA3	"	2×10^2	-	-	-
IUaA4	"	3×10^2	-	+	-
5-3-3-ILaA1	Survival ration # 2 (powder)	2×10^2	10×10^2	+	-
ILaA2	"	-	-	-	-
ILaA3	"	2×10^2	-	-	-
ILaA4	"	3×10^2	-	-	-
5-3-3-IIUaA1	Survival ration # 2 (powder)	1×10^2	5×10^2	-	-
IIUaA2	"	- - -	- - -	- - -	- - -
IIUaA3	"	6×10^2	8×10^2	-	-
IIUaA4	"	1×10^2	-	+	-
5-3-3-IILaA1	Survival ration # 2 (powder)	8×10^2	6×10^2	-	-
IILaA2	"	2×10^2	2×10^2	+	-
IILaA3	"	2×10^2	2×10^2	-	-
IILaA4	"	30×10^3	5×10^2	-	-
5-3-4-aA1	Survival ration # 3 (bar)	1×10^2	-	+	-
aA2	"	1×10^2	-	-	-
aA3	"	-	3×10^2	-	-
aA4	"	1×10^2	-	-	-

*Concentration: $1:10^2$ & $1:10^3$

+ = positive (detectable)

- = negative (non-detectable)

- - - = missing value

TABLE 3. continued.

Code number	Description	Total aerobic count (colonies/g)	Mold count (colonies/g)	Total anaerobic count	Coliform test
5-3-4-IUaA1	Survival ration # 3 (bar)	$>30 \times 10^3$	6×10^2	-	-
IUaA2	"	1×10^2	1×10^2	+	-
IUaA3	"	10×10^2	5×10^2	-	-
IUaA4	"	$>30 \times 10^3$	-	-	-
5-3-4-ILaA1	Survival ration # 3 (bar)	1×10^2	5×10^2	+	-
ILaA2	"	1×10^2	1×10^2	-	-
ILaA3	"	-	11×10^2	+	-
ILaA4	"	1×10^2	-	+	-
5-3-4-IIUaA1	Survival ration # 3 (bar)	$>30 \times 10^3$	1×10^2	+	-
IIUaA2	"	- - -	- - -	+	-
IIUaA3	"	10×10^2	-	-	-
IIUaA4	"	1×10^2	-	+	-
5-3-4-IILaA1	Survival ration # 3 (bar)	3×10^2	-	-	-
IILaA2	"	-	-	-	-
IILaA3	"	2×10^2	- - -	-	-
IILaA4	"	3×10^2	-	-	-
5-3-5-aA1	Survival ration # 3 (powder)	- - -	- - -	- - -	- - -
aA2	"	6×10^2	-	-	-
aA3	"	-	-	-	-
aA4	"	1×10^2	-	-	-
5-3-5-IUaA1	Survival ration # 3 (powder)	1×10^2	-	-	-
IUaA2	"	1×10^2	-	-	-
IUaA3	"	10×10^2	-	-	-
IUaA4	"	7×10^2	-	+	-
5-3-5-ILaA1	Survival ration # 3 (powder)	2×10^2	-	+	-
ILaA2	"	4×10^2	-	+	-
ILaA3	"	2×10^2	-	+	-
ILaA4	"	4×10^2	-	+	-

*Concentrations: $1:10^2$ & $1:10^3$

+ = positive (detectable)

- = negative (non-detectable)

- - - = missing value

TABLE 3. continued.

Code number	Description	Total aerobic count (colonies/g)	Mold count (colonies/g)	Total anaerobic count	Coliform test
5-3-5-IIUaA1	Survival ration # 3 (powder)	2×10^2	-	-	-
IIUaA2	"	3×10^2	20×10^2	+	-
IIUaA3	"	22×10^2	-	+	4×10^2
IIUaA4	"	8×10^2	-	-	8×10^2
5-3-5-IILaA1	Survival ration # 3 (powder)	1×10^2	-	-	-
IILaA2	"	3×10^2	-	+	-
IILaA3	"	30×10^3	-	+	-
IILaA4	"	- - -	- - -	- - -	- - -
5-3-6-aA1	Survival ration # 4 (bar)	6×10^2	-	-	-
aA2	"	-	6×10^2	-	-
aA3	"	- - -	- - -	- - -	- - -
aA4	"	-	-	-	-
5-3-6-IUaA1	Survival ration # 4 (bar)	-	-	-	-
IUaA2	"	5×10^2	-	-	-
IUaA3	"	-	-	-	-
IUaA4	"	-	1×10^2	-	-
5-3-6-ILaA1	Survival ration # 4 (bar)	-	-	-	-
ILaA2	"	-	-	-	-
ILaA3	"	-	6×10^2	-	-
ILaA4	"	-	6×10^2	-	-
5-3-6-IIUaA1	Survival ration # 4 (bar)	5×10^2	1×10^2	-	-
IIUaA2	"	20×10^2	15×10^2	-	-
IIUaA3	"	-	5×10^2	-	-
IIUaA4	"	-	-	-	-
5-3-6-IILaA1	Survival ration # 4 (bar)	-	7×10^2	-	-
IILaA2	"	-	-	-	-
IILaA3	"	-	-	-	-
IILaA4	"	-	5×10^2	-	-

*Concentration: $1:10^2$ & $1:10^3$

+ = positive (detectable)

- = negative (non-detectable)

- - - = missing value

TABLE 3. continued.

Code number	Description	Total aerobic count (colonies/g)	Mold count (colonies/g)	Total anaerobic count	Coliform test
5-3-7-aA1	Survival ration # 4 (powder)	1 x 10^2	2 x 10^2	-	-
aA2	"	1 x 10^2	-	-	-
aA3	"	2 x 10^2	-	-	-
aA4	"	1 x 10^2	2 x 10^2	-	-
5-3-7-IUaA1	Survival ration # 4 (powder)	1 x 10^2	-	-	-
IUaA2	"	2 x 10^2	-	-	-
IUaA3	"	4 x 10^2	-	-	-
IUaA3	"	-	-	-	-
5-3-7-ILaA1	Survival ration # 4 (powder)	13 x 10^2	-	+	-
ILaA2	"	-	-	+	-
ILaA3	"	4 x 10^2	-	-	-
ILaA4	"	-	1 x 10^2	-	-
5-3-7-IIUaA1	Survival ration # 4 (powder)	-	6 x 10^2	-	-
IIUaA2	"	-	1 x 10^2	-	-
IIUaA3	"	1 x 10^2	1 x 10^2	-	-
IIUaA4	"	-	-	-	-
5-3-7-IILaA1	Survival ration # 4 (powder)	-	-	-	-
IILaA2	"	-	-	-	-
IILaA3	"	1 x 10^2	2 x 10^2	-	-
IILaA4	"	1 x 10^2	-	-	-

*Concentration: 1:10^2 & 1:10^3

+ = positive (detectable)

- = negative (non-detectable)

TABLE 4. METEOROLOGICAL DATA (Period covered July-October 1971)

The quantities present are as follows:

1. Cleared site

   1.1 Daily total rainfall, monthly total, and number of rain days.

   1.2 Daily total sunshine duration, monthly total, in hours.

   1.3 Daily maximum relative humidity, daily minimum relative humidity.

   1.4 Daily maximum temperature, daily minimum temperature.

2. Depot in cleared site

   2.1 Daily maximum relative humidity, daily minimum relative humidity.

   2.2 Daily maximum temperature, daily minimum temperature.

3. Jungle site

   3.1 Daily total rainfall, monthly total, and number of rain days.

   3.2 Daily maximum relative humidity, daily minimum relative humidity.

   3.3 Daily maximum temperature, daily minimum temperature.

4. Depot in jungle site

   4.1 Daily maximum relative humidity, daily minimum relative humidity.

   4.2 Daily maximum temperature, daily minimum temperature.

TABLE 4 (1) CLEARED SITE

DAILY TOTAL RAINFALL, MONTHLY TOTAL

(Recorded by Belford recording rain gauge in mm)

July 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Amount, mm	27.9	0.0	3.3	80.7	25.4	1.7	0.0	0.0	0.0	1.7	
Day of month	11	12	13	14	15	16	17	18	19	20	
Amount, mm	0.0	0.0	0.0	27.9	10.2	0.0	12.7	7.6	0.0	31.7	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Amount, mm	2.0	0.0	0.0	0.2	5.3	17.7	1.3	0.0	0.0	0.0	5.1

Monthly total, mm 262.4 Total raindays: 17

TABLE 4 (1) continued.

August 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Amount, mm	0.0	0.0	0.0	0.0	2.5	0.0	5.1	0.0	0.0	0.0	
Day of month	11	12	13	14	15	16	17	18	19	20	
Amount, mm	7.6	0.0	7.6	0.5	12.7	0.0	0.0	2.0	3.5	3.0	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Amount, mm	11.4	trace	2.5	0.0	7.6	1.3	0.0	0.0	25.4	25.4	20.3

Monthly total, mm 138.4 Total raindays: 17

September 1971

Day of month	1	2	3	4	5	6	7	8	9	10
Amount, mm	0.0	3.8	1.9	0.0	0.0	0.0	10.8	0.0	0.0	0.0
Day of month	11	12	13	14	15	16	17	18	19	20
Amount, mm	0.0	trace	0.0	2.0	1.8	13.7	4.1	4.6	trace	7.6
Day of month	21	22	23	24	25	26	27	28	29	30
Amount, mm	2.0	26.6	4.3	0.0	2.5	0.0	12.7	4.3	0.0	0.0

Monthly total, mm 102.7 Total raindays: 17

October 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Amount, mm	0.0	0.0	0.0	0.0	0.0	17.8	73.6	trace	0.0	66.8	
Day of month	11	12	13	14	15	16	17	18	19	20	
Amount, mm	0.5	5.6	0.0	0.0	0.0	0.0	0.0	trace	0.0	2.0	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Amount, mm	1.3	0.0	0.0	0.0	33.0	1.3	0.0	19.0	41.9	0.2	0.0

Monthly total, mm 263.0 Total raindays: 14

TABLE 4 (1) continued.

DAILY TOTAL SUNSHINE DURATION AND MONTHLY TOTAL (in hours)

July 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Duration, hr	2.8	1.3	1.3	3.0	3.5	2.9	0.3	3.7	1.5	8.2	
Day of month	11	12	13	14	15	16	17	18	19	20	
Duration, hr	8.9	3.3	0.0	1.0	2.6	3.2	0.0	0.0	2.8	0.2	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Duration, hr	2.7	3.4	1.0	0.0	4.3	0.4	0.8	0.6	9.8	10.7	5.5

Monthly total, hr 89.7

August 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Duration, hr	4.1	11.6	9.6	11.4	9.8	0.9	1.4	5.9	0.4	1.0	
Day of month	11	12	13	14	15	16	17	18	19	20	
Duration, hr	1.0	3.0	1.3	7.2	3.6	9.9	6.5	3.8	2.4	1.0	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Duration, hr	1.0	3.2	5.7	7.2	4.9	4.2	2.4	2.9	4.0	6.0	4.5

Monthly total, hr 141.8

September 1971

Day of month	1	2	3	4	5	6	7	8	9	10
Duration, hr	4.6	4.4	5.0	5.0	5.9	4.9	3.9	4.1	10.6	9.0
Day of month	11	12	13	14	15	16	17	18	19	20
Duration, hr	9.0	9.9	8.2	7.4	4.0	3.9	4.2	2.2	2.3	9.0
Day of month	21	22	23	24	25	26	27	28	29	30
Duration, hr	7.0	1.8	2.6	8.3	5.2	5.1	2.0	5.8	4.7	5.7

Monthly total, hr 165.7

TABLE 4 (1) continued.

October 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Duration, hr	4.4	4.4	3.5	7.0	9.0	4.9	2.9	1.4	6.2	0.0	
Day of month	11	12	13	14	15	16	17	18	19	20	
Duration, hr	0.0	4.3	9.5	7.3	10.0	9.9	6.9	3.0	7.3	4.2	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Duration, hr	6.5	6.8	8.0	5.2	0.1	5.7	0.0	0.0	0.0	0.0	4.9

Monthly total, hr 143.3

DAILY TEMPERATURE

July 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Maximum, °F	82.8	82.2	82.0	84.2	81.9	80.8	78.6	79.7	77.9	82.8	
Minimum, °F	70.0	70.0	71.2	68.0	68.0	67.6	69.1	68.9	68.5	69.4	
Day of month	11	12	13	14	15	16	17	18	19	20	
Maximum, °F	85.1	83.8	75.9	75.2	81.9	82.9	71.6	74.8	80.6	76.1	
Minimum, °F	69.1	71.1	69.4	67.6	68.7	67.6	66.2	68.0	68.0	66.6	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Maximum, °F	80.8	82.4	79.0	73.2	80.6	79.0	75.4	75.0	79.7	80.6	84.6
Minimum, °F	66.4	69.8	70.0	68.0	67.8	68.5	66.0	65.7	67.3	66.4	62.2

TABLE 4 (1) continued.

August 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Maximum, °F	79.0	82.0	81.0	82.0	81.1	73.9	76.1	80.2	76.1	76.8	
Minimum, °F	67.8	67.6	66.5	66.0	65.8	64.4	63.5	66.2	66.2	66.0	
Day of month	11	12	13	14	15	16	17	18	19	20	
Maximum, °F	77.0	79.9	75.2	78.8	80.4	79.0	79.2	79.2	78.8	72.5	
Minimum, °F	65.1	64.2	64.4	64.2	65.3	64.6	66.2	66.6	64.0	63.0	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Maximum, °F	75.2	77.2	78.4	78.8	80.8	77.2	77.0	76.5	79.2	80.6	79.2
Minimum, °F	64.0	64.0	62.8	60.8	67.5	66.2	66.0	66.2	67.1	66.0	64.0

September 1971

Day of month	1	2	3	4	5	6	7	8	9	10
Maximum, °F	80.0	78.1	79.2	79.0	82.4	84.0	80.8	79.7	81.0	81.0
Minimum, °F	66.2	65.5	67.6	68.0	68.0	70.3	68.2	66.5	67.1	66.9
Day of month	11	12	13	14	15	16	17	18	19	20
Maximum, °F	82.6	82.6	82.9	82.6	81.1	72.9	80.6	78.8	77.0	77.0
Minimum, °F	68.0	68.4	68.9	68.4	64.8	64.8	66.6	67.5	68.4	66.4
Day of month	21	22	23	24	25	26	27	28	29	30
Maximum, °F	76.8	75.4	76.1	80.2	79.0	78.8	78.1	80.8	80.2	81.3
Minimum, °F	66.2	67.1	66.9	66.0	66.4	67.8	66.0	65.5	67.5	67.8

October 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Maximum, °F	79.0	79.7	79.7	78.8	79.7	76.5	76.3	72.5	80.6	87.5	
Minimum, °F	67.8	68.0	67.6	67.6	66.9	66.2	64.8	64.4	63.9	63.0	
Day of month	11	12	13	14	15	16	17	18	19	20	
Maximum, °F	67.1	73.6	73.4	70.0	71.6	72.5	75.2	73.4	78.8	80.2	
Minimum, °F	64.0	62.6	62.6	59.0	58.8	57.2	62.2	64.0	64.4	65.7	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Maximum, °F	77.0	77.0	78.4	79.0	69.8	77.0	70.2	66.4	65.3	65.5	72.9
Minimum, °F	66.2	64.4	63.1	66.2	65.8	66.9	64.6	64.2	60.8	57.6	61.0

TABLE 4 (1) continued.

DAILY RELATIVE HUMIDITY (Recorded by hygrothermograph)

July 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Maximum, %	100	100	100	100	100	100	100	100	100	100	
Minimum, %	71	66	80	62	68	74	74	73	72	66	
Day of month	11	12	13	14	15	16	17	18	19	20	
Maximum, %	100	98	100	100	100	100	100	100	100	100	
Minimum, %	57	62	94	81	58	61	84	74	62	74	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Maximum, %	100	99	100	100	100	100	100	100	100	100	100
Minimum, %	60	58	77	90	70	70	90	78	63	60	47

August 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Maximum, %	100	100	100	100	100	100	100	100	98	99	
Minimum, %	69	54	57	50	58	73	67	56	68	80	
Day of month	11	12	13	14	15	16	17	18	19	20	
Maximum, %	100	100	100	100	100	100	100	100	100	100	
Minimum, %	72	55	83	91	70	49	83	50	52	89	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Maximum, %	100	100	100	100	100	100	100	100	100	100	100
Minimum, %	73	100	78	76	52	65	66	78	64	58	59

September 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Maximum, %	100	100	100	100	100	100	100	100	100	100	
Minimum, %	51	74	68	60	52	47	100	77	44	65	
Day of month	11	12	13	14	15	16	17	18	19	20	
Maximum, %	100	100	100	100	100	100	100	100	100	100	
Minimum, %	55	76	55	50	55	60	61	64	84	51	
Day of month	21	22	23	24	25	26	27	28	29	30	
Maximum, %	100	100	100	100	100	100	100	100	100	100	
Minimum, %	55	81	75	44	53	60	59	47	47	44	

TABLE 4 (1) continued.

October

Day of month	1	2	3	4	5	6	7	8	9	10	
Maximum, %	100	100	100	100	100	100	100	100	100	100	
Minimum, %	52	46	45	43	48	62	63	75	43	92	
Day of month	11	12	13	14	15	16	17	18	19	20	
Maximum, %	100	99	91	91	94	100	100	100	100	100	
Minimum, %	100	33	28	45	47	38	38	61	42	50	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Maximum, %	100	100	100	99	100	100	100	100	100	100	100
Minimum, %	59	47	41	42	97	60	84	100	100	75	52

TABLE 4 (2) DEPOT IN CLEARED SITE

DAILY TEMPERATURE

July 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Maximum, °F	84.6	84.2	81.5	84.2	82.4	82.8	80.4	80.2	79.7	85.8	
Minimum, °F	72.5	73.0	74.3	76.8	69.4	71.1	73.2	71.6	71.6	72.3	
Day of month	11	12	13	14	15	16	17	18	19	20	
Maximum, °F	89.2	85.8	78.4	77.0	83.5	86.0	75.2	77.0	82.6	78.4	
Minimum, °F	73.0	73.4	72.9	71.6	72.0	71.6	70.2	71.6	71.6	70.2	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Maximum, °F	83.3	85.3	78.8	75.4	82.4	80.8	79.7	79.7	84.9	86.0	79.8
Minimum, °F	70.2	73.4	73.4	71.2	71.1	71.6	71.6	71.6	73.8	72.5	73.2

August 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Maximum, °F	85.3	88.7	88.0	88.7	88.0	80.2	82.2	86.0	81.0	82.6	
Minimum, °F	73.8	73.4	73.9	73.4	73.4	73.0	71.4	73.0	73.6	71.4	
Day of month	11	12	13	14	15	16	17	18	19	20	
Maximum, °F	82.6	85.1	81.9	85.1	85.3	87.4	86.4	86.2	86.0	80.6	
Minimum, °F	73.0	71.6	71.4	71.6	72.5	73.0	73.8	73.4	71.6	70.9	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Maximum, °F	82.6	84.2	86.2	85.8	85.6	84.0	81.0	80.8	84.4	85.6	84.9
Minimum, °F	71.2	70.7	71.4	69.4	71.8	72.5	71.8	71.8	72.5	70.3	69.8

TABLE 4 (2) continued.

September 1971

Day of month	1	2	3	4	5	6	7	8	9	10
Maximum, °F	86.0	82.6	84.2	86.9	86.9	87.8	85.6	83.1	86.4	86.2
Minimum, °F	72.0	70.2	70.3	80.1	73.0	74.3	73.0	71.2	71.4	72.5
Day of month	11	12	13	14	15	16	17	18	19	20
Maximum, °F	87.8	85.2	87.8	88.0	86.5	83.8	86.2	82.9	81.1	82.4
Minimum, °F	73.2	74.2	73.6	73.6	71.2	71.1	72.9	72.9	73.2	72.5
Day of month	21	22	23	24	25	26	27	28	29	30
Maximum, °F	82.4	80.6	81.5	85.8	86.0	86.0	82.4	84.9	84.4	86.0
Minimum, °F	73.0	73.0	72.5	71.4	71.8	72.9	71.6	70.7	73.0	73.0

October 1971

Day of month	1	2	3	4	5	6	7	8	9	10
Maximum, °F	83.3	84.2	84.2	82.8	84.4	81.5	82.4	77.2	84.2	73.4
Minimum, °F	73.0	73.2	72.3	73.0	73.0	71.6	69.8	69.8	68.0	69.6
Day of month	11	12	13	14	15	16	17	18	19	20
Maximum, °F	81.2	77.2	78.1	75.2	77.0	77.0	80.2	78.8	84.0	83.8
Minimum, °F	69.4	67.8	68.0	64.8	64.4	62.6	68.0	71.2	70.0	71.2
Day of month	21	22	23	24	25	26	27	28	29	30	31
Maximum, °F	81.0	80.6	82.4	84.2	75.2	81.5	75.2	71.6	69.8	70.7	75.2
Minimum, °F	70.0	70.0	69.4	71.6	70.7	71.6	70.0	69.3	66.2	62.6	66.2

RELATIVE HUMIDITY (from hygrothermograph)

July 1971

Day of month	1	2	3	4	5	6	7	8	9	10
Maximum, %	98	98	97	90	100	97	97	97	100	99
Minimum, %	68	64	74	63	70	74	74	73	73	62
Day of month	11	12	13	14	15	16	17	18	19	20
Maximum, %	94	95	95	99	98	95	98	98	98	97
Minimum, %	59	61	80	82	65	61	85	75	62	74
Day of month	21	22	23	24	25	26	27	28	29	30	31
Maximum, %	98	86	94	97	99	99	98	99	97	97	94
Minimum, %	60	56	84	90	70	69	78	79	64	60	49

TABLE 4 (2) continued.

August 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Maximum, %	97	96	96	90	94	98	97	97	94	95	
Minimum, %	68	54	55	52	58	75	70	58	74	68	
Day of month	11	12	13	14	15	16	17	18	19	20	
Maximum, %	98	99	100	96	99	96	96	96	98	99	
Minimum, %	72	59	74	62	69	56	61	59	64	84	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Maximum, %	98	99	98	97	97	96	98	99	99	100	99
Minimum, %	73	68	59	55	61	70	74	79	69	65	68

September 1971

Day of month	1	2	3	4	5	6	7	8	9	10
Maximum, %	99	100	100	98	97	97	96	98	99	97
Minimum, %	61	72	69	60	61	59	70	75	52	65
Day of month	11	12	13	14	15	16	17	18	19	20
Maximum, %	97	97	98	97	97	99	98	99	100	96
Minimum, %	60	58	63	59	65	70	66	74	85	64
Day of month	21	22	23	24	25	26	27	28	29	30
Maximum, %	96	100	98	98	98	97	99	100	97	92
Minimum, %	65	81	77	59	61	66	75	64	65	60

October 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Maximum, %	96	97	95	100	98	98	100	100	100	99	
Minimum, %	69	64	66	63	67	74	75	84	63	95	
Day of month	11	12	13	14	15	16	17	18	19	20	
Maximum, %	100	98	89	89	85	95	96	93	95	98	
Minimum, %	98	58	50	64	65	61	63	75	65	70	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Maximum, %	99	94	93	86	99	100	97	100	100	100	95
Minimum, %	74	65	60	60	94	73	86	96	97	82	67

TABLE 4 (3) JUNGLE SITE

DAILY TOTAL RAINFALL, MONTHLY TOTAL

(Recorded by Belford recording rain gauge, in mm)

July 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Amount, mm	22.8	0.0	0.5	74.2	24.4	1.3	0.0	0.0	0.0	0.2	
Day of month	11	12	13	14	15	16	17	18	19	20	
Amount, mm	0.0	0.0	0.0	19.0	10.2	0.0	4.1	5.1	0.0	25.4	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Amount, mm	0.5	0.0	0.0	trace	3.0	15.2	trace	0.0	0.0	0.0	2.5

Monthly total, mm 208.4 Total raindays: 17

August 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Amount, mm	0.0	0.0	0.0	0.0	trace	0.0	3.[illegible]	0.0	0.0	0.0	
Day of month	11	12	13	14	15	16	17	18	19	20	
Amount, mm	10.1	0.0	6.3	2.5	10.2	0.0	0.0	2.5	4.1	2.8	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Amount, mm	15.7	trace	3.8	0.0	15.2	1.3	0.0	0.0	6.3	19.0	24.1

Monthly total, mm 127.7 Total raindays: 17

September 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Amount, mm	0.0	3.8	1.9	0.0	0.0	0.0	10.2	0.0	0.0	0.0	
Day of month	11	12	13	14	15	16	17	18	19	20	
Amount, mm	0.0	trace	0.0	0.7	1.5	17.5	4.8	7.1	trace	2.5	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Amount, mm	2.8	17.8	3.0	0.0	2.5	0.0	15.2	3.0	0.0	0.0	-

Monthly total, mm 94.3 Total raindays: 17

TABLE 4 (3) continued.

October 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Amount, mm	0.0	0.0	0.0	0.0	0.0	58.3	58.3	trace	0.0	46.0	
Day of month	11	12	13	14	15	16	17	18	19	20	
Amount, mm	1.0	2.3	0.0	0.0	0.0	0.0	0.0	trace	0.0	1.5	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Amount, mm	trace	0.0	0.0	0.0	22.8	1.3	0.0	12.0	29.2	1.3	0.0

Monthly total, mm 184.1 Total raindays: 14

DAILY TEMPERATURE

July 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Maximum, °F	80.2	78.8	77.9	80.8	78.8	78.8	77.5	78.8	77.2	80.8	
Minimum, °F	71.8	71.6	73.0	70.2	68.9	70.2	71.6	71.4	71.4	72.0	
Day of month	11	12	13	14	15	16	17	18	19	20	
Maximum, °F	83.1	80.8	75.4	75.2	78.4	80.1	74.8	74.8	79.0	75.2	
Minimum, °F	72.1	73.0	71.8	70.0	71.6	70.3	68.9	71.1	70.9	69.4	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Maximum, °F	78.8	80.6	77.0	73.9	79.7	76.1	76.8	77.2	81.9	82.6	84.7
Minimum, °F	69.4	72.5	73.2	70.7	70.0	70.5	71.2	71.2	72.7	71.8	70.5

August 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Maximum, °F	80.2	83.3	83.7	82.9	82.8	77.4	77.4	80.6	76.8	77.2	
Minimum, °F	73.2	72.5	72.5	71.8	71.8	71.8	69.6	71.8	72.5	70.0	
Day of month	11	12	13	14	15	16	17	18	19	20	
Maximum, °F	78.8	80.4	77.0	80.8	80.2	82.2	81.3	81.0	79.2	75.4	
Minimum, °F	70.7	69.8	69.8	70.7	71.6	71.8	72.2	72.9	69.4	69.4	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Maximum, °F	77.0	77.5	80.1	79.3	79.0	77.2	77.2	77.0	78.8	79.2	76.8
Minimum, °F	69.8	69.6	69.6	68.2	68.9	70.3	70.0	71.1	71.4	69.4	68.0

TABLE 4 (3) continued.

September 1971

Day of month	1	2	3	4	5	6	7	8	9	10
Maximum, °F	78.8	77.4	78.8	77.0	80.4	81.5	80.8	78.8	81.5	81.5
Minimum, °F	71.4	69.9	71.2	71.8	72.0	73.2	71.8	70.7	71.2	71.4
Day of month	11	12	13	14	15	16	17	18	19	20
Maximum, °F	82.2	82.4	82.8	82.0	80.4	77.6	78.6	78.1	77.2	77.2
Minimum, °F	72.1	73.0	73.0	73.0	69.4	69.4	71.2	71.4	73.2	71.1
Day of month	21	22	23	24	25	26	27	28	29	30
Maximum, °F	77.4	76.8	76.8	79.3	78.8	78.8	76.1	78.4	79.0	79.7
Minimum, °F	70.2	71.2	71.2	70.0	70.7	71.8	69.6	69.4	70.2	71.8

October 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Maximum, °F	78.6	79.2	79.2	79.2	80.4	75.2	76.6	72.7	78.4	70.0	
Minimum, °F	71.8	72.5	71.8	71.8	71.4	70.7	69.4	68.7	68.0	68.0	
Day of month	11	12	13	14	15	16	17	18	19	20	
Maximum, °F	69.6	73.0	74.3	71.6	73.4	73.2	75.2	73.4	78.6	78.8	
Minimum, °F	67.8	66.0	66.6	64.0	62.8	61.2	66.0	67.8	68.0	67.8	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Maximum, °F	77.2	77.0	76.6	77.0	70.7	75.2	70.7	68.2	67.3	66.0	69.4
Minimum, °F	67.8	66.6	66.0	67.5	67.6	68.9	67.1	66.2	62.6	60.4	63.5

DAILY RELATIVE HUMIDITY (Recorded by hygrothermograph)

July 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Maximum, %	100	100	100	100	100	100	100	100	100	100	
Minimum, %	89	80	100	73	100	100	97	97	96	91	
Day of month	11	12	13	14	15	16	17	18	19	20	
Maximum, %	100	100	100	100	100	100	100	100	100	100	
Minimum, %	65	74	100	100	83	81	100	100	71	98	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Maximum, %	100	100	100	100	100	100	100	100	100	100	100
Minimum, %	74	60	88	100	88	90	100	100	77	69	48

TABLE 4 (3) continued.

August 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Maximum, %	100	100	100	100	100	100	100	100	100	100	
Minimum, %	96	63	73	52	74	100	98	67	89	87	
Day of month	11	12	13	14	15	16	17	18	19	20	
Maximum, %	100	100	100	100	100	100	100	100	100	100	
Minimum, %	96	65	100	75	98	65	79	70	85	100	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Maximum, %	100	100	100	100	100	100	100	100	100	100	100
Minimum, %	100	100	81	65	76	100	100	100	100	89	100

September 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Maximum, %	100	100	100	100	100	100	100	100	100	100	
Minimum, %	100	100	100	100	86	70	93	100	55	82	
Day of month	11	12	13	14	15	16	17	18	19	20	
Maximum, %	100	100	100	100	100	100	100	100	100	100	
Minimum, %	78	74	74	72	86	100	100	100	100	100	
Day of month	21	22	23	24	25	26	27	28	29	30	
Maximum, %	100	100	100	100	100	100	100	100	100	100	
Minimum, %	87	100	100	100	100	100	100	100	95	71	

October 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Maximum, %	100	100	100	100	100	100	100	100	100	100	
Minimum, %	88	78	78	74	77	100	100	100	84	100	
Day of month	11	12	13	14	15	16	17	18	19	20	
Maximum, %	100	100	100	100	100	100	100	100	100	100	
Minimum, %	100	62	42	68	75	66	65	100	80	100	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Maximum, %	100	100	100	100	100	100	100	100	100	100	100
Minimum, %	96	88	68	74	100	100	100	100	100	100	100

TABLE 4 (4) DEPOT, IN JUNGLE SITE

DAILY TEMPERATURE

July 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Maximum, °F	79.7	78.8	77.0	79.7	78.6	78.6	77.7	78.3	77.2	80.4	
Minimum, °F	73.0	73.0	73.6	71.2	69.8	71.4	74.8	71.8	71.8	72.5	
Day of month	11	12	13	14	15	16	17	18	19	20	
Maximum, °F	83.3	80.8	76.1	75.0	77.9	80.2	75.4	74.8	79.7	75.4	
Minimum, °F	73.0	73.6	73.4	71.4	71.8	71.4	69.4	70.7	71.8	70.0	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Maximum, °F	78.8	80.4	77.4	74.5	78.8	77.0	77.0	77.0	81.5	82.4	83.8
Minimum, °F	70.0	73.2	73.4	72.5	71.2	71.6	71.6	71.4	73.0	72.5	72.9

August 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Maximum, °F	80.2	83.5	84.2	82.8	82.4	77.5	77.4	80.8	77.9	77.9	
Minimum, °F	73.6	73.4	74.3	73.4	73.4	73.0	71.2	73.2	73.4	71.6	
Day of month	11	12	13	14	15	16	17	18	19	20	
Maximum, °F	79.0	80.2	77.4	80.6	80.6	82.6	81.5	80.8	79.0	75.9	
Minimum, °F	71.6	71.6	71.2	71.6	72.5	73.4	74.3	73.8	71.2	71.2	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Maximum, °F	77.0	77.2	79.7	78.8	79.3	77.0	77.2	77.0	79.0	79.0	77.0
Minimum, °F	71.2	70.0	72.5	69.6	71.6	71.6	71.4	71.6	72.5	69.8	68.9

September 1971

Day of month	1	2	3	4	5	6	7	8	9	10
Maximum, °F	78.8	78.4	79.7	78.4	80.2	81.5	80.8	78.8	82.6	80.8
Minimum, °F	71.6	69.4	71.6	72.7	73.2	74.3	73.4	72.0	72.0	72.9
Day of month	11	12	13	14	15	16	17	18	19	20
Maximum, °F	88.5	87.8	82.9	82.0	80.6	78.8	78.4	78.1	78.1	81.5
Minimum, °F	73.4	73.6	74.3	74.5	70.2	72.0	72.0	73.4	71.6	71.6
Day of month	21	22	23	24	25	26	27	28	29	30
Maximum, °F	81.9	77.2	79.0	81.0	79.0	81.5	77.0	78.8	79.0	79.0
Minimum, °F	72.0	73.0	71.8	71.6	71.6	72.5	71.6	70.7	73.0	73.0

TABLE 4 (4) continued.

October 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Maximum, °F	79.2	79.3	79.0	80.4	81.1	76.1	76.5	73.0	77.5	70.2	
Minimum, °F	73.4	73.4	73.0	73.2	73.0	72.7	70.0	69.8	68.5	68.5	
Day of month	11	12	13	14	15	16	17	18	19	20	
Maximum, °F	70.0	72.5	73.8	71.8	73.6	73.6	75.6	73.4	78.4	77.9	
Minimum, °F	68.4	66.6	67.8	65.1	64.4	63.9	67.6	68.4	69.4	70.3	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Maximum, °F	78.6	76.6	77.7	78.4	73.8	77.4	74.3	71.6	69.8	68.0	71.6
Minimum, °F	70.3	69.4	68.9	70.5	71.6	72.5	70.7	69.6	66.0	63.5	65.8

DAILY RELATIVE HUMIDITY (Recorded by hygrothermograph)

July 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Maximum, %	96	97	97	99	100	96	95	96	97	98	
Minimum, %	81	75	88	74	84	90	84	85	83	80	
Day of month	11	12	13	14	15	16	17	18	19	20	
Maximum, %	91	91	98	99	98	96	99	99	95	98	
Minimum, %	68	72	86	94	78	74	85	85	71	84	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Maximum, %	96	86	90	97	97	100	99	97	96	95	94
Minimum, %	74	66	75	88	82	81	86	90	74	69	59

August 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Maximum, %	95	95	92	91	91	96	96	95	91	94	
Minimum, %	84	65	70	60	70	84	84	68	80	80	
Day of month	11	12	13	14	15	16	17	18	19	20	
Maximum, %	97	96	100	96	98	95	95	95	99	100	
Minimum, %	86	71	90	71	85	68	74	71	79	93	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Maximum, %	98	100	100	97	97	95	99	100	100	100	100
Minimum, %	90	87	75	66	81	86	86	91	81	80	86

TABLE 4 (4) continued.

September 1971

Day of month	1	2	3	4	5	6	7	8	9	10
Maximum, %	99	98	100	96	96	95	97	96	96	95
Minimum, %	75	85	85	84	79	71	83	88	62	75
Day of month	11	12	13	14	15	16	17	18	19	20
Maximum, %	95	95	95	95	96	100	100	100	99	96
Minimum, %	75	72	72	72	82	88	87	87	95	70
Day of month	21	22	23	24	25	26	27	28	29	30
Maximum, %	96	98	99	97	96	96	100	100	95	88
Minimum, %	74	92	88	70	81	79	95	82	80	73

October 1971

Day of month	1	2	3	4	5	6	7	8	9	10	
Maximum, %	93	95	95	99	97	99	100	100	99	99	
Minimum, %	80	74	78	69	73	93	93	97	79	97	
Day of month	11	12	13	14	15	16	17	18	19	20	
Maximum, %	100	99	93	87	88	94	94	95	97	100	
Minimum, %	100	66	55	69	70	67	66	89	75	81	
Day of month	21	22	23	24	25	26	27	28	29	30	31
Maximum, %	99	95	93	90	100	100	98	100	100	100	96
Minimum, %	85	74	68	70	97	87	94	98	99	92	80

DISCUSSION

There are points to be considered concerning the observations and results of the tests on combat and survival rations, changes in physical, chemical and biological properties may be discussed as follows:

Physical changes

Visual observation showed that many of the ration packages appeared to have been attacked by ants or other insects, exceptions being dehydrated cooked rice and the majority of banana jam samples. The attacks made on the ration packages by insects might have been induced by the smell of food left contaminating the outside of the packages when they

were sealed. Unlike the survival rations, the dehydrated cooked rice and banana jam were particularly dry and smell less. This might have been one of the reasons for their not having been attacked by ants and other insects.

It appeared that the containers of these rations are not insect-bite proof and they are susceptible to perforation, particularly at creases, in normal handling, transport and storage. Oily leakages from inside some of the packages were observed at the inspection made after withdrawal. These leakages might be accounted for by ant attack and/or bad sealing of the package.

Weight changes were observed in almost all test items, and most cases were of increasing weight. Greater weight increases appeared to occur in test samples stored in the depot in the jungle site than in those stored in the depot in the cleared site. This might be accounted for by the fact that the humidity prevailing in the jungle site was generally higher than in the cleared site. The survival rations of powder types showed more weight increase than the bar types. The increase in weight of the dehydrated cooked rice might be accounted for by its hygroscopic nature, the paper bag certainly being permeable to water vapour.

Chemical change

This particular group of samples was not subjected to tests for chemical changes because the foodstuffs are solid. Only liquid foods, such as canned ones were tested for pH changes which is taken to be an indicator of change in food condition.

Biological change

It is believed that degradation of stored samples is largely accounted for by bacteria and mold growth on the samples. The combat and survival rations were subjected to microbiological tests. The tests made were aerobic count, mold count, anaerobic and coliform tests. In not very many cases did samples appear to contain anaerobic or coliform bacteria as confirmed by qualitative tests for these classes of organism. It is possible that bacteria and/or mold get into food samples through

breakages in packages caused by ants or other insects. Identification of bacteria and mold species was not attempted due to lack of reference cultures.

CONCLUSION

It appears that the test results for the first withdrawal of the rations are not very consistent. Although minor changes in weight were observed, the causes could not readily be ascertained. Greater weight increases occurred in the rations stored in the depot in the jungle site than in those stored in the depot in the cleared site. Greater weight increases occurred in the powder type of survival rations than in the bar type ones. Therefore (because of the location) it is suspected that generally higher humidity in the jungle could be responsible for the former difference, but it cannot be confirmed at this early stage. Mold count and aerobic count are positive for most cases, while coliform and anaerobic tests are negative for most cases. It could be seen, then, that the rations were susceptible to aerobic bacterial and mold growth. Breakages in packages are believed to be responsible for the appearance of bacteria and mold in the food samples. Again definite conclusions cannot be drawn at this early stage as to the causes of the appearance of bacteria and mold. Comparison of the data obtained at different withdrawals and different seasons of the year should give us a clearer idea on the problems.

ACKNOWLEDGEMENTS

The authors wish to express their thanks to the Microbiology Unit, ASEAN, for their generous cooperation in providing space and facilities in the laboratory, and to Mr. Paitoon Kittichaichananon and Mr. Suchart Suntornpan who carried out the microbiological tests. Thanks are also due to Dr. L.E. Wood of RDC-T for providing valuable guidance in the prosecution of the project and for making many arrangements to bringing it into being.

APPENDIX I

TEST PLAN

SAKAERAT EXPERIMENT STATION

APPLIED SCIENTIFIC RESEARCH CORPORATION OF THAILAND

	SUBJECT	**PRESERVED FOODS** (Combat and Survival Rations)
1.	Sponsor	Preserved Food Organization
	Manufacturer	Preserved Food Organization
2.	Purpose	To study the changes in physical and chemical properties of combat and survival rations when stored under different conditions over different length of time. To determine their shelf lives. To study microbiological growth.
3.	Scope of trial	Number of types 9 Number of replicates 4 Number of withdrawal 8 Number of sites 2 Number of shelf levels 2 Number of specimens On sites : 576 cleared, 576 jungle Controls : 288 Number of specimens subjected to tests prior to exposure 36 Total 1476

4. Exposure

Sites: cleared, 50 x 50 metre area.
Jungle, adjacent to the cleared site.

Methods: specimens contained in cardboard boxes and stored in the shelter, similating field storage, and an air-conditioned room.

Controls: kept in an air-conditioned room about 250 metres away from the cleared site.

Specimens: 5-2-1, Dehydrated cooked rice.
5-2-4, Banana jam.
5-3-1, Survival ration # 1, in bar.
5-3-2, Survival ration # 2, in bar.
5-3-3, Survival ration # 2, in powder.
5-3-4, Survival ration # 3, in bar.
5-3-5, Survival ration # 3, in powder.
5-3-6, Survival ration # 4, in bar.
5-3-7, Survival ration # 4, in powder.

5. Assessment

Visual on site.
Weight changes.
Microbiological growth.

6. Withdrawal Programme

2 years with withdrawals at 3 monthly intervals.

7. Meteorological data

Routine.

8. Reports

At each withdrawal.

APPENDIX II

IDENTIFICATION CODES

The samples are labelled with a code consisting of a succession of figures and letters occupying eleven positions. Reading from the left, these are as follows:

Position 1 Arabic figure denoting test material.
(5 is for preserved foods).

Position 2 Dash.

Position 3 Arabic figure denoting the type of preserved food:

1 for canned food.
2 for combat rations.
3 for survival rations.

Position 4 Dash.

Position 5 Arabic figure denoting exact nature of food sample.

Position 6 Dash.

Position 7 Roman figure indicating the location of the sample during the exposure period, thus

I in the depot at the cleared site.
II in the depot at the jungle site.

No figure in the air-conditioned building.

Position 8 Upper case letter indicating the storage shelf:

U for upper.
L for lower.

Position 9 For all samples covered in this report, a lower case "a" indicating that the samples were enclosed in cardboard boxes, "b" indicating that the samples were outside cardboard boxes on the shelf.

Position 10 For all samples covered in this report, an upper case "A" indicating that they were withdrawn after 3 months exposure (first withdrawal).

Position 11 Arabic figure indicating the identity of the sample in a group with otherwise identical labels (or indicating number of replicate in a group).