food preferences, and other related facts concerning this beetle.

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MOISTURE LOSSES FROM SOIL SAMPLES AFFECTED BY CONTAINERS, TIME, AND PLACE OF STORAGE

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Though many ways have been devised to follow soil moisture trends, the gravimetric method is still very popular because it is accurate and inexpensive. Occasionally it may be necessary for research workers to take soil moisture samples on areas a great distance from their laboratory. As much as four or even eight hours may elapse before the samples can be weighed. A review of literature in this field failed to show any work on this subject so a study was initiated to determine how long soil samples could be exposed to drying in different containers without losing a significant amount of moisture before they were weighed.

Methods

Moisture losses from samples of clay loam soil of uniform moisture content were measured in six types of containers exposed to three periods of drying under two storage conditions. The types of containers were as follows: (1) large cans measuring 3.75 inches OD by 2.75 inches in height without masking tape, (2) large cans with masking tape, (3) small aluminum cans measuring 2.50 inches OD by 1.75 inches without masking tape, (4) small cans with tape and (5) quart jars filled one-third full. Large cans and jars contained approximately 200 grams of soil while the small cans held about 50 grams. The sixth type of container was a check sample included with each group of containers which was taken at the same time as the others but weighed immediately. The others were allowed to dry for 4, 8 and 24 hours. One group was left in the field and the other stored in a building for the drying period.

Each container type was replicated five times. With six types of containers, three periods of drying and two places of storage, there was a total of 180 samples. All samples were weighed in their respective containers except the jars. These samples were removed and placed in cans for weighing. Air temperature was recorded at both places of storage during the test period. All data were analyzed using analysis of variance with significant means separated by Duncan's Method (Le Clerg, 1957).

Results

Soil samples in small cans and jars had the greatest loss in moisture during the period tested as shown in Table 1.

There was a highly significant difference (.01 level) between the periods exposed to drying, the place of storage and containers. There was a highly significant interaction between containers and hours indicating that some containers were better than others when exposed to periods of drying. The analysis of variance and separation of means is shown in Table 2.

Table 2. Analysis of Variance Showing Separation of Significant Means

Source	D.F.	S.S.	M.S.
Total	179	759.85	
Storing	1	18.09	18.09**
Containers	5	264.87	52.97**
S X C	5	6.81	1.36
Hours	2	89.53	44.76**
S X H	2	0.35	0.17
C X H	10	83.04	8.30**
Reps	4	3.95	0.99
R X S	4	8.84	2.21
R X C	20	40.34	2.02
R X H	8	11.03	1.38
Error	118	233.00	1.97

** Significant at the .01 level.

Since air temperatures have a great deal to do with moisture loss, the temperatures were recorded at both places of storage, inside and outside. These data are presented in Table 3.

Table 1. Mean Soil Moisture Percentage by Place of Storage, Type of Container and Time Exposed to Drying.

Place of storage	Containers	4 hours	8 hours	24 hours	Means	Storage means
Inside house	Check	23.88	23.01	23.65	23.51	22.67
	Large cans	23.62	23.72	21.64	22.94	
	Large & tape	23.63	24.72	21.75	23.36	
	Small cans	18.58	21.91	21.42	20.64	
	Small & tape	24.45	25.25	21.70	23.80	
	Jars	21.30	22.45	20.46	21.40	
Outside house	Check	23.88	23.01	23.65	23.51	21.98
	Large cans	22.66	22.20	21.33	22.06	
	Large & tape	23.56	23.14	21.74	22.80	
	Small cans	19.75	22.29	18.81	20.28	
	Small & tape	22.08	25.03	21.59	22.90	
	Jars	20.26	21.13	19.42	20.27	

Table 3. Inside and Outside Air Temperature During the Period of Study.

Time	Place of Storage	
	Inside	Outside
	(Degrees F)	
11 A.M.	75	94
3 P.M.	76	100
6 P.M.	77	93
9 P.M.	78	58
12 midnight	75	57
3 A.M.	71	52
6 A.M.	68	52
9 A.M.	66	57
11 A.M.	68	83

Discussion

The separation of significant means was as follows:

Containers		
Check	Small tape	Large tape
23.51	23.35	23.12
Large	Jars	Small
22.53	20.84	20.46
Hours		
8	4	24
23.16	22.32	21.43

All means for hours were significantly different. All means underlined by the same line were not significantly different (.05 level). Those not underlined by the same line were significantly different.

The interaction between containers and hours was due largely to the small cans. In both places of storage, the small cans lost considerable moisture after four hours. Both groups of small cans in both places of storage gained about three percent in soil moisture. The reason for this is not known but it seems probable that loose fitting lids on the aluminum cans were responsible.

Moisture loss in the jars was due to condensation on the sides and after the soil was removed for weighing, the moisture remained in the jar. If the jars had been completely full, this loss probably would not have occurred.

Soil moisture samples in the large cans, large cans with tape and small cans with tape, apparently can be left eight hours without a significant loss of moisture. This was probably due to tighter fitting lids and the tape. Samples left for twenty-four hours lose a significant amount of moisture.

Place of storage, inside or outside, appeared to be important in all cases. Table 3 shows a difference in air temperature between the two places of storage during the first two drying periods.

Summary

Soil samples placed in large cans, plus tape and small cans plus tape did not lose a significant amount of moisture after having been left for four or eight hours before weighing. Small cans without tape, however, had lost considerable moisture after only four hours but in the eight hour sample they appeared to gain about three percent in soil moisture. The loosely fitting lids of the small aluminum cans may have been responsible for these variations. All samples lost a significant amount of moisture when weighing was delayed twenty-four hours. Accuracy was increased in all cases by storing samples inside a building.

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