Compounds containing both radiophosphorus and radiocarbon are also detected. A mixture of C^{14} and P^{32} labeled ADP on spots 4 and 5 exposed both films with different intensities. If there is an equal quantity (in counts per minute) of the two nuclides in a given spot, the closest film will be about four times as dark as the second film. A large excess of C^{14} will expose the closest film proportionally more. The reverse situation, where a doubly labeled spot contains many-fold more P^{32} counts per minute than C^{14}, cannot be immediately resolved. However, the relatively short half-life of P^{32} (14.3 days) permits the resolution to be made after an appropriate decay. This would be more difficult in the case of P^{32}-S^{35} labeled compounds.

In general, when C^{14}-P^{32} or S^{35}-P^{32} chromatograms contain only one radionuclide per spot, visual comparison of the two films permits a simple identification of the material. Under some conditions, doubly labeled spots may also be resolved.

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Strontium-90 in the 1959 United States Wheat Crop

Abstract. A broad sampling of the 1959 United States wheat crop has been analyzed for the presence of strontium-90. The level of strontium-90 found in these samples is in general agreement with the findings of other investigators, with the exception that the highest levels of strontium-90 in wheat were found in samples from Oklahoma.

An extensive investigation of the 1959 United States wheat crop for the presence of strontium-90 has been completed by this laboratory. Eighty-eight samples from 18 states were collected by nonscientific personnel at grain elevators and grain terminals within the respective states. The samples were taken from wheat mixtures from crop areas surrounding the elevators and terminals. All samples were transmitted to this laboratory for analysis.

Table 1. Strontium-90 content of wheat samples by states.

State	Samples (No.)	Picocuries/kilogram			Picocuries/gram of calcium		
		Average	Max.	Min.	Average	Max.	Min.
Arizona	1	9.4			24.4		
California	4	7.6	14.7	4.7	22.7	52.6	11.9
Colorado	4	25.0	43.6	10.1	51.9	104	19.4
Idaho	8	19.4	48.5	9.9	41.4	78.7	22.0
Illinois	3	55.4	69.1	25.5	174	231	75.2
Indiana	9	53.0	85.7	25.6	135	232	67.4
Kansas	8	50.9	93.4	24.0	119	222	47.0
Minnesota	4	38.7	46.7	30.8	117	154	88.2
Missouri	3	44.5	54.0	36.7	134	164	105
Montana	8	29.9	40.3	17.7	85.4	104	51.5
Nebraska	5	54.9	80.0	36.7	141	211	96.5
Nevada	1	7.7			17.6		
North Dakota	8	27.4	44.3	18.7	95.7	158	62.2
Ohio	5	51.3	68.6	29.1	140	196	76.8
Oklahoma	8	82.8	132	59.9	233	366	182
South Dakota	3	30.1	35.6	23.1	79.2	85.5	68.5
Texas	5	58.6	85.1	44.3	125	181	92.4
Utah	1	19.2			38.4		

The preparation of wheat samples for analysis was straightforward. Seventy-five grams of wheat were ground in a pin mill and then ashed at 450°C for 20 to 24 hours. The inorganic residue was dissolved with a small amount of concentrated nitric acid. Strontium nitrate carrier was added, and the sample was digested 1 hour on a steam bath to promote isotopic exchange. Essentially all of the ash was dissolved by this procedure.

The amount of strontium in the wheat was determined by the fuming nitric acid method of Martell (*1*). The dissolved sample was treated with fuming nitric acid, and strontium was precipitated as the nitrate. After two nitrate precipitations, the precipitate was dissolved in water, and yttrium was precipitated as a hydroxide. The yttrium-free Sr^{90} was held for 10 to 14 days to permit the Y^{90} daughter to accumulate to radioactive equilibrium. The yttrium was again separated as a hydroxide and then precipitated for counting as an oxalate. Strontium was precipitated and counted as a carbonate. The counting was done in a Tracerlab CE-14 low-background counter which had been standardized with K^{40}, Sr^{90}, and Y^{90}.

The calcium content of the wheat was determined in a separate analysis. The results of the calcium analysis were used in computing picocuries of Sr^{90} per gram of calcium.

One wheat sample was analyzed by an independent laboratory, Nuclear Science and Engineering Corporation. The same sample was also analyzed by the Minnesota Department of Health. The results of the three laboratories were in agreement.

Table 1 shows the results of our analyses (*2*). Strontium-90 levels varied widely between samples within any particular state. When duplicate runs were made, however, the duplicate results were in agreement with the initial runs. The results are listed both in picocuries per kilogram of wheat and picocuries per gram of calcium. The highest levels were found in the south central part of the United States, with very low levels in the western United States.

The results of this survey show levels in the upper Midwest to be slightly lower than those reported by Caldecott for the 1958 wheat crop (*3*). On the other hand, the findings for Texas and Oklahoma wheat are somewhat higher. It is possible that these differences may be due to rainfall variations in the sampled areas from one year to the next.

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References and Notes

1. E. A. Martell, "The Chicago sunshine method, absolute assay of strontium-90 in biological materials, soils, waters, and air filters" [University of Chicago, Enrico Fermi Institute for Nuclear Studies, 1956 (AECU-3262)].
2. A detailed breakdown of the strontium-90 content by area within states is available from this laboratory upon request.
3. *Strontium Program, New York Operations Office, U.S. Atomic Energy Comm., Health and Safety Lab. Quart. Rept. HASL-69* (1959), pp. 129–130.

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