soil and none came by migration from the directly deposited Sr^{90} on the epidermis.

The epidermis contained 12.7 $\mu\mu$c of Sr^{90}. If 2.2 $\mu\mu$c of this total is a maximum estimate of the amount due to root uptake, then at least 10.5 $\mu\mu$c must have been due to direct deposition. The total Sr^{90} content of the entire wheat kernel was 47.2 $\mu\mu$c. Hence at least 22 percent of this total can be ascribed to direct deposition.

If the findings of this experiment can be generalized, a substantial drop in the Sr^{90} content of the 1960 wheat crop can be expected since the fallout rate and presumably the direct deposition of Sr^{90} on plants was much less in 1960 than in 1959 (*5*).

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References and Notes

1. "Fallout program quarterly summary report: December 1, 1959 through March 1, 1960," *U.S. Atomic Energy Comm. Rept. No. HASL-84* (April 1960), p. 100.
2. "Sr-90 in Human Diet in the United Kingdom," *Agr. Research Council Rept. No. ARCRL/1* (Her Majesty's Stationery Office, London, 1959).
3. C. C. Lee, *Science* **129**, 1280 (1959).
4. T. Earle, "Method of stripping epidermal material from grain," U.S. Patent Office No. 2867,256, 6 January 1959. Mr. Earle's address is Grain Purification, 859 Swarthmore Ave., Pacific Palisades, Calif.
5. Many of the radiochemical analyses reported here were done by Joseph Catania, Analytical Division, Health and Safety Laboratory. It is a pleasure to acknowledge his assistance.

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Preparation of a Floral Initiating Extract from Xanthium

Abstract. An extract from lyophilized tissue of flowering *Xanthium* (cocklebur) plants initiates floral development when applied to *Xanthium* test plants maintained on long-day photoperiodic conditions. Details of the preparation of the extract are described.

Hamner and Bonner (*1*) have submitted the first evidence of a hormone formed in *Xanthium* at the site of photoperiodic perception, the leaf, and later utilized by the bud in the transition from the vegetative to the flowering condition. They also record attempts to find a floral initiating preparation in extracts from flowering plant material. At the same time they tested numerous chemicals for activity. Although they did occasionally find evidence of floral-initiating activity in their plant extracts, they were unable to demonstrate any consistent pattern or to repeat their results with any confidence.

Table 1. Flowering response of *Xanthium* after application of extract.

Flowering response	Numerical av. of flowering response (*6*)
Untreated control plants	
All ten plants vegetative	0.0
Extract-treated plants	
Five plants vegetative (one plant, stage one; two plants, stage two; two plants, stage three)	1.1

Since that time there have been occasional published reports of preparations exhibiting floral-initiating properties. Such reports have not met the test of consistent repetition, with the exception of the now well-known effect of gibberellic acid in stimulating floral development in many long-day photoperiodically sensitive plants. Lang (*2*) suggests that gibberellic acid is probably not the primary floral-initiating stimulus, but that it acts indirectly in stimulating flowering. The action of gibberellic acid in promoting more rapid flowering in *Xanthium* (*3*) also appears to be an indirect effect.

The experiment described in the present report is the last of four successful demonstrations of floral initiation in *Xanthium* plants resulting from applications of as yet unknown substance(s) extracted from the branch parts of flowering plants. Our preparation has been independently checked by B. H. Carpenter and K. C. Hamner (*4*), and the results are in accord with our own.

Flowering branch tips were harvested from indigenous *Xanthium strumarium* L. var. *canadense* (Mill.) T. and G. (*5*) of the Long Beach area. The plants were picked when the staminate terminal inflorescence was from ½ to 1 cm in diameter. Each branch carried three to five mature leaves. The fresh material was frozen in liquid nitrogen and broken into fine fragments while in the frozen state. Care was taken that the material remained frozen until it had been thoroughly dried in a laboratory vacuum lyophilizer. After lyophilization, the material was placed in sealed containers and stored in a deep freeze at −20°C.

The lyophilized material was extracted with absolute methanol under a partial vacuum sufficient to maintain the temperature of boiling methanol between −5° and −10°C. A modified Soxhlet apparatus was used with a condenser containing a dry ice-acetone slurry as a coolant. The methanol solvent was removed from the extract by evaporation at room temperature or below in a Rinco apparatus attached to a water aspirator system. The product was a dark green, tarry residue which was mixed to homogeneity with anhydrous (USP) lanolin.

Two grams of the residue mixed with 17 g of lanolin was applied to the underside of the leaf surface of ten test plants. Ten control plants were treated in like fashion with 17 g of pure lanolin. During the 14 days subsequent to the application of the lanolin preparations, all test plants and control plants were maintained on a precise 8-hour dark and 16-hour (500 ft-ca intensity) light regime. On the 14th day after application, the terminal bud of each plant was dissected to ascertain the flowering response. The flowering stages were numerically evaluated (*6*), and the results are presented in Table 1. Three earlier experiments had yielded essentially similar results.

It is our belief that these results constitute the first reproducible demonstrations of floral initiation in a short-day plant as the direct result of an extract prepared from the tissues of flowering plants. It is suggested that this is a crude extract of the flowering stimulus. Currently, efforts are being directed toward further concentration and characterization of the active entity in this extract (*7*).

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References and Notes

1. K. C. Hamner and J. Bonner, *Botan. Gaz.* **100**, 388 (1938).
2. A. Lang, *Proc. Natl. Acad. Sci. U.S.* **43**, 709 (1957).
3. R. G. Lincoln and K. C. Hamner, *Plant Physiol.* **33**, 101 (1958).
4. A preparation of 2 g of extract mixed in 17 g of lanolin was given to B. H. Carpenter and K. C. Hamner, Botany Department, University of California at Los Angeles. The mixture was applied to ten test plants of *Xanthium;* ten comparable plants served as controls. All plants were maintained on long-day conditions for 17 days, after which they were dissected. The treated plants were flowering at the 50-percent level. All controls were vegetative.
5. C. L. Hitchcock, A. Cronquist, M. Ownbey, J. W. Thompson, *Vascular Plants of the Pacific Northwest* (Univ. of Washington Press, Seattle, 1955), part 5.
6. Results were evaluated in accordance with a numerical scale based on the diameter and morphological stage of development of the terminal staminate inflorescence. Vegetative plants were rated as zero on the scale. The first morphological change in the stem apex that could be clearly recognized as flowering was assigned a value of 1.0. A flowering apex measuring 0.25 mm in diameter was evaluated as 2.0. An additional increment of 1.0 was allowed for each 0.25 mm increase in the diameter of the developing inflorescence.
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