Table 1. Response of *Cucumis sativus* L. to allyl trimethylammonium bromide and gibberellin A_3 added to aerated solution cultures used as the root growth medium.

Concentration of AMAB or GA_3 (molar)	Flower sex responses			Vegetative responses	
	Node of first pistillate flower above cotyledons	No. of nodes producing*		Position of first tendril	Plant heights (monoecious cucumber) or lengths of first internode (gynoecious cucumber) (cm)
		Pistillate flowers	Staminate flowers		
Effects of allyl trimethylammonium bromide on a monoecious cucumber (var. Marketer)					
0 (control)	18 c†	1a	19 b	6a	302 d
10^{-6}	10 b	2a	18 b	7 b	256 c
10^{-5}	7 b	2a	18 b	9 c	207 b
10^{-4}	6 b	9 b	11a	10 c	108a
5×10^{-4}	2a	9 b	12a	11 d	79a
Effects of gibberellin A_3 on a gynoecious cucumber (var. MSU 713-5)					
0 (control)	1a	10 c	0a	3 b	2.1a
10^{-7}	2a	10 c	0a	3 b	2.4a
10^{-6}	2a	10 c	0a	3 b	2.6a
10^{-5}	2 b	9 c	1a	2a	2.6a
10^{-4}	6 c	5 b	4 b	2a	5.5 b
10^{-3}	11 d	0a	9 c	2a	13.0 c

* Number of nodes confined to first 20 in the monoecious cucumber and to 10 in the gynoecious cucumber.
† Means not containing a common letter are significantly different at the 5-percent level [see D. B. Duncan, *Biometrics* **11**, 1 (1955)].

flowers in the gynoecious cucumber up to the tenth node (Table 1). While no flowers were usually formed at the first node, there was an uninterrupted sequence of staminate flowers from the second through the ninth nodes. At $10^{-4}M$ GA_3 staminate flowers were continuous through the second to fourth nodes with some additional nodes that produced staminate flowers before the tenth. A few plants produced both staminate and pistillate flowers at the same node. Such "mixed nodes" immediately preceded the reversion to the pistillate phase. Gibberellin at $10^{-5}M$, or higher, changed the position of the first tendril from the third to the second node. Similarly, the promotive effects of GA_3 on staminate flower formation paralleled the increase in elongation of the first internode.

These results indicate that flower sex expression in *Cucumis sativus* L. may be subject to control through adequate levels of certain chemical stimuli continuously available to the roots through the solution culture technique. While many plant growth substances will increase the number of pistillate flowers on monoecious cucumbers, as well as the ratio of pistillate to staminate flowers, and cause pistillate flowers to form at somewhat earlier nodes, in no instance have these effects approached the magnitude of those indicated for AMAB, nor were they associated with a delay in tendril formation and reduced vegetative extension. Similarly GA_3, at heroic dosages to the foliage, has induced some staminate flowers to form on two to five nodes on the gynoecious cucumber (*3, 5*), but when applied at appropriate concentrations in the root medium it causes a complete reversion in flower sex expression for an extended period. Thus, the mutually competitive inhibition of AMAB and GA_3 in vegetative responses (*6, 11*) applies also in sex expression. These results emphasize the significance of the apparent endogenous gibberellin level in modifying inherent flower sex types in the cucumber.

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Rainfall and Deposition of Strontium-90 in Clallam County, Washington

Abstract. A linear relationship between cumulative strontium-90 deposition and rainfall has been observed from measurements made at five sites on the Olympic Peninsula. When an estimated contribution from dry deposition is subtracted from the measured total, the strontium-90 concentration in precipitation is seen to be independent of the amount of precipitation.

It has been known for some time that rainfall is the primary process by which fission products in the atmosphere are deposited on the earth's surface. From an extensive monthly rain collection network in the United States in 1956, linear relationships between strontium-90 deposition and amount of rainfall were observed within limited geographical areas (*1*). Other studies in the United States (*2*) and the United Kingdom (*3*) with open vessel collectors and soil analyses (*4*) have borne out this relationship. In those studies where only rainfall was measured, the strontium-90 concentration (activity per unit volume of rain), over a period of a month or more, was independent of the amount of rainfall.

Although the importance of the contribution of dry deposition has been considered as a possible reason for calculated high strontium-90 concentrations in areas of low precipitation, when debris deposited during both wet and dry periods was measured, there have been few attempts to determine the amount of strontium-90 that deposits in the dry state. Recent information from Norway, a country of comparatively heavy precipitation, suggests that at the end of June 1959, as much as 30 percent of the estimated strontium-90 deposited may have been dry fallout (*5*).

In addition to the U.S. Atomic Energy Commission's world-wide soil sampling program, a study was made of the strontium-90 deposition in a limited geographical area where the yearly amount of rainfall varies markedly from site to site. In 1957, four sites in Clallam County, Washington, on the Olympic Peninsula were selected (Sequim, Port Angeles, Joyce, and Forks) where the mean annual amount of rainfall varies from 15 inches to 110 inches as one proceeds in a westerly direction. The sites were resampled in 1959 and 1960 with the addition of one more location, Clallam

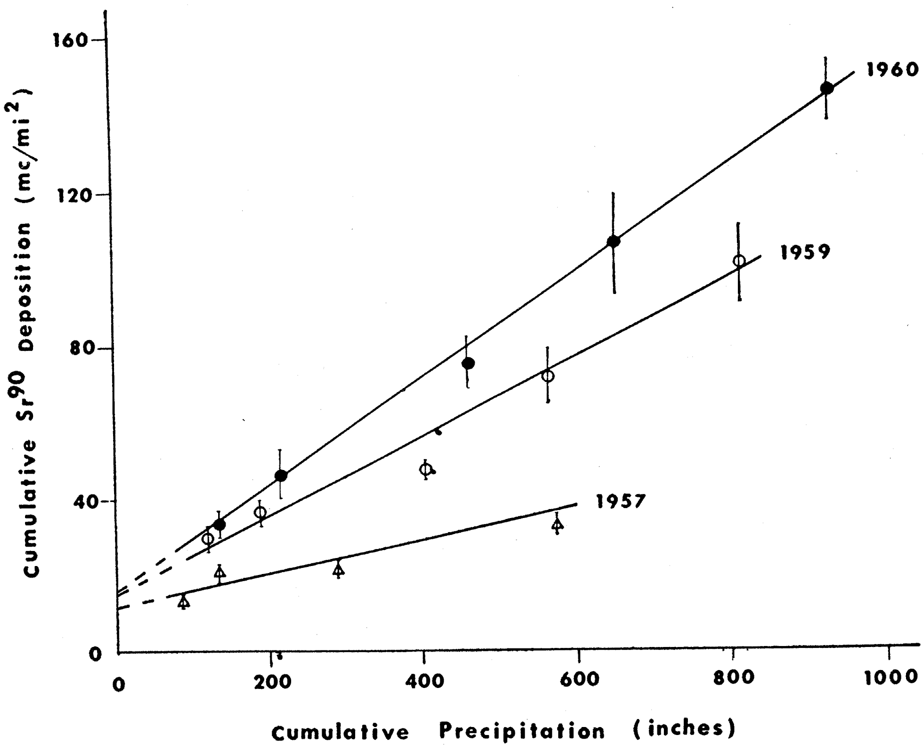

Fig. 1. Cumulative Strontium-90 Deposition at Five Sites in Clallam County, Washington as a Function of Amount of Precipitation (1-1-53 to sampling date). The standard deviation from the mean of replicate results is represented by vertical lines through the points. In the case of a single analysis, a standard deviation of 10 percent was assumed.

Bay. The annual rainfall since 1953 at each site has been very consistent and, in fact, has varied only slightly from long-term average figures published in 1939 (*6*). From the monthly rainfall patterns for the five sites, one may conclude that the seasonal trends are the same. July and August are the driest months, after which the rainy season comes on gradually, reaching its peak in December or January. The range is relatively small from site to site during the period of low rainfall, while the largest divergence in rainfall occurs during the months of highest precipitation. These five sampling sites are, in all probability, subjected to rainfall from the same westerly air masses that pass over the peninsula from the ocean.

Figure 1 shows the average cumulative strontium-90 measurements of soil samples collected in 1957, 1959, and 1960 plotted against the cumulative amount of rainfall from 1953 through 1960. A linear relationship between strontium-90 deposition and rainfall amount is clearly indicated. The dashed portion of the straight line determined by the method of least squares is an extrapolation to zero rainfall on the assumption that the relationship between strontium-90 activity and rainfall continues to be linear in this region. If this is indeed the case, then it would appear that a significant portion of strontium-90 deposited on the soil in this area was *not* brought down by rainfall. The cumulative fallout per inch of rain increases from one year to the next as evidenced by the change in slope of the straight lines. The values of the *y*-intercept, which are taken to represent the cumulative dry deposition, are 12 ± 3 millicuries of strontium-90 per square mile in 1957, 15 ± 5 in 1959, and 16 ± 2 in 1960.

Plots of the measured activity of strontium-90 per inch of precipitation versus the amount of precipitation are curvilinear and show a decrease in the strontium-90 concentration with increasing amounts of rain. This would be expected since the straight lines have positive *y*-intercepts or, in other words, since significant amounts of strontium-90 fell out during dry periods. If the further assumption is made that the same amount of cumulative dry deposition has occurred at each site during each sampling year, then by subtracting this amount from the total measured deposition, one obtains the contribution from rainfall alone. The resulting plot of strontium-90 deposition and rainfall is a straight line which passes through the origin. It may be concluded that in Clallam County the cumulative strontium-90 concentration in rain is independent of rainfall provided that a correction is made for the strontium-90 which has fallen out in the dry state, by gravitational settling, vertical impaction, or some other mechanism. The 1960 data, which are averages of six to eight determinations, show this more clearly than the data for the earlier years which are results of single, or at most, duplicate analyses.

This study indicates that at sites within the specific area examined, there is a linear relationship between the cumulative strontium-90 deposition and precipitation. About 16 millicuries of strontium-90 per square mile had been deposited during dry periods in Clallam County since the beginning of weapons testing to the end of 1960, whereas only one-quarter of this amount fell out in the dry state between 1957 and 1960. The relatively small amount of dry fallout during the latter period can probably be explained by the fact that most of the debris was stratospheric and was brought down primarily by rainfall after it had penetrated the troposphere. When the amount of dry deposition is taken into account, the strontium-90 concentration in precipitation is observed to be independent of the amount of precipitation.

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