Table 1. Correlations of haploids with diploids of homozygous and heterozygous background. YEPD and MV are normal and MVDEX and MVETOH are stress media; d.f. = degrees of freedom for the correlations; *F* represents the ratio of the "among clones within slabs" and the "within clones" or "error" mean squares; *r* is the correlation coefficient.

Medium	Haploid mating type	Correlations: Homozygous diploids *r*	Homozygous diploids *F*	Heterozygous diploids *r*	Heterozygous diploids *F*
		NG-treated haploids (d.f. = 38)			
YEPD	*a*	−.191	1.17	−.119	2.24†
YEPD	*α*	+.247	1.34	−.033	3.21†
MV	*a*	+.074	1.10	+.098	2.46†
MV	*α*	−.274	1.68*	+.296	2.60†
MVDEX	*a*	+.022	1.22	+.762†	6.44†
MVDEX	*α*	−.079	1.70*	+.356*	2.84†
MVETOH	*a*	+.098	1.53	+.657†	6.35†
MVETOH	*α*	−.064	1.22	+.617†	4.40†
		Control haploids (d.f. = 19)			
MVDEX	*a*	−.036	1.16	+.124	1.31
MVDEX	*α*	−.023	1.41	−.172	1.24
MVETOH	*a*	+.008	1.09	+.265	1.17
MVETOH	*α*	−.026	1.09	−.158	1.61

* Significance at the .05 level or less. † Significance at the .01 level or less.

Coincidentally, two of the mutant clones resulting from the crosses with X2180-1B were *a* and two were *α*, which reduced the degrees of freedom in all treated-cell correlations from 40 to 38.

The only significant correlations were obtained between the treated haploids and their heterozygous diploids on the stress media (Table 1). Three of these are highly significant, and the fourth is significant at the 5-percent level. The *F* values are also larger for the heterozygous than for the homozygous diploids. The treated haploids, homozygous diploids, and heterozygous diploids were the same throughout the experiment, the only difference being that cells derived from these clones were grown on different media. The degree and nature of the heterozygosity in the background genotype necessary to bring about the change from no dominance to partial dominance remain to be determined.

Similar phenomena have been observed in *Drosophila melanogaster* and *Tribolium confusum* (*6, 7*). Crowding, with a presumed increase in environmental stress, increases partial dominance of egg-to-adult viability (*6*). Wallace found a very slight increase in viability from egg to adult of homozygous flies in which one chromosome had been given x-irradiation, but a slight decrease when these same chromosomes were introduced into heterozygous strains (*7*). In my experiment, an untreated diploid clone of the same genotype was included on each slab of treated diploids, and the growth rates of these clones were compared by means of a sign test with the average growth rate of the treated clones on the same slab. With the diploids of homozygous background, the untreated control grew more quickly on 19 slabs and more slowly on 29, giving a nonsignificant chi-square of 1.69. With those of heterozygous background, the control grew more quickly on 38 slabs and more slowly on ten, giving a chi-square of 15.19 (significant at the .01 level), an effect similar to Wallace's second observation. However, overdominance—an increase of heterozygote growth rate over the homozygote—was not detected in the diploids with a homozygous background. This may simply be because of the relatively small amount of data in my experiment.

The effects of newly induced mutations appear similar in both drosophila and yeast. It may therefore be possible to employ yeast to determine the reasons for the striking effect of background genotype on partial dominance.

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Tritium Movement in Soil of Tropical Rain Forest

Abstract. *Tritiated water applied to the surface of soil in a tropical rain forest was found in free water of the litter and top 18 centimeters of soil as long as 7 months after the application. Plant roots, even in the high-rainfall environment of a tropical rain forest, therefore are exposed to tritiated water for considerable periods of time after release.*

Tritium might be released to the tropical environment through military or peaceful thermonuclear detonations. The behavior of such releases in the tropical ecosystem is not well known, although Koranda (*1*) found tritium in soils and plants of Eniwetok Atoll 12 years after testing of thermonuclear weapons had ceased there. We now report on the residence half-times of tritium in clay soils of the tropical rain forest in the Luquillo Mountains of eastern Puerto Rico.

A soil plot, 0.94 m^2 in area, was prepared by installing a lysimeter (*2*) 18 cm below the soil surface, without disturbing the soil above, from a horizontal tunnel originating outside the plot. Free water that was percolating through the soil was collected in the lysimeter, drained into a plastic collection vessel, and sampled after every rain for 3 weeks and weekly thereafter. The downslope terminus of the plot was fitted with a metal tray that was placed as nearly as possible at the litter-soil interface to collect surface run-off water. Two rain gages were placed at the sides of the plot to measure rainfall at the forest floor. Above, canopy rainfall was measured by a standard tipping-bucket rain gage on a tower. From a sprinkling can, 1 liter of tritiated water (concentration, 20 mcurie/liter) was applied to the plot. The sampling program lasted for 210 days after the tritium was applied. Tritium was determined by standard methods of liquid scintillation counting in 1-ml water samples. We did not convert results to absolute activities because all we required was the variation of count rates with time.

Tritium activity in soil water collected 18 cm below the surface reached a peak in approximately 16 days and declined exponentially during the rest of the experiment (Fig. 1, curve *A*). The effective half-life (*3*) after reaching the peak (uncorrected for tritium decay) in this soil (found by least-squares analysis) was 16.3 days. The curve represents the spatial distribution in soils, and was obtained in the soil profile with a fixed-point collector which measures the shape of the distribution. Thus, the time distribution is interpreted as a mirror image of the moving spatial distribution (at peak) passing through the lysimeter. Tritium moved through the soil profile with a sharp leading edge, followed by a long, exponentially declining tail.

The first phase of tritium release in soil-surface water had an effective half-life of approximately 2.9 days; the second phase had a half-life of 35.6 days. The first phase of tritium loss in the surface probably reflects penetration of the moving front of tritium into the profile and dilution and equilibration with the incoming waters which saturate the surface litter. The second, longer-lived phase may represent partial release of tritium trapped as immobile water in the tortuous pore spaces of the soil near the surface. The fact that the effective half-life of this phase is longer than in the soil profile means that, in the soil surface or surface litter, there is some compartment which has less complete equilibration with incoming fresh water than that indicated by the soil profile. Such compartments could include the water used in metabolism by soil and litter organisms.

Cumulative rainfall during the experiment was 184 cm above the forest canopy and 137 cm at the forest floor (Fig. 2). Although the rainfall pattern had many highs and lows of input, tritium loss occurred as a more or less smooth function of time. Soils remain close to saturation constantly, and saturated flow through the lysimeter begins within a few minutes after the start of rainfall.

A theoretical model for the behavior of tritium in soils (*4*, *5*) contends that tritiated water applied as a unit pulse to a soil surface will move downward in the soil profile as a front or peak which separates preexisting water from water entering the system after the tritium input. According to the model, the peaking phenomenon occurs because of the rapid rate of self-diffusion in soils, as compared with the slow rate of bulk water movement. The rapid exchange prevents the tritium pulse from overtaking old water in the soil, and from being overtaken by new inputs of water. Vertical diffusion causes the natural peak to broaden during downward movement in the soil, but we expect concentrations of tritium in the free soil water after the peak to approach zero if all phases of immobile water are equally rapidly exchanged with the freely moving water (*6*).

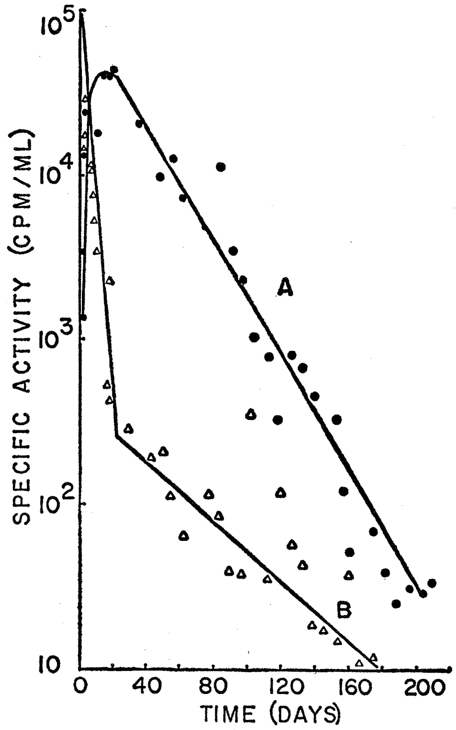

Fig. 1. Loss rates of tritium from soil and from surface litter in a tropical rain forest. (*A*) Tritium in free soil water collected 18 cm below the surface; (*B*) tritium in free surface water.

Clay soil has many tortuous pore spaces that may inhibit free molecular diffusion of tritiated water. In clay soils there are other sites, such as clay water films and exchangeable hydrogen, that could have a restricted molecular exchange with the freely moving bulk water. Such diffusion-restricted compartments would result in exponential die-away curves, since the process of removal would consist essentially of successive dilution in an infinite series.

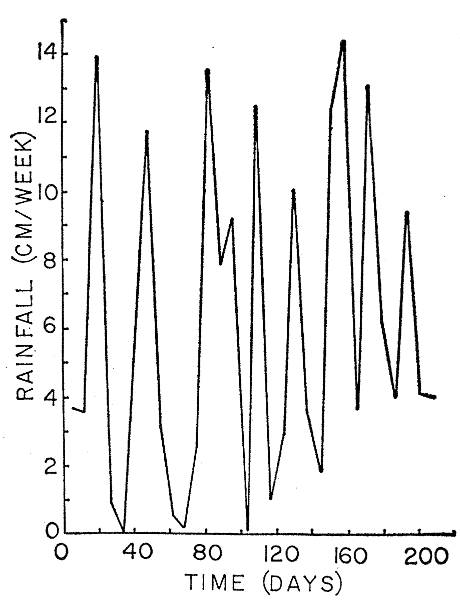

Fig. 2. Rainfall input to the tropical rain forest during the experimental period. No relationship was found between tritium activity in soil and surface waters and rainfall.

The occurrence of the two-phase release curve in the soil litter and mineral surface supports the view that in soil there are somewhat isolated compartments of immobile tritium which do not have complete, rapid exchange with the freely moving bulk water.

We conclude that the basic model proposed by Zimmerman *et al.* (*4*) for tritium movement in soils must be modified to allow for the existence, in clay soils, of isolated compartments of immobile water that do not have completely free molecular exchange with the more rapidly moving phases. Even in clay soils of the tropical rain forest, most of the tritium pulse passed through the profile in the form of a peak or front in a manner similar to that shown by Zimmerman *et al.* After the peak the profile remained labeled. This behavior must be considered in predicting the bio-environmental effects of thermonuclear detonations. If tritium moved in soils as a peak analogous to the movement on a chromatographic column, it would relatively quickly be carried out of the major rooting zone of most plants in high-rainfall areas. The residual labeling of the soil profile as shown here implies that plant roots would be exposed to tritium long after the input, and that food products grown on these soils would be correspondingly contaminated.

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