TARC Note

A Property of Tropical Rain Shower

It is generally recognized that rainfall property is closely related to soil erosion. In the tropics, rainfall of high intensity occurring for a short period causes soil erosion. Therefore an experiment was conducted to analyse in detail the rainfall characteristics.

Rain intensity was measured by using a tipping bucket rain gauge, which generates electric pulse every 0.5 mm of rainfall. The size of raindrops was measured by using the glass plate blotter method (Mihara's method).[1)]

Rainfall which occurred on September 29, 1981 at Bangkhen, Bangkok, was analysed in detail into the following parameters; rain intensity and kinetic energy of rainfall, distribution ratio of the number of raindrops and amount of rain fractions composed of raindrops differing in their diameter.

The rainfall was a typical rain shower in the tropics. As shown in Fig. 1, the rainfall lasted for about one hr and was heavy in the first half of the period, showing the maximum intensity at 20–23 min after the beginning of the rainfall. The total precipitation was 19 mm.

Distribution of raindrop size was determined at different times by the Mihara's method.[1)] In general, raindrops of middle and large size were observed at the very beginning of the rain shower. During that period, there were also a large number of small raindrops less than 0.8 mm in diameter, and a small number of large raindrops more than 4.0 mm. Although the number of such small raindrops was large, the relative amount of rain fraction contributed by them was small, as shown by the low distribution ratio of that fraction to the total amount of rainfall.

Two peaks in the distribution of rain fractions composed of different size raindrops were observed at the intensity of 1 mm/min, which was the maximum intensity during the rainfall. One of the peaks corresponded to raindrops with a diameter of 0.8 to 1.2 mm, and the other to raindrops of 4.8 to 5.2 mm. After the rain intensity reached the maximum, the relative amount of rain fraction composed of raindrops ranging from 0.8 to 1.2 mm in diameter increased while the large raindrops rapidly decreased with time.

It is generally recognized that erosivity is closely related to intensity of rainfall. Particularly, kinetic energy of rain is the factor most closely related to erosion. The kinetic energy was computed from mass and number of raindrops obtained by the experiment, and falling velosity of raindrops was calculated by Mihara's empirical equation. As shown in Fig. 1, it was observed that the maximum kinetic energy was 2.96×10^{4} erg/cm^{2} · min which corresponds to the rain intensity of 1 mm/min and the minimum kinetic energy was 2.01×10^{3} erg/cm^{2} · min corresponding to the rain intensity of 0.2 mm/min. Relation between the rain intensity and the kinetic energy is shown in Fig. 2. The kinetic energy shown when the rain intensity was increasing was higher than that shown when the intensity was decreasing. The kinetic energy in the former case increased at the rate of rain intensity to the power of 1.01, whereas that of the latter case decreased in proportion to rain intensity to the power of 1.64. The difference of the kinetic energy found between the former case and the latter case depends on the role of large raindrops: in the former the relative amount of large raindrops was more than that in the latter case.

Acknowledgment

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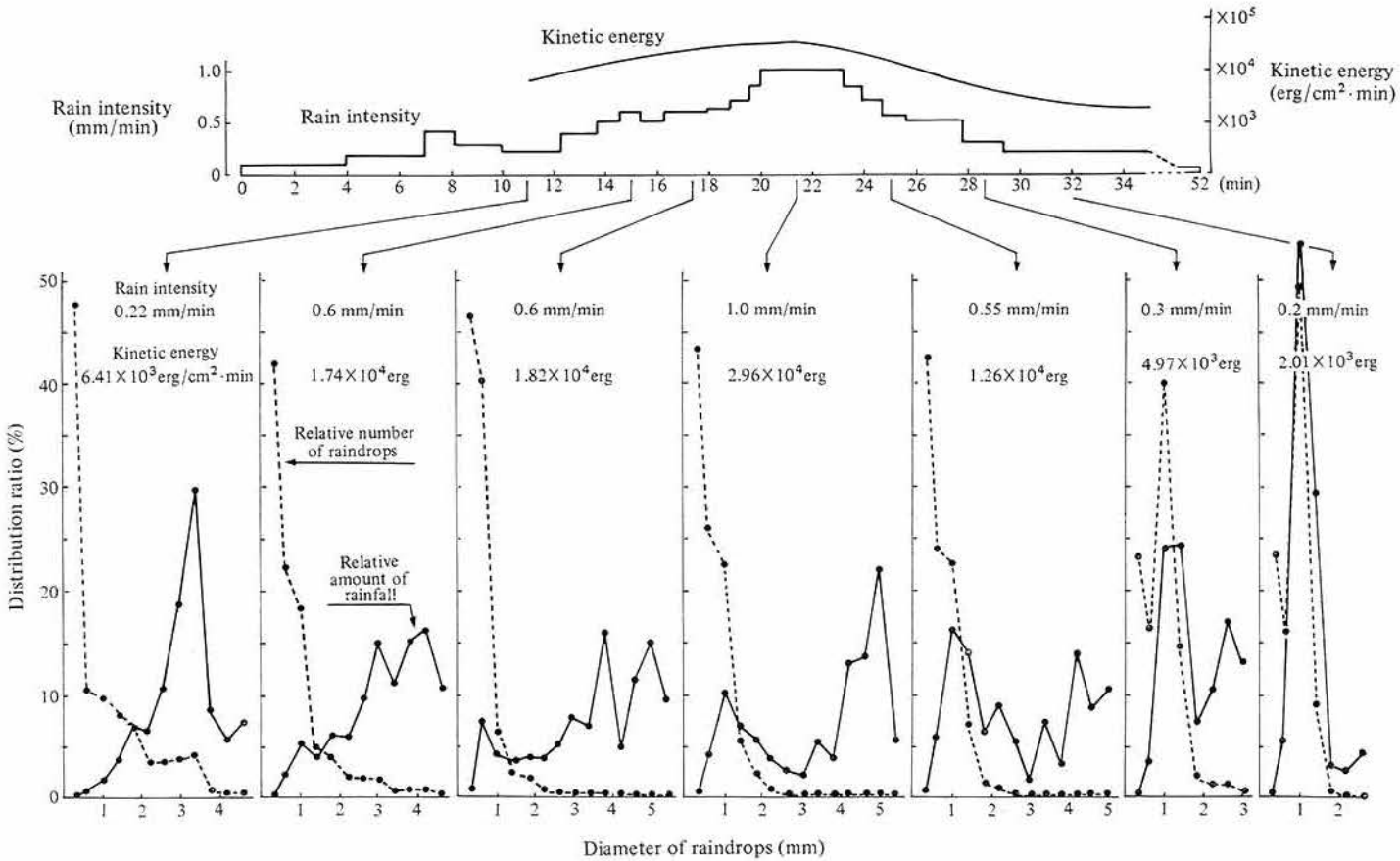

Fig. 1. Raindrop distribution and amount of rainfall depending on the size of the drops and rain intensity and kinetic energy

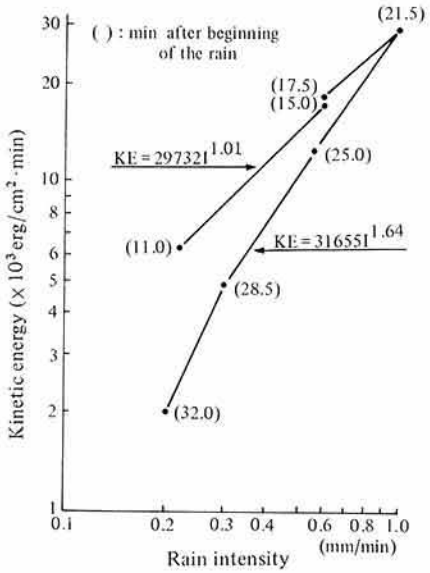

Fig. 2. Relation between rain intensity(I) and kinetic energy(KE)

1) Mihara, Y.: Raindrop and soil erosion, *Bull. Nat. Inst. Agr. Sci.*, A. No. 1, 1–52 (1951).

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