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Fig. 1 Here 5 mm drops fall in a 20 mph wind. Wind is blowing from left to right

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# How *WIND* Affects the Size and Shape of RAINDROPS

IF waterdrops fall in wind long enough, they will have the shape of an oblate spheroid with a flattened area between bottom and upwind side (Fig. 1). That is one conclusion of this study investigating effects of wind on raindrop parameters commonly used in soil erosion studies. Test results hopefully will permit more accurate simulation of natural conditions when studying erosion by wind-driven rain and will aid in understanding wind effects on natural raindrops.

The motion and path of waterdrops falling in wind were measured in a wind tunnel-raintower. Multiple-exposure photographs were taken of drops falling from 34 ft above the wind tunnel floor. The wind tunnel is 5 ft wide, 8 ft high, and 100 ft long. Air movement is from a 200,000 cfm industrial fan powered by a 100 hp internal combustion engine. Airflow in the wind tunnel is modified by a honeycomb and two screens to give a relatively uniform velocity distribution beneath the raintower. Drops released from 34 ft above the tunnel floor attain at least 95 percent terminal velocity before reaching the floor. Here individual drops of known size were used. Drop sizes were determined gravimetrically; equivalent diameters were then calculated. The drops were assumed to be spheres with a density of 1 g per cc. Drop formers produced drops of 2.2-, 3.6-, 4.3-, or 5.0-mm.

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This is an abstract. The complete report includes schematics of the wind tunnel-raintower facility plus the camera-Strobotac arrangement. Summaries of the test data evaluate test results in terms of their influence on the water-drop parameters used in rainfall erosion studies. For this report, request Paper I-210 from ASAE, St. Joseph, Mich. 49085. Cost is 50¢ per copy — or your ASAE Member Order Form.

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The light source is a repeating electronic stroboscope that can create up to 25,000 flashes per min. The camera is a Polaroid 150 with 3000 ASA speed film. Drops were photographed through Plexiglas.

Drop velocity is calculated by dividing the distance between drop images each time the stroboscope flashes by the actual time between flashes. Waterdrops were photographed after falling 2.5, 4, 5, 6 and 7 ft in winds of 6.3, 10, 15, and 20 mph.

In these tests waterdrops were dropped 26 ft into the 8-ft wind tunnel. Horizontal and vertical velocities and horizontal drop displacement were measured from the photographs; kinetic energy and waterdrop momentum were calculated. Prediction equations then were developed for horizontal velocity and displacement of the drops falling in the wind tunnel.

Vertical drop velocity decreased as wind velocity increased to lower the resultant velocity in wind below that in still air. The resulting decrease in kinetic energy and momentum exhibited by the drops in wind may be due to this specific physical arrangement and may not apply to natural rain.

Although some parameters under study were undoubtedly affected by the lab facility, conclusions can be drawn about the effects of wind on both natural and simulated rain. The velocity of natural raindrops falling in wind is the vectorial sum of the terminal drop velocity in still air and the average horizontal windspeed. The prediction equations developed for displacement and horizontal velocity can be applied to rain simulated with other facilities.

The effects of wind on kinetic energy of field-simulated rain can be estimated using the prediction equation for horizontal velocity and assuming that wind does not affect vertical velocity. If waterdrops fall in wind long enough, they will have the shape of an oblate spheroid with a flattened area between the bottom and the upwind side. • •

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