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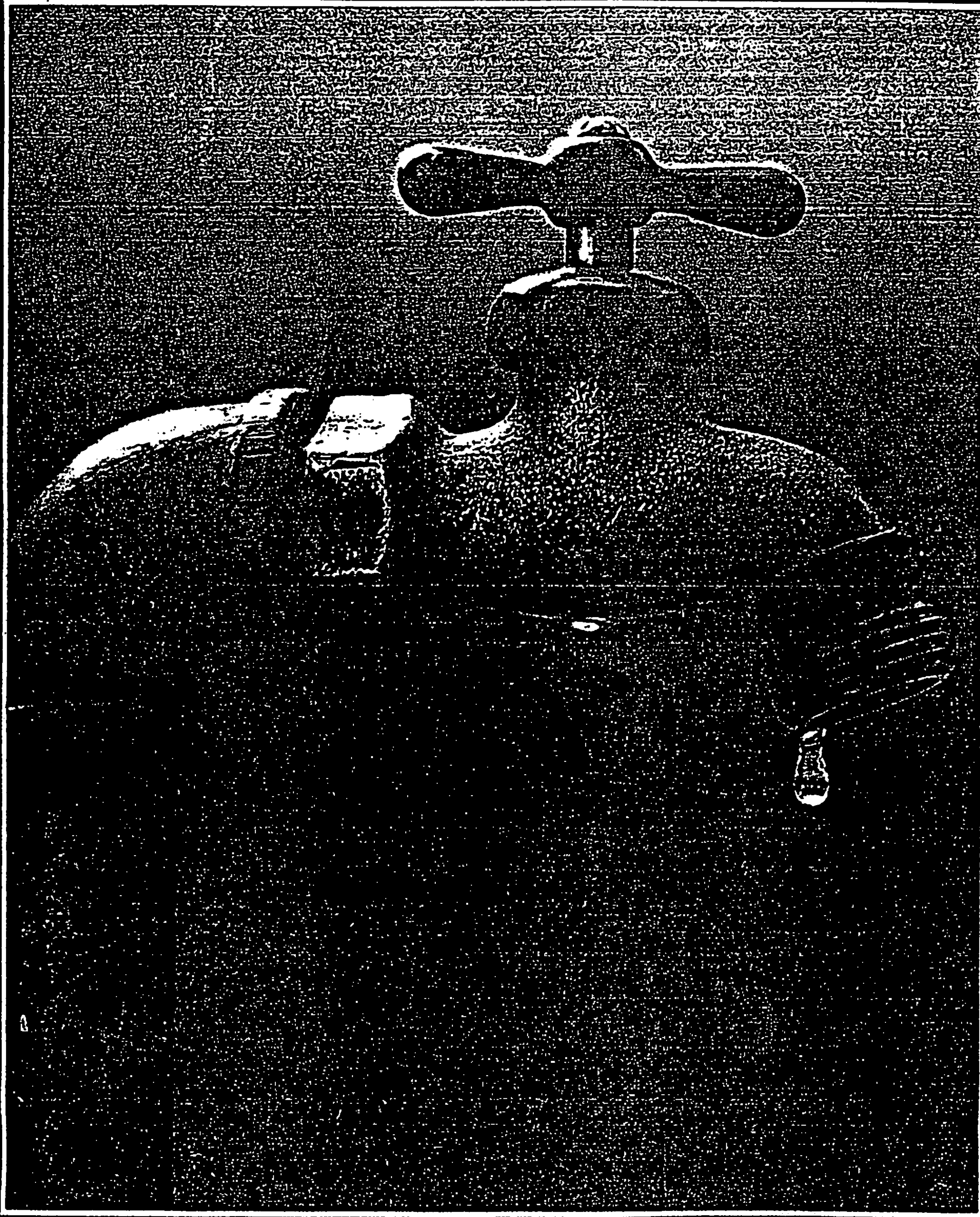

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PEN POINTS

No net loss of wetlands?

After reading the news item, "Group Calls for No Net Loss of Wetlands" [*JSWC*, November-December 1988, page 472], I have to agree that "we need better guidelines" that even our SCS [Soil Conservation Service] agents can understand and *not* misinterpret or read what they want into them.

So far the swampbuster provision has been nothing less than a nightmare. In the area that we work, we have never drained the so-called swamp which, in my estimation, contains frogs, ducks, polywoggs, and can't be farmed in a good year.

With the guidelines as they are written now, they will not let you tile sidehill seeps and borderline ground that can be farmed every other year, depending upon when you can get to it.

I also understand that we do not need any more farm ground, but what I don't understand is what is wrong with tiling borderline ground? I'm talking about ground that can be farmed if it's a dry year.

These people, "bipartisan groups," apparently don't look beyond the unscrupulous farmer and greedy contractor. Apparently, in certain areas tiling swamps is the going thing.

I would like to hear from Governor Thomas Kean and Mr. William K. Reilly because these conditions that they are addressing are literally raising Cain with normal land drainage in this area.

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Understated impact

It was good to see an article acknowledging that the Conservation Reserve Program (CRP) harms agribusiness firms [*JSWC*, "Agribusiness and the CRP," September-October, 1988, pages 379-380]. However, I beg to differ with the authors on their measure of the severity of the impact on agribusinesses and local economies. The losses are not limited to the profit margins on lost sales. Forgotten in the analysis were the losses in revenues and employment for all main street business people who depend upon the rolling over of the agribusiness dollars in their communities.

A paper by Daniell Otto, Iowa State University extension economist, measuring the impact of the 1983-84 PIK program, "Estimated Impacts of the PIK Program on Rural Economy of Iowa," found that the indirect economic impact represented $80 to $100 lost elsewhere in the economy for every $100 of lost agribusiness revenue. More disturbing was the loss of jobs—every 10 lost agribusiness jobs pushed 8 to 10 other community workers into unemployment. The CRP would mirror the PIK's impact—only over 10 years and not just 1. The U.S. Department of Agriculture's Economic Research Service has published similar findings.

Also forgotten yet more threatening to the local economies is the economic effects of the aftermath of the CRP. Unlike the PIK program, when the CRP payments cease, the landowners will not be able to return the land to row crop production without first satisfying sodbuster regulations. Sodbuster regulations haven't been declawed as have the highly erodible land conservation regulations. They still require that soil losses be limited to "T" [soil loss tolerance]. Contour farming and winter cover crops won't work. Any kind of reasonable rotation including row crops will require that the land be terraced. That terracing will have to be done immediately to preserve the farms' original corn bases. Terrace costs could very quickly wipe out the entire 10 years of CRP payments. How many landowners will spend that much money? Agribusiness and rural communities face the very real prospect that the CRP land will be permanently abandoned as major revenue sources at the same time that CRP dollars are lost.

Concerning the author's conclusion that CRP payments will negate much if not all of the direct losses by the local economy; if that is true, then the government is paying too much rent. However, as evidenced by typical area cash rent levels, CRP payments little more than offset the average net revenues that would result from the land remaining in production. Those foregone profits could be considered to offset local economy losses. There is little excess.

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What tools for BMP education?

I commend those involved in efforts to illustrate the role of best management practices (BMPs) in conservation efforts ["Rainfall Simulation: A Tool for Best Management Practice Education," *JSWC* July-August 1988, page 288]. "A picture is worth a thousand words"; furthermore, "seeing is believing." Although articles have appeared in scientific and popular magazines about using BMPs to protect agricultural productivity and reduce nonpoint pollution, an educational effort such as that described is a new and exciting program that warrants wider application.

Using demonstrations to develop data for quantification of BMPs is still another benefit of such efforts. The infinite combination of BMPs for the topographic, soil, cropping, and climatic conditions in U.S. agriculture will pose a continuing dilemma. For this reason, use of physically based models that require input data, such as that made available with simulators to provide model calibration and validation, provide an alternative method for evaluating BMPs. While I have been a proponent of the modeling approach, I also recognize the adage "garbage in, garbage out" and that we cannot ignore the educational value of full-scale demonstrations for farmers and ranchers.

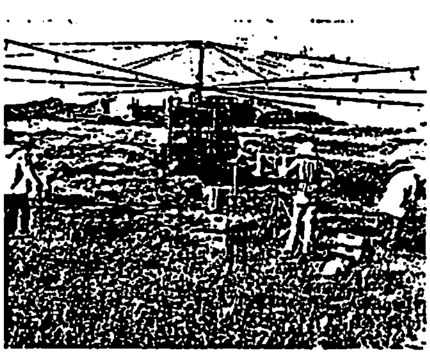
The advantages and disadvantages of rainfall simulation research have been well documented, including the features of nozzle and drop-forming simulators (*1, 10*). Obviously many of these simulators are of the same fundamental design. Meyer (*5*) enumerated 10 characteristics needed to stimulate natural rainstorms, including drop size distributions and drop impact velocities. All of the simulators enumerated by Bubenzer (*1*) meet some, but not all, of Meyer's characteristics, and such is the case with the simulator used in the Virginia demonstrations.

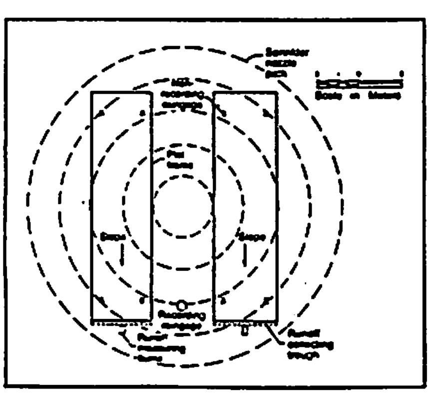
Lusby (*4*) commented on the simulator design used in Virginia: "Studies of drop size in natural rainstorms indicated that size is extremely variable, but that the proportion of large size drops generally increases with intensity. The sprinkler head chosen for the facility produces fewer large size drops at the higher intensities than is contained in natural rainfall. Although fewer large size drops are present than in natural rainstorms, the uniformity of coverage somewhat offsets this deficiency." [Author's note: Most simulators do not permit drop size to change with intensity.]

Most researchers use the Laws and Parsons (*3*) data as the design basis for natural storms and select a Veejet 80100 nozzle, rather than the Rainjet 78C used in Virginia. Furthermore, the 11-foot-high upward-discharging nozzles probably do a poor job of reproducing the kinetic energy of thunderstorms. [The Rainjet 78C nozzle provides about 40 percent of the kinetic energy of natural rainstorms at two inches per hour (Personal communication with David Harley, Agricultural Research Service, Ft. Collins, Colorado).]

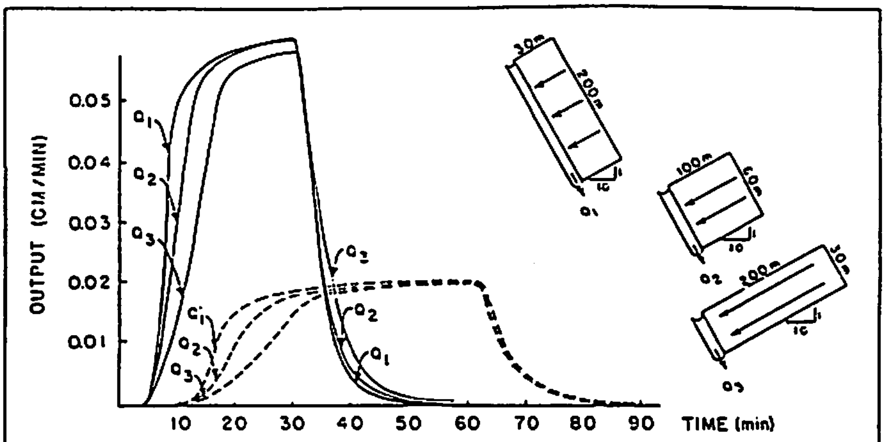
An alternative simulator might be the rotating boom (*9*). It is portable (one-half hour to set up and disassemble) and requires less water (3,600 gallons maximum for a one-hour run at 2.50 inches per hour versus 90,000 gallons for the Virginia configuration). While there is intermittent application as the nozzles on each boom rotate over the plot, it produces applications near the kinetic energy of thunderstorms. In addition, the unit can be made for less than $25,000, compared to the $40,000 for the Virginia unit. Time required to assemble the plots is less than that described in Virginia because the plots are smaller. The rotating boom simulator is the basis of the experimental equipment being used to determine parameter values for the Water Erosion Prediction Project (WEPP) (2).

The WEPP experimental plan for rangelands is similar to that used in Virginia,





Rotating boom simulator and layout of experimental plots relative to it.



Comparative response of a single-place, 600-m² watershed with various width-length ratios. The plane roughness was assumed to have a Manning's value of 0.05 with a slope of 10%. Channel slope was assumed to be 3% with a Manning roughness of 0.020. The final infiltration rate was assumed to be 12.6 mm/hr.

Runoff differences from watershed geometric changes and precipitation patterns

Geometry L × W (m)	Precipitation: Rate (mm/hr)	Precipitation: Duration (minutes)	Runoff: Peak (cm/hr)	Runoff: Peak Per Unit Width (cm/hr/m)	Runoff: Volume (cm)
30 × 200	5.0	30	0.0605	3.02 × 10⁻⁴	1.536
100 × 60	5.0	30	0.0602	10.0 × 10⁻⁴	1.450
200 × 30	5.0	30	0.0586	19.5 × 10⁻⁴	1.335
30 × 200	2.5	60	0.0204	1.02 × 10⁻⁴	0.945
100 × 60	2.5	60	0.0203	3.38 × 10⁻⁴	0.886
200 × 30	2.5	60	0.0198	6.6 × 10⁻⁴	0.802

namely a one-hour (dry soil) simulation on day one, followed 24 hours later by two one-half-hour runs about a half hour apart to reflect wet and very wet antecedent soil moisture respectively. Whereas the Virginia experiments use an H-flume to measure outflow from the plots, experience with the erosion work in the western U.S. indicates that sediment deposition in the flume restricts the adequacy of such a device. As an alternative, a supercritical flow flume (*8*) with a peak measuring capacity of 1.3 gallons per second is being used with a water level sensor. Aliquots of the water-sediment-chemical outflow are then obtained throughout the hydrograph to quantify concentrations of the sediment and/or chemical in the outflow.

The Virginia data for different no-till operations relative to those for conventional tillage are interesting but perhaps incomplete. It would have been helpful if the ratios had been presented for different soils, crop stages, and antecedent moisture levels. The six sites presented for no-till soybeans, for example, presumably represent different soils. Did the reduction (ratios) remain constant across soils, crop stage (the authors state they do the simulation work when the crops are immature to show greatest differences between BMP and conventional tillage), and antecedent moisture levels? It may not be economically feasible to fulfill a demonstration and research objective with the Virginia procedure.

Finally, some comments are in order about plot shape and its effect on runoff and erosion. For example, a long, narrow plot generally produces less runoff than the same size watershed having short overland flow lengths. The runoff difference is due to infiltration during the recession. Smith and Parlange (*7*) illustrate this point using a kinematic cascade model (*6*). Two precipitation inputs (50mm/hr for 30 minutes and 25 mm/hr for 60 minutes) were used for a 6,000 m² watershed conceptualized by planes (a) 30 m long × 200 m wide, (b) 100 m long × 60 m wide, and (c) 200 m long × 30 m wide. The hydrograph shapes and runoff volumes (see figure and table) varied appreciably for the six combinations. Of greatest significance was the dramatic change in the discharge peak per unit width with different plot shapes and different rainfall intensities, which in turn greatly affected the shear of the water moving over the surface and thus the shear-induced erosion and transport capacity. These runoff-per-unit width effects may be even more dominant for sediment and nutrient losses because of the nonlinear response of erosion and sediment transport to precipitation intensity and runoff per unit width. Only a detailed analytical relationship like the kinematic cascade model or involved simulator experiments can discern such observations that might result from a plot shape change. Thus, an argument can be made of the need for a long plot to study BMPs.

The demonstrations being made with the Virginia experiments are very beneficial. In future applications, improved or alternative equipment might be more helpful, as would be a more complete presentation of the results so that they might be applied to prototype situations and could be used in model development to implement BMPs for the range of soil, cropping, and climatic conditions in need of evaluation.

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...And a response

Dr. Renard's comments on the article "Rainfall Simulation: A Tool for Best Management Practice Education" accurately refect some of the limitations of the rainfall simulator design we used. Most of his comments, however, concern use of the simulator for research purposes, and that is not what our article was about. We wrote a paper about the use of rainfall simulation for BMP education, not for research. From an educational standpoint, we believe that the rainfall simulator design we used is far superior to the rotating-boom design for several reasons.

First, the Virginia simulator produces rainfall that "looks" like natural rainfall because the simulated rainfall falls continuously. In contrast, rotating-boom simulators apply rainfall intermittently at very high intensities. The rainfall, consequently, does not look "real" from an observer's point of view, even though its time averaged kinetic energy may more closely approach that of natural rainfall.

Second, our rainfall simulator can be used to simulate rainfall on areas ranging in size from 100 to 65,000 square feet. This allows much more flexibility in site selection and demonstrations of two or more BMPs simultaneously (we have done four simultaneously). Also, larger plots are more impressive to observers. In contrast, rotating-boom simulators cover much smaller areas, and simultaneous storms can be applied only on two plot areas of 14 feet by 35 feet (*1*). These small plots are suitable for research but marginal for demonstrations with large numbers of people.

Third, the rainfall simulator we described costs much less than a rotating-boom simulator. Dr. Renard's price comparison does not consider the size of the two different systems. The cost of the rotating-boom simulator is reported to be $25,000. The cost of a simulator of our design, which would cover an area similar to a rotating-boom simulator (two 14 feet by 35 feet plots) would be about $7,000 and would not require a specialized truck for transport.

Fourth, as with system cost, water requirements and the time required for system set-up and take-down will vary with plot size. Water requirements and set-up and take-down time for the simulator described in the article will be similar to that of the rotating boom for rotating-boom sized plots. With respect to set-up and take-down time, we have found that plot preparation (installation of borders, flumes, etc.) is what takes a lot of time. Setting up or taking down a rainfall simulator of either type is comparatively trivial on small, rotating-boom-sized plots.

Dr. Renard's other comments concerning appropriate types of flumes and plot dimensions are interesting in a research context, but they have little to do with the use of rainfall simulators for educational purposes.

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