Can drip irrigation be used in grain production?

NEWARK, Del. — The same amount of water has been on the earth since the beginning of time and there's not much we can do about it, says University of Delaware professor emeritus and agronomist William H. Mitchell. Though the total supply is great, only about 1 percent is available for homeowners, industry and crop irrigation — probably in that order. The rest is tied up in icecaps and saltwater.

"As we go from doughts to floods and back to droughts again, it's usually the last event that sticks in our minds," Mitchell says. "This is what makes planning for responsible water use so difficult. Many parts of the eastern U.S. have experienced serious droughts in the past decade, but progress toward more efficient water use drops to a trickle as soon as it starts raining. We seem unable to accept that it will probably be worst the next time around, even though acknowledged authorities predict that by the year 2000 — a mere 16 years from now — national water consumption will increase by 33 percent."

Irrigation represents the largest single use of freshwater in the U.S. In 1955 it consumed half the total available water, and the proportion continues to grow. "As demands for water increase and supplies tighten, will agricultlure be able to get what it needs?" asks Mitchell. "Studies have shown that in some parts of the U.S., industry can afford to pay 50 times as much for water as can agriculture. It's clear who will get the water in a competitive market."

These are sobering facts, facts that lead many to believe the country's next resource crisis will involve water — especially water for food production.

Mitchell and others familiar with the benefits of drip or trickle irrigation believe this system can offer at least a partial solution to such problems. Their high hopes are based largely on its potential for efficient water use and the reduced energy costs associated with low operating pressures. In addition, it is well suited to small, irregular fields, the agronomist says. Pivot irrigation is the first choice on large symmetrical fields and is likely to remain so, at least for the present.

Currently, trickle irrigation is used primarily on high value vegetable, fruit and nursery crops. When tubing must be replaced annually, this cost is considered an acceptable tradeoff with these crops, given the system's many positive features, which include earlier and higher yields. For the future, however, Mitchell believes the system's greatest potential will lie with more extensive crops such as field corn — particularly in small fields.

Some technological improvements must be made before trickle systems will be economical on lower value crops, the agronomist says. For one thing, drip irrigation must be able to function without lateral line replacement for 10 years or more.

"This will reduce the annual capital investment cost," he says, "though it will add new challenges. The lateral tubing must be plug-free, and suitable for subsurface placement. It should also be able to deliver plant nutrients and pesticides to the root zone."

Coming up with such a system is a formidable assignment, the agronomist admits. Components already exist, but there are missing parts and it will take dedicated research and development to put the package together. He believes the effort will be well repaid if the payoff is reduced unit production costs and a more conserving use of water.

Shortly before his retirement last December, Mitchell completed a 10-year irrigated field corn study on the Delaware Agricultural Experiment Station's Newark research farm, using drip tubing buried at a depth of 14 inches. Lateral lines were about 200 feet long, laid out on 36-inch centers runing perpendicular to a prevailing 3 to 5 percent slope. Unfiltered municipal water was applied through the system at a pressure of 5 psi. The chlorinated water contained a moderate amount of iron which was clearly visible on the interior walls of the tubing but did not appear to limit its performance.

The study included both broadcast fertilizer and anhydrous ammonia subsurface fertigation treatments. All feed lines were well below the depth of tillage operations, which included annual moldboard plowing. The soil was a highly fertile silt loam with a water-holding capacity of about 2 inches per foot of soil.

"The most striking fact to emerge from the study," reports Mitchell, "was that after 10 years the system functioned as well as it did during the first year. It proved to be an excellent carrier of anhydrous ammonia. Sequential ammonia applications to deliver 100 pounds of nitrogen through the system increased nitrogen efficiency and consistently produced top yields."

In 1983, the final year of the study, 100 pounds of N delivered this way produced about the same yield as 175 pounds broadcast prior to plowing.

"With refinements," says Mitchell, "this system could be scaled up to practical size and be competitive with sprinkler systems on small fields, using less water and nitrogen than conventional irrigation."

Some irrigation needs can't be met by subsurface irrigation, the scientist admits. And, as with any new development, there will be unforseen problems to solve as the system goes into more general use.

"Rocky fields, sloping land, water impurities and restricted movement of capillary moisture in sandy soils place obvious limits on trickle irrigation," he says. "Improved technology through research and development will solve many of these difficulties. Others will be harder to handle. But, all in all, the limitations are few when balanced against trickle irrigation's potential for water, nutrient and energy conservation."

Del. releases corn inbred

NEWARK, Del. — The University of Delaware Agricultural Experiment Station has released a yellow dent corn inbred, DE811, for use as a germplasm source of resistance to European corn borer and Southern corn leaf blight. Seed is now available to plant breeders and seed producers.

The new inbred was developed by James A. Hawk. Three years of evaluations in Delaware and at the U.S. Department of Agriculture Corn Insects Research Unit at Ankeny, Iowa, show it to be resistant to both broods of European corn borer, Ostrinia nubilalis (Hubner). It is also resistant to Southern corn leaf blight, B. maydis race 0, a major leaf blighting fungus on the Delmarva peninsula. Preliminary tests indicate it may also have intermediate resistance to Northern corn leaf blight. It is susceptible, however, to anthracnose stalk rot and common leaf rust.

DE811 has upright leaves above the ear, good flowering synchrony and two-eared tendency at low plant populations. It has purple silks, red cob and yellowish-brown (bronze) kernels. Pollen production is rated good and seed quality is average.

Limited yield trials indicate that DE811 has satisfactory combining ability and should be tested with inbreds of both Lancaster and Stiff Stalk groups.

Only three other public inbred field corn lines have second brood corn borer resistance, Hawk says, and it is likely that DE811 is a new source, since it is not related to these lines.