IRRIGATION WATER QUALITY IMPLICATIONS

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Water quality has become nearly a universal concern. Evidence of contamination has been found in nearly every region of the world. Almost anything we do has been implicated in causing some form of water quality degradation. It is therefore, not unexpected that irrigation would have some share of the blame. Irrigators apply fertilizers, pesticides and other materials to their crops. There is concern for how much of these materials runoff or seep below the root zone and contaminate water supplies. Soil erosion on irrigated land and the leaching of salts is also a concern.

The problem, however, is analysis and interpretation. We are now able to find contaminates at levels that were unheard of only a few years ago. This ability has superseded all others. We can now find and document substances of which we have little knowledge and really do not know what affect they have or what constitutes a harmful dose. In such an atmosphere, people have become apprehensive and worried and the scientific community has often not been much help. Those who may gain funds to do research sound the alarm so that the political bodies that control the money may give them a grant, while other knowledgeable scientists in related fields try to down-play the problem. Who is the public to believe? Eventually the truth will emerge, but in the interim persons and enterprises may be unjustly harmed. It is an age old problem of being able to recognize harmful situations soon enough to prevent excessive damage and cost without wasting time and resources on non-problems.

In the area of irrigation some of all of the above sources of water quality problems have already been identified. We do and have had fertilizer, particularly nitrates, escape from irrigated enterprises. Pesticide drift and deep seepage have occurred. Irrigated fields, in some areas, have experienced excessive erosion and various salts have been leached from irrigated land into other water bodies where damage has occurred. The problem is that most of these negative results are quite site specific and this point is frequently lost in the public perception of the problem. Finally, a substantial body of the public view irrigation in the Plains as a wasteful enterprise. In their view, we are wasting our precious water resources to produce subsidized, surplus crops. So not only are irrigators polluting the remaining water supplies, but they are doing it with procedures that are unnecessary. Obviously such simple cause and effect solutions do not address the problem in a very desirable manner. In additions, a large majority of the irrigators in the region are not causing any measurable harm to the quality of the water resources that might be attributable solely or exclusively to irrigated agriculture. We do, however, have some problems and they are being addressed.

Nitrate leaching to the ground water has been studied in several locations, but Nebraska has done the most work. Nitrates along the Platt River were recognized earlier than in most areas and a great deal of work was done to delineate the size and scope of the problem and to develop programs to prevent future nitrate pollution and restore the quality of the impaired aquifer.

Pesticide movement is being studied at each of the states in the region. A long list of pesticides have been studied, but the one of primary interest is Atrazine and the other triazine based compounds. Atrazine is the most widely used pesticide and the one that shows up most frequently in studies of water quality.

Atrazine was originally believed to be so strongly held on soil particles that it would pose little or no water pollution hazard. This has proved to be mistaken. Part of the problem was related to the capability of chemical analysis at the time of its development. Compounds could not be found in amounts of less than a few parts per million and nothing could be found at these levels during the early work. In addition, the pesticide had very desirable weed control properties, so, its use was quickly adopted all over the region and large amounts have been distributed on the land.

More recent studies have shown that Atrazine is not completely absorbed on the soil particles and that it is more soluble than originally believed. Unless incorporated into the soil soon after application much of the atrazine may wash off with the surface soil particles during a runoff event. Incorporation, however, reduces this loss to acceptable level when applied in the correct amount and during acceptable weather.

The most surprising aspect was the solubility. Recent studies have shown that under certain soil and moisture conditions atrazine may seep deeply into the soil far beyond the top few inches of the surface where its activity is intended. This portion is available to contaminate ground water and is the focus of several studies. The fate of this material is not yet fully understood, but continued research should answer these questions.

Chemicals used with irrigation systems, primarily center pivots, is another concern. Drift of chemicals during windy weather is a continuing problem. Using nozzles near the canopy or ground surface can reduce drift problems, but can not be used with all pesticides of interest. Nozzles high above the crop canopy usually have better uniformity of coverage, but the greatest susceptibility to drift loss and damage to adjacent property. High speed center pivots can reduce the time needed to apply chemicals and thus reduce the chances of wind drift during an application, but no one system works best with all chemicals under all conditions and irrigators must choose what to do to solve the problems in their particular situation.

A larger concern is backflow of chemicals into the irrigation water source. Most states have laws regarding devices that are required to prevent such occurrence and

now EPA (the U.S. Environmental Protection Agency) requires such equipment on the label of the pesticides if they are approved for use with irrigation applications (Chemigation). To apply chemicals without such devices will subject the individual to substantial penalties, if caught. The primary piece of equipment is a spring loaded check valve that is quick acting and water tight. If the pressure on the irrigation system should fail during the application of chemicals the check valve will close and prevent water contaminated with chemicals from flowing back into the well or other water source. There are many other items required, but the check valve is the heart of the system.

Spills and misapplication are also a concern with chemigation. Part of the required equipment on the label is intended to help prevent spills. Misapplication is addressed by most states by requiring those who wish to chemigate to attend training and take an examination.

Finally, erosion and leaching of salts is important, but very site specific. Erosion is only a problem with erosion prone soils on slopes steep enough to cause movement. In much of the Central Plains region the erosion is primarily due to rainfall during periods of little plant cover and would be no more or less severe if the field was irrigated or not. In some areas there would be no crop production without irrigation and thus the erosion can be attributed to irrigation, but normal erosion control measures can and should be used to control such situations.

Leaching of salts from irrigated soils is primarily a problem in the driest portions of the region. Irrigation where rainfall is not sufficient to leach the salts accumulated from the irrigation applications must include some leaching flows to maintain the salt balance within the soil. If salts accumulate too long production suffers. The bigger problem for most irrigation systems is the over application of irrigation water to soils with an abundance of soluble salts. This excess water dissolves these salts and either contaminates the groundwater below or the drainage from the area contaminates the surface waters leaving the area. In either case, the quality of adjacent waters is degraded by the addition of excess irrigation waters. Nationally, the quality of the waters in the Colorado River and in the wetlands of southern California are attributable to this source. These salts must go somewhere. If we could irrigate with pure water and not over apply water to any part of the field there would be no problem. But this is never the case. The answer is to reduce the salt load by careful control and in a few limited cases by impondment of the drainage flows in areas where the excess salts will cause little harm.

Irrigation generally in the Central Plains is not a significant water pollution source. Obviously, there are locations where this is not true, but the most significant ones are being addressed and the other concerns will be addressed.

The more pressing problem for the future of the irrigation industry in the Central Plains is how will irrigators cope with reduced water supplies and/or use restrictions. The demands for more and higher quality water are increasing and the interests are

much more diverse than when irrigation started in the region. Voters decide in the final analysis how resources will be managed and the voice of agriculture is small and that of irrigators smaller yet. The saving grace in many parts of the region is that agriculture is the only demand for the resource.