Issues and options

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As we look ahead, it is clear that there is no single solution to the problem of increasing salinization of California's soils and water supplies.

The San Joaquin and Imperial valleys are in semi-arid regions in which irrigation is essential for the production of crops. Although irrigation has made these two of the most agriculturally productive areas in the world, it has also created a serious challenge — the accumulation of salt in the soil.

As is pointed out in the preceding articles, nature is the major source of salts in our soils and water. Even high quality, "pure" water contains salt — enough so that each acre-foot of water used for irrigation adds 350 pounds of salt to the land. As this water evaporates and is used by plants, the salt is left behind, raising the salinity of the remaining water. Salt is also added as water passes through the soil and dissolves native salts. In poorly drained areas, the water table rises and eventually reaches the root zone of plants, injuring or weakening them, or causing them to die.

There are three major options in addressing this challenge: (1) improved water management to reduce the amount used to irrigate crops, thereby reducing the amount of salt introduced to an area; (2) research to develop more salt-tolerant plants; and (3) development of satisfactory systems to drain salts away from agricultural areas.

A significant effort in the first option is the California Irrigation Management Information System, a joint project of the University of California and the California Department of Water Resources. This project is designed to provide growers the information needed to make the most efficient use of irrigation water based on crop, soil type, method of irrigation, temperature, humidity, and other factors involved in plant development. Research by the University is aimed at finding the most critical points in a crop's development when water is absolutely essential and even a modest shortage can dramatically reduce yield.

We have learned that crops vary in their tolerance to salt during the growing period, opening the way to the use of water of different quality during various growth stages.

A new management strategy developed for poorly drained areas is to plant deep-rooted crops such as safflower to "mine" water, removing enough from the soil to lower the water table. After salt is flushed deeper into the soil, a more shallow-rooted crop such as alfalfa can be safely planted.

Recycling irrigation water to cut down the amount of new salt introduced to farmland is another management technique being investigated. Research to develop salt-tolerant plants may expand the range of crops grown and increase the salt tolerance of certain crops. Some crops such as cotton, barley, safflower, and sugarbeet are more tolerant to salinity than are such crops as beans and corn. World seed collections are being screened to locate useful plants that grow well under saline conditions; wild species are being sought to hybridize with domestic species; genetic engineering is being utilized to transfer salt-tolerance from one plant or organism to another.

In addition to providing salt-tolerant plants, research is contributing to our knowledge about the specific mechanisms used by plants to tolerate and in some cases to thrive in conditions of high salinity.

Desalting to recover water is being explored in California and other fresh-water-deficient areas of the world. The technology, still under development, could reduce the new water required but it does not remove the salt from a region, and given the magnitude of the problem, it is questionable whether it would have a significant impact.

Improved management can reduce the rate at which salt is accumulated in soil and water, and salt-tolerant plants will prolong the length of time the land can be cultivated, but they will not solve the salinity problem in California. Eventually a system must be developed to remove salt from the area. The ultimate solution, particularly in soils with an impermeable clay layer underneath, is to construct drains to remove salinized water from the area.

The question then becomes what to do with this saline water. The options include evaporation, desalting, drainage into a salt sink or into the ocean, or a combination of all three. Evaporation will require an area equivalent to 15 to 20 percent of the acreage farmed and would still leave a salt disposal problem. This latter problem has become more complex, because drainage water from some areas also contains elements such as selenium and boron, which can accumulate to toxic levels.

The Delta disposal plan described in the U.S. Bureau of Reclamation (San Luis Unit) Information Bulletin 1 (January 1984) appears to be the most comprehensive solution for the San Joaquin Valley. Salt water from the drain would be introduced into the Suisun Bay through diffuser pipes at times of peak water flow. A series of reservoirs along the drain would store the saline water before discharge, and monitor as well as isolate toxic substances. Treatment plants at the reservoirs would remove toxic substances from the water prior to release. Early-warning biological monitoring devices would be used to shut down the movement of water if the concentration of salt exceeded the dilution capacity of the Delta.

The conclusion is that all options should be used, including the best irrigation and cropping management systems and the development of additional salt-tolerant crops. However, given the volumes of salt that are added with each irrigation, the long-term solution must be the removal of the salt from irrigated cropland of the San Joaquin and Imperial valleys.

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