California Fertilizer Ass'n, Sacramento Feb 24, 1978

GETTING THE MOST OUT OF OUR WATER

L. K. Stromberg
Fresno County Farm Advisor

After two years of severe drought, California is hopefully on the road to at least temporary recovery. Unless some drastic changes in our water supply takes place much of California will continue to have recurring periods of water shortage.

I'm most familiar with the situation in the southern San Joaquin Valley so I'd like to use this as an example.

We have already expanded our agriculture beyond the total resources available. The primary resources used to produce crops are soil, sunshine, air, and water. We still have a lot of soil, sunshine, and air left over after the available water has been used.

There is no practical way to reduce the consumptive use of water by plants. The total use is determined by climatic factors, the length, the day, and the area of green leaves which shade the ground. We have no control over the climate or length of day, but we do have some control over the area of green leaves.

There is obviously some improvement in the efficiency of individual farm irrigation, but not much improvement possible in the total basin efficiency (Bulletin 198 of the Department of Water Resources, May 1976, shows the Tulare Lake Basin to be 96 percent efficient).

There is (and has been for several years) an overdraft of ground water. During 1976 and 1977 the overdraft was considerably greater than the average of recent years. If this overdraft continues, sooner or later the water table will be lowered to a point where cost or quality will make it unusable for irrigation.

Faced with these grim facts, what are the alternatives?

1. We could reduce the acreage of our present crops until they come into balance with our firm water supply. This would reduce the total water consumed as well as reduce the economic base. we would have to forbid any further development of land.

2. We could substitute some of the summer growing crops with winter growing crops such as cereal grains which take advantage of the shorter days. These winter crops would use less water, the present acreage would be maintained, but these lower value crops would reduce the economic base. we would again have to forbid expansion!

3. More water could be imported to satisfy the needs of the present cropping pattern without further depleting the ground water. This would again mean that there should be no further expansion of agriculture.

4. Enough water could be imported to prevent ground water overdraft, satisfy the present needs, and permit the expansion of agriculture to the limit of our other resources.

5. The last alternative would be to do nothing about controlling water use or augmenting the water supply. This may be the most politically acceptable alternative. In such event, when the overdraft has sufficiently depleted the reserves, the total economic picture of the area would decline as would the well-being of people elsewhere who need and want our products.

Hopefully, there will be a few years before the full impact of the ultimate drought hits us. What can we do in the meantime to get the most out of the water we have?

Minimum leaching can be practiced. That is, applying only that water required to satisfy the plant needs and just enough to prevent salt buildup within the root zone. This is considerably less water than most growers now use. I think most of the excessive water applications are made to annual crops during the preplant irrigation. I can see no need to wet the soil below six feet for these crops. The available moisture-holding capacity for a sandy soil may only be an inch per foot and for a good clay loam soil may be as much as 2.5 inches per foot. So if you start out with a soil that is at the wilting point throughout, the range of

application should not exceed 6 to 15 inches. Usually the application can be somewhat less than this because rarely if ever is the 6 foot depth of soil all at the wilting point.

I've often had growers tell me "Boy, I gave it a soaking this year -- I laid in 22 inches in the pre-irrigation." This excessive use may not always be a waste of water if the deep percolation enters a usable ground water supply -- such as is found on the east side of the San Joaquin Valley. It is, however, a waste of energy if the water is being pumped for irrigation. On the other hand, excessive use of pre-irrigation water may even be desirable during those rare years when we have high stream flow and the water would otherwise find its way to the ocean. We can and do use diverted river water for winter and spring irrigations to recharge the ground water. In this case the drain water and irrigation supply are co-mingled and hence desirable.

A different situation exists on the west side of the San Joaquin Valley where the shallow ground water is exceedingly saline. Where this exists the drainage water and the water supply are separate. Any water which passes below the root zone in excess of that needed to maintain the salt balance of the soil, enters this salt sink and cannot be pumped and used for irrigation. Not only is it lost for further use, but it aggravates an already serious drainage problem.

Minimum leaching is an important water saving system where the drainage water and the water supply must be kept separate.

Many of our soils in this area crack when they get dry. Many of them take water at a rapid rate even though they may be clay loams. For these reasons it is difficult to get just a small amount of water into the soil. This is particularly true if the fields are a half mile long. The answer to that is to shorten the irrigation run or convert to sprinkler irrigation so the distribution can be more nearly uniform.

This, of course, costs more per acre foot to apply -- and I can't argue with this. More labor is required for shorter surface runs. Sprinklers have a large

capital investment plus the energy needed to operate a sprinkler system is equivalent to lifting the water another 100 feet.

All of these statements are essentially true. The price of labor, ~~power~~ energy, and water will determine whether any of these water saving methods are justified.

On the west side of the southern San Joaquin Valley it typically costs slightly in excess of 100 dollars an acre foot to pump water. This includes electric power cost of about 8 cents to lift an acre foot of water one foot, depreciation and repair costs of the well and pump. With these high costs a little more on labor and/or capital investment might be justified. Even an additional 8 dollars an acre foot for water for sprinklers may be warranted if you can apply one foot instead of two by using a sprinkler system.

We hear a lot about various irrigation methods -- drip, low pressure sprinklers, movable trickle irrigation systems -- all which claim to reduce consumption of water. All of these systems are good and have a place, but they do not reduce the consumptive use of water but can prevent runoff and reduce deep leaching to a minimum.

In some places with perched ground water just beyond the main root zone much of this water can be used even if it is quite saline. This reduces the amount of water which must be applied on the surface and reduces the problem of disposing of the extra drainage water. This appreciably improves the duty of applied water.

In some trials conducted on cotton in 1976 and 1977 where a saline water table stood between 7 and 8 feet, we were able to produce slightly better than average yield of cotton with a preplant irrigation and one additional crop irrigation in mid-July. The crop was able to get nearly half of its needs from the perched water. I think that the use of this perched water can be expanded as we learn more about its management. There is a lot of this type of land in California. It is estimated that the San Joaquin Valley has nearly 400,000 acres of land with water standing at 5 feet

or less, most of it too saline or contains too much boron to be pumped for irrigation.

There are many things that we can do now to stretch our limited water supply. There are many more possibilities which need investigating. We need to know more about irrigating with more saline water; we need more basic research on reducing transpiration of plants; we need some fundamental research on reducing respiration of plants to increase total bio-mass with the same amount of water. We need continued work to develop the production function data for more crops with respect to water. The future isn't as dim as I may have pictured at the outset, but it will be grim if we don't get on with some of these studies and plan to get more good quality water to some of the irrigable land in California.

I hope Mr Allison takes note of these remarks and get cracking on these plans and projects —