

# EMERGING ISSUES FOR ALFALFA IN CALIFORNIA AND ARIZONA

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## ABSTRACT

Alfalfa is the largest acreage crop in California, second largest in Arizona, and in 2001 one of the highest in value. The relentless expansion of Western dairying has provided a powerful market demand for alfalfa, but urbanization, water restrictions, and competition with high value crops restrict acreage. These forces have approximately counteracted each other; acreage has been relatively constant over long periods, despite a dramatic increase in acreage in 2001 in both states. The key issues for alfalfa in this region are: profitability, water availability, water quality, biotechnology, public perception, and issues related to forage quality. The rapidly expanding population of dairy cows and horses in this region has created an expansive universe of demand for alfalfa hay, but market share of alfalfa sold to dairies has declined significantly, which is a challenge for growers. Water transfers create an unpredictable large factor for growers. Without question, the most important issue for alfalfa is water quantity, availability, and price, with water transfers of various sorts being likely scenarios for the future. Water quality issues are also important emerging issues, particularly in California. In an increasingly urbanized Southwest, alfalfa growers need to promote the public understanding of the important attributes of the crops they grow—this is particularly a challenge for alfalfa, which is two steps removed from the dinner table.

**Keywords:** Water, irrigation, water use efficiency, biotechnology, markets, future trends

## INTRODUCTION

Alfalfa is the largest acreage crop grown in California and the second largest in Arizona; in both states, alfalfa vies with cotton for the largest acreage field crop. In this region, alfalfa is rotated with cotton, with specialty vegetable crops, wheat, and in some areas tomatoes and corn. Growing conditions, yields, varieties and economics in many parts of Arizona are similar to those in the Imperial Valley of southern California, or in the high desert regions of California. Within California, there are large north-to-south differences in production. This paper reviews the emerging issues common to this area, which may be termed the 'Southwestern' production region of Western US states.

## SHORT TERM ACREAGE AND PRICE TRENDS

During the past year or two, acreage in this region has increased substantially, driven by demand by dairies and the horse market, coupled with lack of alternatives to plant. The acreage increase in the Central Valley of California (the largest acreage area in the region, totaling about 500,000 acres) was the most affected, with an estimated 15-20% increase from 2001-2002. The loss of sugarbeets in Northern California (Intermountain regions and Sacramento Valley), and a

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depressed cotton situation in the San Joaquin Valley of California and Arizona has increased interest in planting of alfalfa hay in these regions.

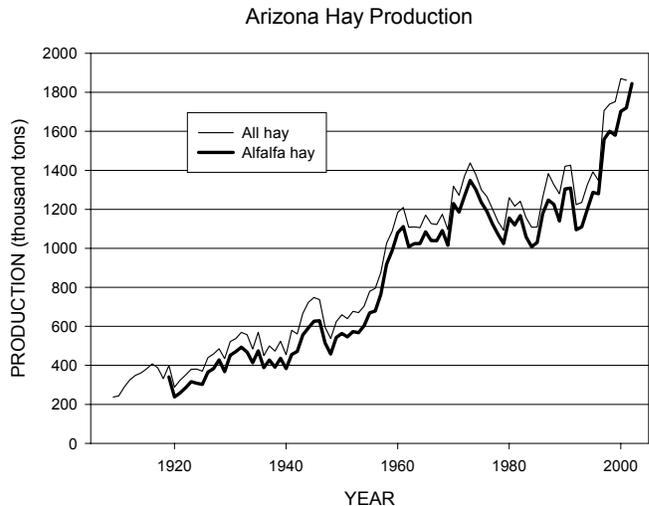
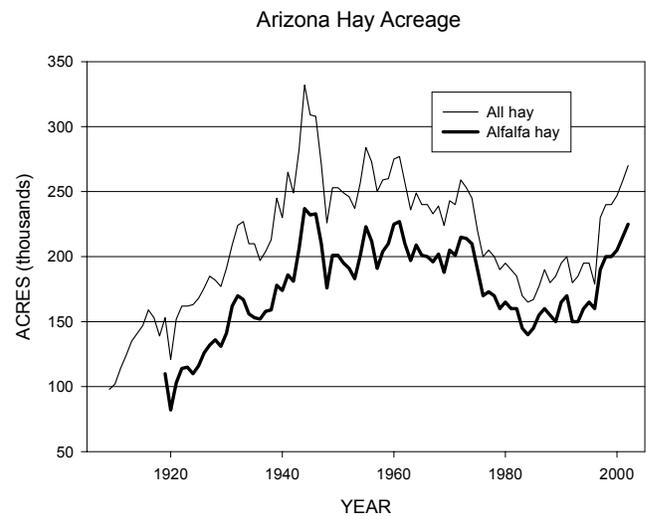
**Impact upon price.** Although one would think that such a dramatic change in acreage would substantially reduce price for alfalfa hay, but the ‘crash’ that many had predicted early in 2002 did not take place. It could more accurately be called a ‘moderation’ in average price, with a greater emphasis on quality factors. Between 2001, which was a ‘banner year’ for alfalfa hay prices, there has definitely been a softening in 2002; there was much more of a price penalty for lower quality hay categories, but high quality hay seemed to hold its own through most of the summer and through the fall.

## LONG TERM TRENDS

**Arizona.** Acreage of harvested alfalfa hay in Arizona has averaged about 176,000 acres between 1919 and 2002 (Figure 1). The maximum was in the 1950s, but the recent increase in acreage is apparent in this data; the 2002 acreage of 225,000 acres is the 5<sup>th</sup> highest in 84 years of reported acreage. Alfalfa acreage has increased steadily since 1993, when alfalfa hay was harvested from 150,000 acres in Arizona. Acreage of other hay (e.g. Bermuda, sudangrass, and oats) has averaged 45,000 acres between 1919 and 2002 and was reported at 45,000 acres in 2002.

**California.** California has seen a similar pattern in maximum acreage as Arizona, with the maximum occurring during the 1950s through the 1980s, with a gradual reduction after about 1980 (Figure 2). The recent jump in acreage can also be seen in this graphic, and the historical importance of ‘other hay’ (grassy, meadow, sudangrass, oat, small grain, bermudagrass, etc.). These types of hay have actually maintained or even increased their importance in these two states due to the importance of horses to the hay markets.

In both Arizona and California, the factors of water price and availability, the relative



**Figure 1.** Hay Acreage and Production Trends in Arizona. (USDA-Ag Statistics)

value of other competing crops for acreage, the change of field crop acreage to vine and orchard crops in California, and urbanization have all acted to limit expansion of alfalfa acreage in this region. However, there are factors which create considerable ‘pull’ in the other direction as well.

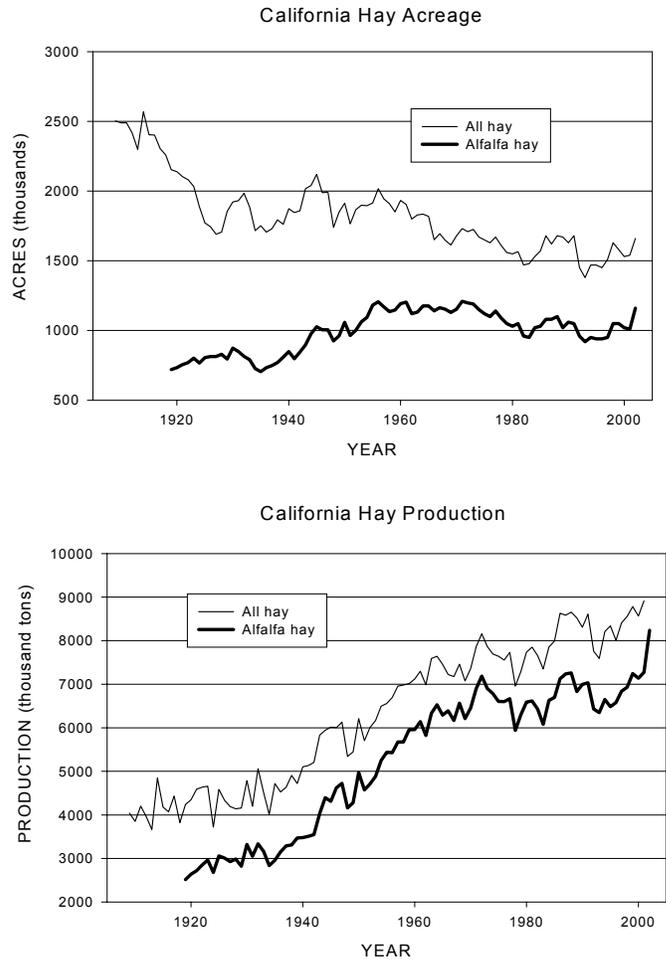
## MARKETS

**Dairy.** Pulling the other direction is the monumental increase in the dairy industry, centered around Phoenix in Arizona, and the Central Valley (Kern County through Sacramento County) in California.

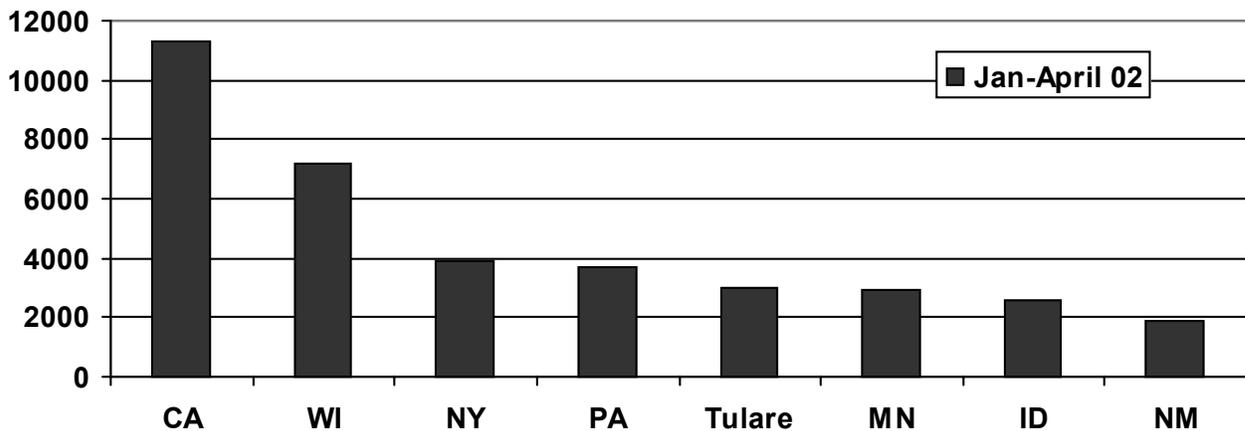
California became the nation’s number 1 dairy state in 1993, and now produces nearly 20% of the nation’s milk (Figure 3). In Arizona, the number of milk cows and milk replacement heifers has increased from 118,000 in 1992 to 173,000 in 2002. The dairy cows in California now number more than 1.5 million. The relentless expansion of the dairy industry in this ‘Southwestern’ belt over the past 20 years is nothing but phenomenal, and shows little signs of abating. New Mexico, for example, showed an average increase of 16% in 2002 compared with 2001. The dairy industry in Arizona has grown tremendously around Phoenix.

A significant component of this increase are dairies moving out of the Chino milkshed (near Los Angeles), expanding into California’s Central Valley, and to many other locations throughout the West. Although many states have heard about dairies moving out of California, many do not realize that this has been accompanied by a continual expansion within the state. The Chino milkshed still has a large number of cows, though slowly reducing in number. This has been offset by very large rates of expansion elsewhere in the state. However, several regions (particularly in the Southern San Joaquin Valley) in the California have experienced severe restrictions and legal problems for new sites due to environmental restrictions (air and water) due to manure management issues. This has not reduced the number of cows, however, and new sites are still being developed elsewhere in California, such as the Sacramento Valley and the Northern San Joaquin Valley.

**Horses.** The USDA Agricultural Statistics Service does not provide estimates of number of horses as they do with other animals. However, a conservative estimate of number of horses in Arizona is 170,000 (Bruce Beattie, Equine Economic Report, [www.azsthorseassoc.com](http://www.azsthorseassoc.com)). In California, it is also unknown how many horses are spread throughout the state, but the number



**Figure 2.** Hay Acreage and Production Trends in California. (USDA-Ag Statistics)



**Figure 3.** Production of milk (X million lbs.) of the 7 top US states in dairy production (Jan-April, 2002). If Tulare County, CA were included, it would be the 5<sup>th</sup> largest US state in dairy production. Data: CDFA CA Dairy Information Bulletin, July, 2002. California surpassed Wisconsin in total milk production in 1993, and now produces nearly 20% of the nation's milk.

is large—possibly 800,000 - 1 million. Some of the needs of horses are met through grazing, some through purchased feed and hay. How big of a demand does this represent? No one knows for sure, but we can calculate a rough estimate. If we assume that a horse requires 20 pounds of feed per day and that 50% of the feed is met by feeding hay, then the horse hay market in Arizona is over 300,000 tons, and in California more than 1.4 million tons or about 20% of the hay produced in these states. The percentage hay fed to horses in southern CA and AZ is greater, due to the lower rainfall and lack of locally-available grazed forage. Throughout this region, the trend is for growth in the horse hay market, since the number of horses follows human population trends. The demand for bermudagrass hay in AZ and CA, for example has been strong in recent years. This is particularly important for those growers interested in producing mixed alfalfa-grass hays or pure grass hay, or medium-quality alfalfa hay which is weed-free.

**Beef Cattle.** The number of feedlots in both Arizona and California has decreased in the past 10 years, with a somewhat stronger interest just the past two years when beef prices have been high. The long-term trend, though is for dairy cattle numbers to go up, and beef cattle numbers to stay constant or decrease.

**Hay Prices.** Alfalfa hay, in particular, has become much more of a cash crop in recent years (Figure 4). Price typically oscillates from low to high every few years, but the general trend has been increasing prices since 1949 when statistics were first recorded. The most dramatic increase in hay price occurred in the 70's where hay price increased from \$33/ton in 1971 to about \$85 /ton in 1980. This increase corresponds with an inflationary period in the economy and to a time when grain prices were high. Hay prices

## EMERGING ISSUES: Water Quantity

Alfalfa has a particular problem with the issue of water for several reasons: First, the quantity of water required annually is large on an annual basis, ranging from less than 3 acre feet/year in Intermountain areas to over seven in Southern California and Arizona. The CA statewide average use is likely between 4 and 5 acre feet/year on approximately 1 million acres, but higher quantities are used on a per-acre basis in S. California and Arizona. Secondly, alfalfa is a perennial, with little flexibility to quickly switch crops when water supplies are tight. Thirdly, economic returns for alfalfa are considered moderate compared with many specialty crops, limiting its viability when water becomes expensive. Lastly (and perhaps more importantly) alfalfa does not have an immediate recognition factor with urban dwellers, and its products (milk, cheese, beef) or its other attributes (N<sub>2</sub> fixer, soil protector, wildlife habitat) are not immediately recognized by the public. Without question, water (quantity, availability and price) is the ‘Achilles heel’ of alfalfa in Arizona and California, and many neighboring western states.

To make this statement is not to say something that is very controversial—for water is a major limiting factor for ALL of western agriculture. Even those crops touted as ‘high value’ crops are not likely to compete very successfully for water with many types of urban or environmental uses of water, when the criteria are primarily economic or political. But the problem is particularly severe with alfalfa.

**California Water Issues.** The most dramatic of recent California water wars was the shutting-down of alfalfa production and other agriculture in the Klamath Basin of Oregon and California early in 2001. This sudden and dramatic cutting off of water sent a shock wave through the Klamath Basin, but also through all of agriculture—for all growers recognized a pattern that could be repeated in other areas. The situation remains ‘touchy’ and controversial in the Klamath basin. Was the Klamath situation the sudden but temporary misfortune of but a few growers, or is it a representative pattern that will be repeated in the same place or elsewhere, perhaps with slightly different dynamics?

Many experts believe that water transfers of various sorts (environmental, regulatory, or voluntary purchases) are very likely to be a part of California’s future, especially for alfalfa. In many areas feeling the crunch, alfalfa may be the major crop affected. A very recent transfer in the news includes proposals to fallow substantial quantities of land in the Imperial Valley and the Palo Verde Valley, to transfer water to the Metropolitan Water District in Los Angeles. Consider the following partial listing of water transfers and issues of various types that are pending or considered, from South to North, in California (these are all in various stages, from proposed to ‘in process’):

- Agreements to permanently transfer 200,000 acre feet per year from Imperial Irrigation District to San Diego in exchange for improvements in infrastructure. This is reportedly the largest rural to urban water exchange in US history.
- Near complete, long-term agreements to transfer 29% of the water from the Palo Verde Valley (Blythe) to Los Angeles during drought years.
- Recent Proposals to fallow large percentages of agricultural land in Imperial Valley to transfer water to Los Angeles. In an interesting turn of affairs, environmental concerns about the health of the Salton Sea for wildlife habitat have environmental groups arguing in favor of continued agricultural drainage into the Salton Sea.

- Renewed commitment by California not to exceed its 4.4 million AF allocation from the Colorado River (CA has exceeded this amount every year).
- Adjudication of Mojave Desert groundwater use by alfalfa farmers in conflict with growing urban demands.
- Purchase of water from various districts in the Central Valley to restore San Joaquin Valley wetlands and wildlife refuges.
- CalFed proposals to fallow large acreages (200,000 acres) of farmland in the Bay Delta for restoration of habitat
- Economic transfers of water to meet the needs of southern cities from the Sacramento Valley water supplies.
- Efforts to restore stream flows, lake levels, and meander of major rivers and tributaries, like the Sacramento and in various regions for aesthetic, recreational, and wildlife needs.
- Continued uncertainty of water availability in the Klamath Basin due to Endangered Species Act (key species are suckerfish and salmon) ruling to maintain lake levels and stream flows.
- Proposed transfers of water from the Trinity Reservoir for endangered species habitat.
- Possible impact of California Endangered Species listing of Coho salmon in the Sacramento and Intermountain watersheds, impacting perhaps both pumping and surface water supplies.
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Whatever the multiple causes, water transfers (economic, voluntary, regulatory or court-determined) are very likely to be a powerful force, sometimes impacting a region slowly and predictably, other times suddenly and unpredictably. What the future will bring is impossible to say, but with California alfalfa, water will likely be at the center of it.

**Arizona Water Issues.** An estimated 95% or more of agricultural land in Arizona is irrigated. Most of the urban growth in the state is on agricultural land, due the restrictions on building developments on land without a history of water use. The 1980 Groundwater Code (Code), as well as urbanization, has resulted in a reduction in irrigated acreage in Arizona. The goal of the GMA was to stabilize groundwater levels or to slow the overdraft. The act established active management areas (AMAs) and required that active management plans be reviewed every 10 years. We are now in our third active management plan.

There are currently five active management areas in the state: Santa Cruz, Tucson, Pinal, Phoenix, and Prescott. Note that not all of the state is regulated including significant areas near the Colorado River in southwestern Arizona and most of northern and eastern Arizona. The AMAs are in the central and southern parts of the state where competition for groundwater supplies is most severe. Irrigation non-expansion areas (INAs) – no new irrigated land – Douglas, Joseph City, Harquahala. Management goals (Prescott, Tucson, Phoenix) – safe yield by 2025. Santa Cruz – safe yield and prevent local water tables from experiencing long-term declines. Pinal AMA – protect agricultural economy as long as feasible and preserve water supplies for future non-agricultural users.

Many parts of the state affected by this law use a combination of groundwater and surface water, but the surface water also comes under the jurisdiction of this act.

Water allotments were established from historical crop acreage mixes from 1975 to 1979, annual consumptive use for each crop, and an irrigation efficiency depending on the irrigation system. In the Phoenix AMA, for example, the typical water allotment is 5 acre-ft/acre multiplied by the historical acreage. A farmer may apply more water than he is allotted per acre to a crop, but then he must farm fewer acres so as not to overrun his total allotment. Conversely, he may use less water than his total allotment, and accumulate water in a flex account. Water accumulated in flex accounts has been a point of controversy to say the least; farmers want to keep it and others want to take it away. Water allotments may change in the future due to new estimates of crop consumptive use and/or irrigation efficiency, both of which affect water allotment calculations.

Much of the alfalfa that is grown in Arizona is grown outside of the AMAs and is not affected directly by the law. However, within the active management areas, the controversy relevant to alfalfa is the annual consumptive use established at 6 feet, which some argue is too low, and being able to increase the total allotment due to a larger percentage in the crop mix compared to 1975 to 1979.

The Code prohibits the sale or lease of subdivided land in an AMA without the demonstration of an assured water supply of renewable water sources (not groundwater). Under the Assured Water Supply Rules (AWS Rules) adopted in 1995, new development in an AMA must demonstrate that sufficient water supplies of adequate quantity and quality are available to meet the proposed new development uses for 100 years. Only after demonstration of sufficient water supply can a development be approved for sale to the public.

### **EMERGING ISSUES—Water Quality**

Alfalfa, in general, has relatively minimal negative impact upon the environment—the pesticide intensity is low, and alfalfa canopies prevent the erosion of soil, a major source of contamination to rivers and streams. However, there are a few concerns:

**TMDLs.** If growers have not yet heard about TMDLs, it is likely that they will in the near future. TMDL (Total Maximum Daily Load) is an acronym for the maximum allowable level of any pollutant, whether it be a pesticide, sediment, temperature, or other pollutant. Since this will be reported on elsewhere in this proceedings, we will not dwell on it here, but the different TMDL requirements for different regions are likely to have an impact in coming years.

In California, there is concern by Water Quality boards about the presence of organophosphates (e.g. Chlorpyrifos or Lorsban, or diazaron) in surface waters in the San Joaquin Delta and in other surface waters. Alfalfa has been implicated in these observations, primarily for the treatment of Alfalfa Weevil and the Egyptian Alfalfa Weevil, though also for summer worm control. There is evidence that irrigation water can move these compounds off of alfalfa fields into the sloughs, streams, and rivers, after which they may impact the Bay Delta. In one study by Rachael Long (et al.) in California, OP insecticides applied for weevil control in the spring caused death of a test organism in irrigation water runoff in virtually all of the cases (Figure 5).

Members of the California Alfalfa Workgroup and CAFA have been active in trying to address this issue through education and research.

A second concern is the detected presence of herbicides used as winter-dormant sprays in alfalfa in a few wells in the northern San Joaquin Valley.

Current evidence is that these may result from catch basins which allow percolation of water into groundwater zones, not through surface percolation.

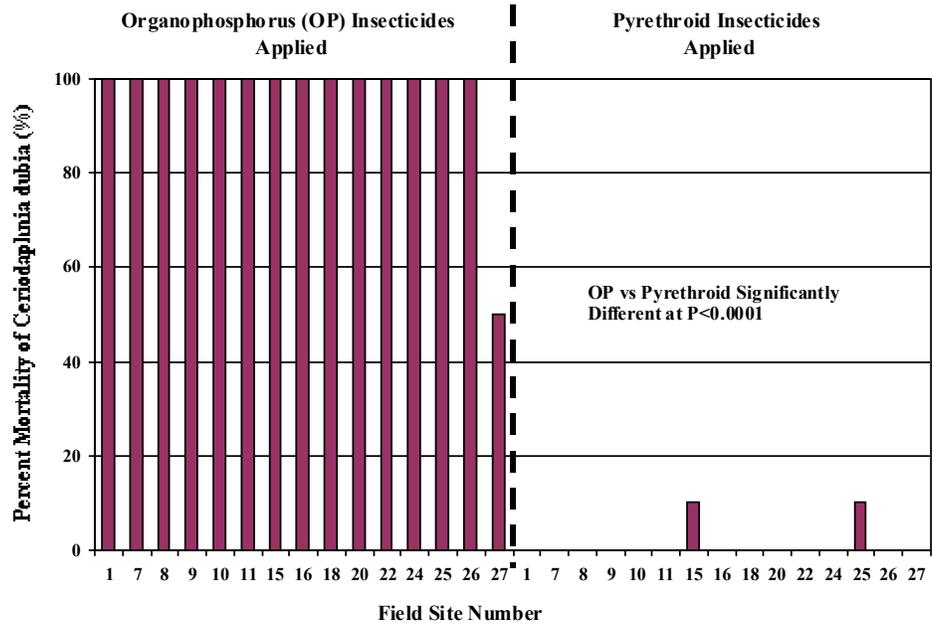


Figure 5. Effect of insecticide choice on mortality of *C. dubia* (water flea) exposed to field runoff water in a 24-hour test from 15 paired field comparisons (pyrethroid vs. organophosphate insecticide). The *Ceriodaphnia* is sensitive to parts per trillion of the O.P. insecticide. In this case, mortality occurred three to seven weeks after application. (Long, et al., California Agriculture 56:163-169)

Additional issues may arise through the TMDL process of EPA or through Endangered Species regulation (which also affects water quantity). The process of regulation is complex and dynamic. Although there are some technological issues to be resolved, many in the alfalfa industry feel that it is important that the industry addresses these important areas before they are regulated to do so.

Water quality and water quantity are interrelated issues. One of the primary solutions to the problem illustrated by Figure 1 is to prevent off-site movement of water. This of necessity requires improved irrigation management. Irrigation management is a key aspect of improvements in water use efficiency and mitigation of water quality.

### EMERGING ISSUES: Forage Quality and Changing Markets

To be realistic, alfalfa has been losing significant 'market share' in recent decades. The reality of 'decreased market share' is an important emerging issue, and something that alfalfa producers should face. While approximately 45 to 50 lbs of alfalfa per dairy cow per day was produced in the early 1970s, today, California produces about 20-25 lbs per dairy cow per day. (The amount actually consumed by each dairy cow is lower, but difficult to measure). However, there is a clear downward trend on the incorporation of alfalfa in dairy rations. While previously, dairies have relied almost exclusively upon alfalfa for their forage needs, now there is more reliance on small grains and corn silage as well as many commodities that have entered the market, often at very low prices.

Forage quality measurement and understanding is at the crux of this issue, as the pressure to produce higher quality hay is likely to intensify in the future. What is it that alfalfa offers, other than “stuff that cows eat”? The methods and approaches to measuring forage quality are likely to undergo several important changes in the near future (see other article, this proceedings). Alfalfa does have unique and important qualities, but alfalfa growers must be increasingly more sophisticated in their understanding of forage quality, to assure that alfalfa remains a critical part of dairy rations (and for other uses) in the future.

### **EMERGING ISSUE—Biotechnology**

In the popular press, the late 1990s to current times has been termed the ‘golden age of biology’, since so many rapid advances have been made in genetics and biotechnology. These efforts will undoubtedly have an impact upon alfalfa. The most dramatic and immediate effect will be from Roundup-resistant alfalfa, which will enter the market likely in 2004. Roundup-Ready crops have swept through acreage of corn, soybean, and other crops in the Midwest USA during the late 1990s. Although the technology is still being evaluated for alfalfa, it is likely that interest will be high, and significant acreage may follow. Other advances in biotechnology, including improved quality lines, may be in the offing. Alfalfa will likely have to face the same types of perception issues as other crops have faced with regards to varieties altered through biotechnology.

### **EMERGING ISSUE –Public Perception/Non-economic values of alfalfa**

Alfalfa provides a tremendous source of wildlife habitat. Additionally, it fixes its own nitrogen and protects the soil from erosion. It provides a very high quality of yield with relatively low impacts upon the environment. But who in the general public knows this? An ignorant public can easily dismiss a crop such as alfalfa, since few understand its value and importance. In an agricultural system where decisions are increasingly made by a non-agricultural public, it behooves farmers to help the public understand the importance of their crops, and how they contribute to their daily lives. An important ‘emerging issue’ with alfalfa is the perception of the public as a whole. This includes both the value of alfalfa nutritionally and economically, but also in terms of non-economic values such as wildlife habitat, open spaces, soil conservation, and aesthetic value.