EMERGING ISSUES WITH FORAGES IN THE SOUTHWEST

Dan Putnam, Mike Ottman, Tom Griggs, David Drake, Denise McWilliams, Joe Brummer, and Willie Riggs[1]

ABSTRACT

The southwestern states from NM west, produce about 22% of the nation's alfalfa and 14% of all hay. The western states as a whole produce over 40% of the US alfalfa crop. A key emerging issue for all western states is the phenomenal growth in western dairying that now produce over 40% of the nation's milk (up from 15% in the 1970s), with 92% of the growth centered in CA, ID, NM and AZ. Nearly 30% of the nation's milk is now produced in the SW states alone. Issues surrounding water supply, availability, and quality are without a doubt the most critical issues facing forage growers in the Southwest. Energy costs (also linked to water due to the need for pumping), and profitability, government regulation, pest pressure, and standardization of forage quality for markets remain high on the list of important issues for growers. The introduction of a genetically-modified alfalfa in 2005 has provided new tools as well as challenges in marketing, and emerging issues for coexistence of GE and non-GE markets. Off-site movement of organophosphates are an issue in surface-irrigated regions, particularly CA. Lack of pest management tools, and research support for forages are also key limiting factors for alfalfa and other forages in western regions.

Keywords: statistics, alfalfa, dairy, forage, corn silage, trends, regulation

INTRODUCTION

There are a wide range of critical issues affecting forage producers throughout the Southwest. It is not surprising that water issues (water supply and water quality) dominate this region, since it is the dries agricultural region of the US. This region, although historically sparsely populated, is also one of the most rapidly urbanizing regions of the US. Many of the issues facing forage grower in this region originate from the interface between rural and urban populations, from regulation to water quality, and water transfers. At the same time, forage producers in the Southwest face a dynamic situation with regards to demand for hay.

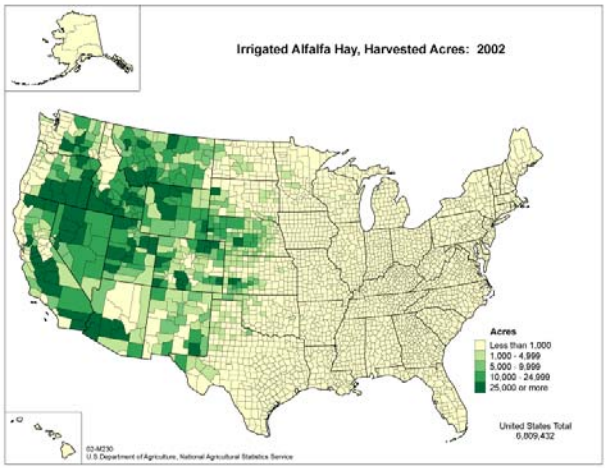

Figure 1. Irrigated alfalfa acreage in the US

[1] Forage Specialists from CA, AZ, UT, NM, CO, and NV, respectively. Sr. author address: DH Putnam, Department of Plant Sciences, University of California, Davis, CA 95616 dhptnam@ucdavis.edu published **In:** Proceedings, 2006 Western Alfalfa & Forage Conference, December 11-13, 2006, Reno, Nevada Sponsored by the Cooperative Extension Services of AZ, CA, CO, ID, MT, NV, NM, OR, UT, WA, WY. Published by: UC Cooperative Extension, Agronomy Research and Extension Center, Plant Sciences Department, University of California, Davis 95616. (See http://alfalfa.ucdavis.edu for this and other alfalfa proceedings.)

A FEW STATISTICS

The Southwestern region of the United States includes the States of Colorado and New Mexico west to include Utah, Arizona, Nevada and California. This is an arbitrary demarcation; the largest hay-producing state in the US is Texas which is frequently grouped with the SW states. Texas, however, has limited acreage of irrigated forages compared to the rest of the Southwest. Irrigated alfalfa regions of the US begin approximately in western Nebraska and Kansas, extending throughout all western states (Figure 1).

Table 1. Rank of Crops in Value and Acreage, Western States

State	All Crops Value	Field Crops Acreage	Field Crops Value
	#1 Crop	*#1 Crop*	*#1 Crop*
AZ	Vegetable	Forage	Forage
CA	Fruits	Forage	Forage
CO	Grain	Wheat	Forage
ID	Vegetable (potato)	Forage	Vegetable (potato)
MT	Grain	Wheat	Forage
NV	Forage	Forage	Forage
NM	Forage	Forage	Forage
OR	Forage	Forage	Forage
UT	Forage	Forage	Forage
WA	Fruit (apples)	Wheat	Wheat
WY	Forage	Forage	Forage

(Data: USDA Ag. Statistics Service)

Hay Production. In all western states except Washington, hay is either #1 in acreage or #1 in value (Table 1). Alfalfa is the key irrigated forage crop for all western states, and is the largest component of 'hay value'. The Southwestern US states produced approximately 22% of the US alfalfa crop, and 14% of all US hay products in 2005-06 (Table 2). Combined with the Pacific NW States of MT, WY, ID, WA, and OR, the 11 western states produced a little over 40% of the nation's alfalfa crop in 2005 (Figure 2, see also Shewmaker et al., this proceedings).

Table 2. Current Acreage and Production of alfalfa and all hay products, Southwestern US states (data, USDA Agricultural Statistics Service)

	Alfalfa Hay								
	Arizona	California	Colorado	Nevada	New Mexico	Utah	TOTAL or AVE	%of US	US total
Acreage x 1,000 (2006)	250	1,060	770	270	220	540	3,110	13.9%	22,407
Yield, t/a (2005)	8.4	6.9	3.7	4.8	5.1	4.2	5.5	163.2%	3.38
Production, tons (2005)	2,184	6,900	2,960	1,248	1,224	2,226	16,742	22.1%	75,771
Value, $ x 1,000 (2005)	268,632	952,200	298,960	149,760	156,672	213,696	2,039,920	27.9%	7,319,756
	All Hay								
	Arizona	California	Colorado	Nevada	New Mexico	Utah	TOTAL or AVE	%of US	US total
Acreage x 1,000 (2006)	295	1,600	1,540	480	310	700	4,925	7.9%	62,697
Yield, t/a (2005)	7.75	5.76	2.64	3.58	4.28	3.76	4.63	189.7%	2.44
Production, tons (2005)	2,324	8,935	4,085	1,609	1,413	2,594	20,960	13.9%	150,590
Value, $ x 1,000 (2005)	284,732	1,150,613	409,210	195,246	176,328	244,240	2,460,369	19.7%	12,491,263

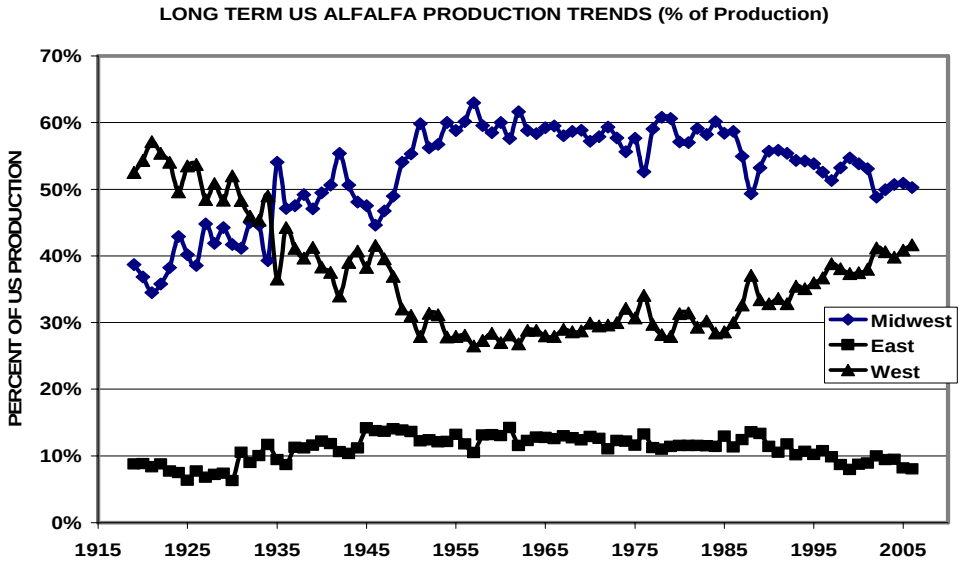

Figure 2. Long-term trends in alfalfa production, 11 Western states (AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY), 12 Midwestern states (IA,IL, IN,KS, MI, MN, MO, NE,ND, OH, SD, WI) compared with 27 eastern states (data

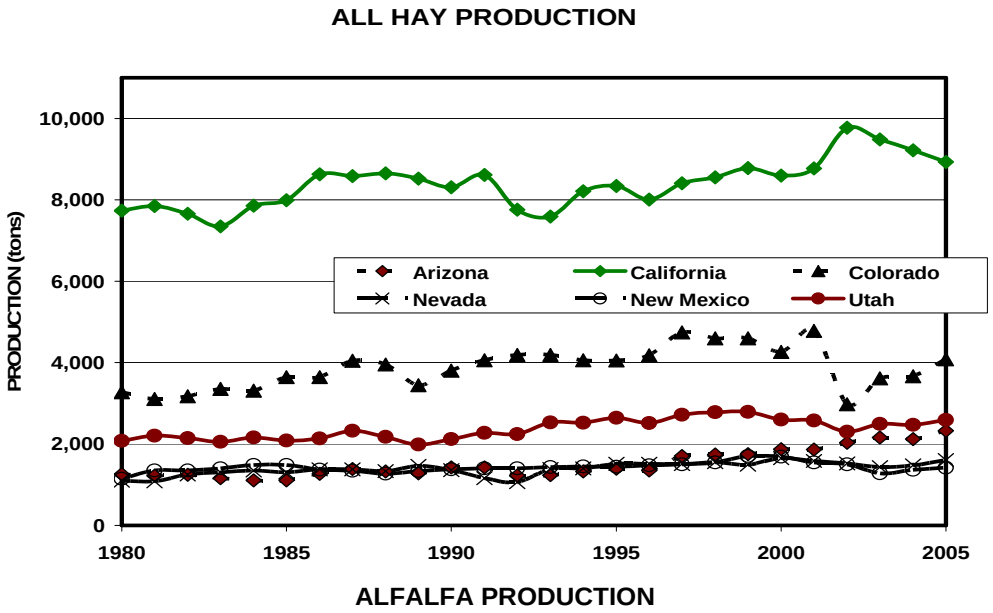

Figure 3. All hay production, 6 SW US states, 1980-2005 (data USDA Agricultural Statistics Service)

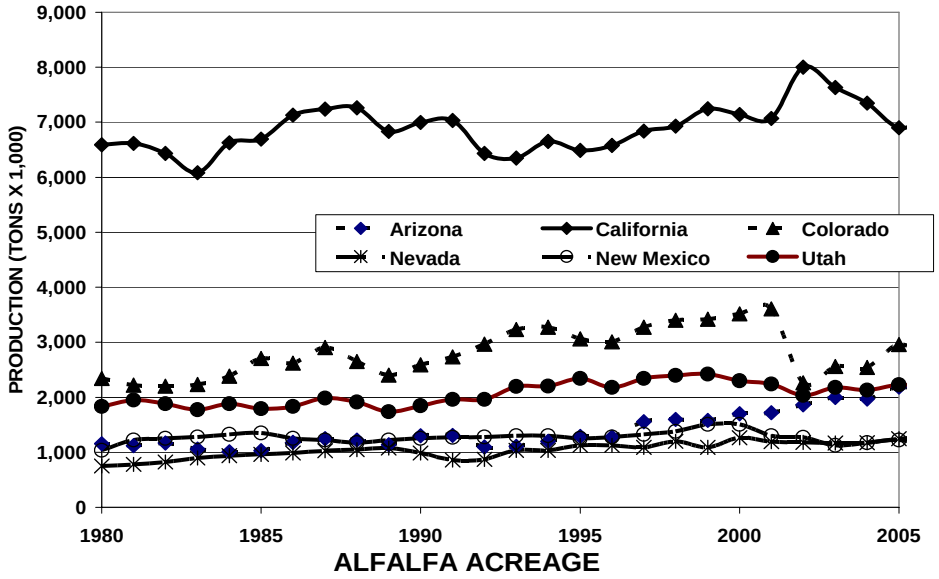

Figure 4. Alfalfa production trends, SW US States (USDA Ag. Statistics Service)

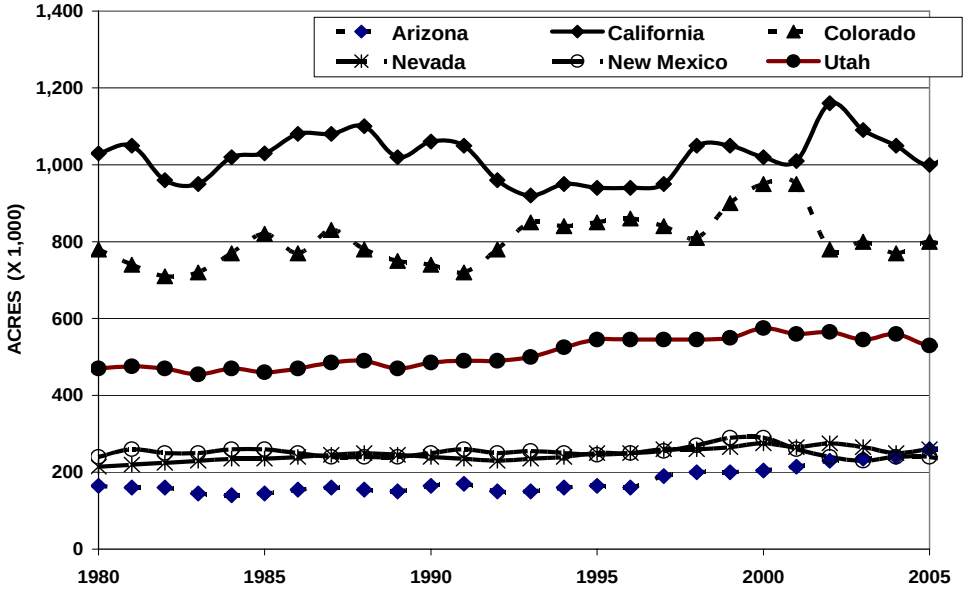

Figure 5. Alfalfa acreage trends, SW US States (USDA Ag. Statistics Service)

Alfalfa has a long western history. Historically, after its early success during the 1850s California Gold Rush, alfalfa moved rapidly throughout the West so that by the turn of the 20th Century, 98% of US alfalfa was produced west of the Mississippi River (USDA documents). However, records show that by the 1930s, Midwestern alfalfa production exceeded western production, particularly in the upper Midwest (Figure 2). In the last decades of the 20th Century, Western production of alfalfa has increased from 30% of US production to over 40% of US production (Figure 2). In the 1990s, alfalfa surpassed wheat as the nation's 3rd most important crop in economic value and 4th in acreage (USDA-Ag. Statistics Service).

All hay production in this region is led by California and Colorado, followed by Utah, Nevada, New Mexico and Arizona (Figure 3). Not surprisingly, alfalfa production trends (Figure 4) are similar to the trends for all hay, since alfalfa is the key forage in these states. Alfalfa acreage has been primarily flat in the past 20 years in this region, with only slight increases in Utah and Arizona (Figure 5). There have been temporary increases in acreage, such as in Colorado in the late 1990s, and California in 2001, but acreage quickly equilibrated back to its historical levels in these states. It is interesting that alfalfa acreage has gravitated around constant acreage in this region over the past 25 years in spite of very large increases in dairy cow numbers in this region (see below), as well as large increases in horse demand. It is likely that increased demand in this region was approximately balanced by factors which provide pressure for reduced acreage including water cost and supply limitations, competition with other crops, and conversion of farmland to urban development.

Alfalfa yields have improved substantially in southwestern states since records have been kept by the USDA since the early part of the 20th Century (Figure 6). The most dramatic gains have been in Arizona and California, with more modestly in the other southwestern states (Figure 6). Substantial increases were seen particularly in the 1950s-1970s. Increases in yield over this period are likely accounted for by improved harvesting mechanization (allowing more cuts/year), fertilizers, new herbicides and insecticides, improved irrigation methods, and the introduction of improved varieties with non-dormant high-yielding characteristics and multiple pest resistance. This dataset indicates either modest or no increases in yield during the past ten or more years, which may correspond to the

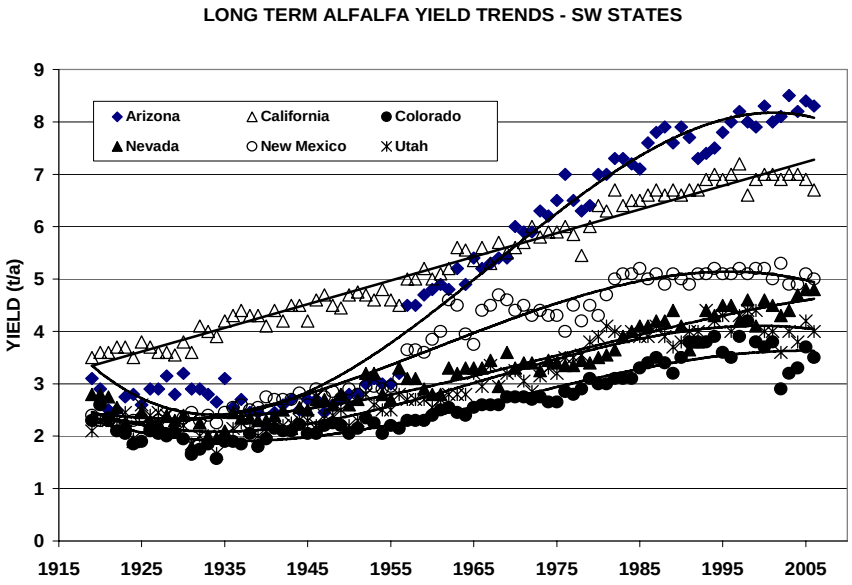

Figure 6. Change in alfalfa yields, SW US states from 1917 through 2005 (data USDA-Ag. Statistics Service)

increased use of short cutting schedules which reduce yields but provide higher quality to meet the demands of the dairy industry.

Dairy Trends. The recent growth of dairy farming in the West, and in the Southwest in particular has been nothing short of phenomenal. New Mexico has emerged from a very minor dairy state to one of the top 10 dairy states in the US during the past two decades, with a growth of over 700% in cow numbers since 1980 (Figure 7). New Mexico is followed in relative growth rates by Idaho, Arizona, California, Colorado and Arizona. Reductions in dairy cow numbers were observed in Montana, Hawaii, and Wyoming, with no change in Alaska. Cow numbers in all western states in 2005 were about double those in 1980 (Figure 7). Expert predictions show this trend to continue at least in the short term.

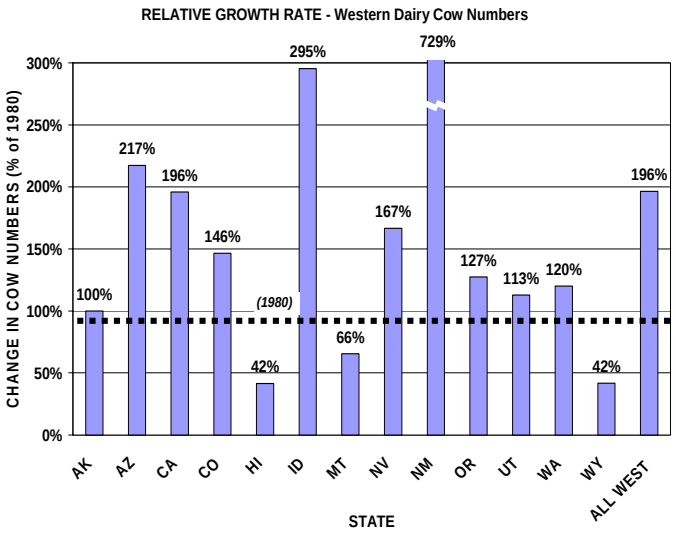

Figure 7. Relative Change in Dairy Cow Numbers- Western States, 1980-2005

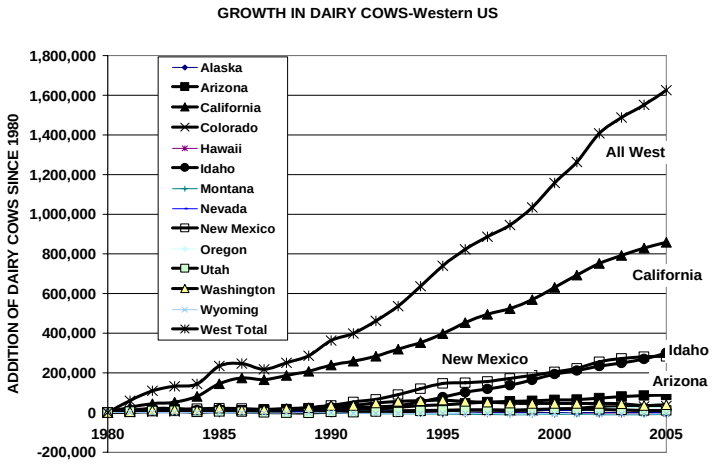

Figure 8. Absolute Change in Dairy Cow Numbers, Western States, 1980-2005

These relative growth rates, particularly in Idaho and New Mexico are remarkable, driven in part by the movement of dairy units from Southern California to other states. However, the absolute growth rates in cow numbers have been highest in California itself (Figure 8), followed by Idaho, new Mexico, and Arizona. California became the largest US milk-producing state in 1993, and now produces more than 40 billion pounds of milk, and all western states more than 70 billion (Figure 9). Western states were minor milk producing states for decades, producing less than 15% of the nation's milk, but since the 1970s rapidly rose in production so that western states now produce over 40% of the nation's milk (Figure 10), and southwestern states 29.9% of the nation's milk in 2005.

The growth in milk production in the West has been a function both of cow numbers and production per cow. For example, in California, milk production per cow has increased at the rate of 2.2%/year, while cow numbers increased at an average of 3.8%/year. In 20 of the past 25 years, California has added an average of 34,000 cows/year since 1980.

52% of the growth in cow numbers since 1980 comes from California, while 92% of the growth in dairy cows is accounted for by the states of CA, ID, NM, and AZ (Figure 11). Some of the most intensive growth in cow numbers in CA have been in the past 5 years (Figure 11). The factors that have caused these growth rates are related to lower costs of production in the West, availability of labor, availability of productive high quality forages and byproducts, co-location with family and ethnic group, population growth, citing of cheese plants, support infrastructure, and the economic power of moving dairies from high land-value urban regions such as Los Angeles to California's Central Valley or throughout the West.

It is an understatement to say that this growth in dairy cows in western regions has created tremendous environmental challenges with regards to both air and water quality, but has also significantly impacted markets for hay and forage crops.

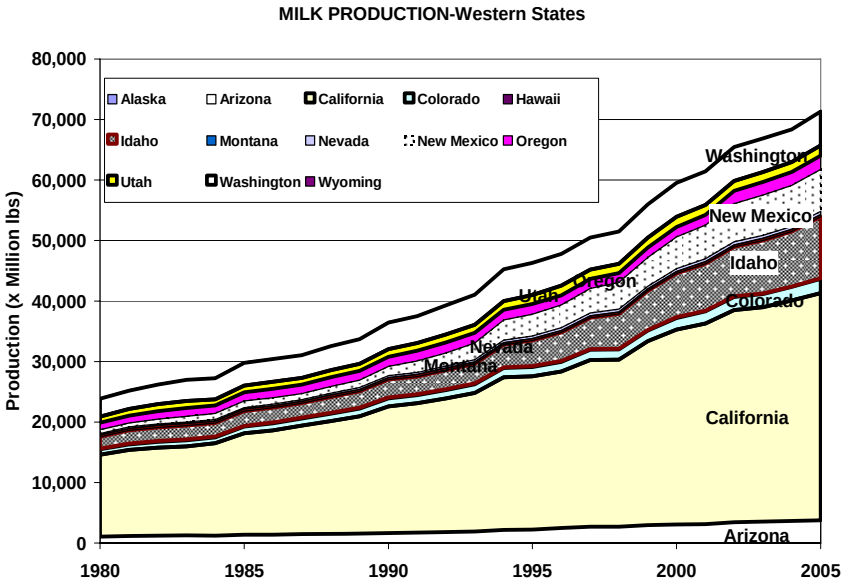

Figure 9. Milk Production, 11 Western US States.

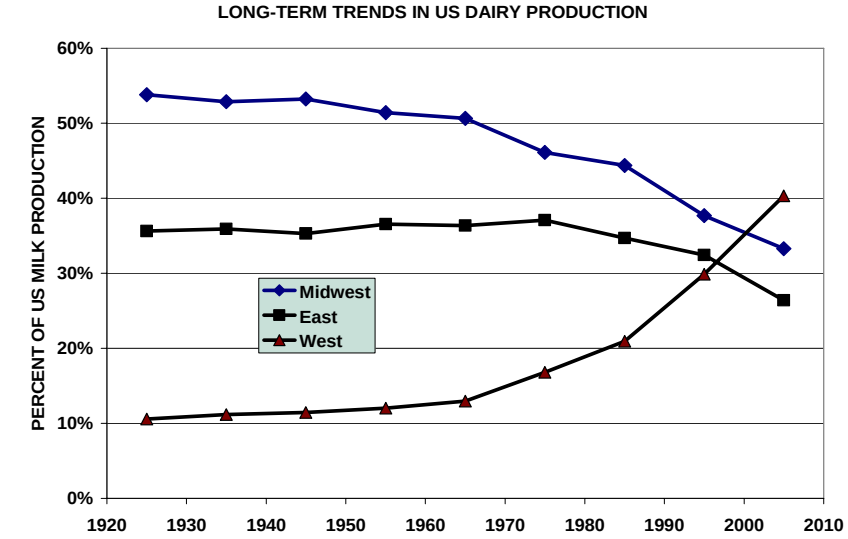

Figure 10. Change in Milk Production, 27 Eastern states, 12 Midwestern states, and 11 Western States.

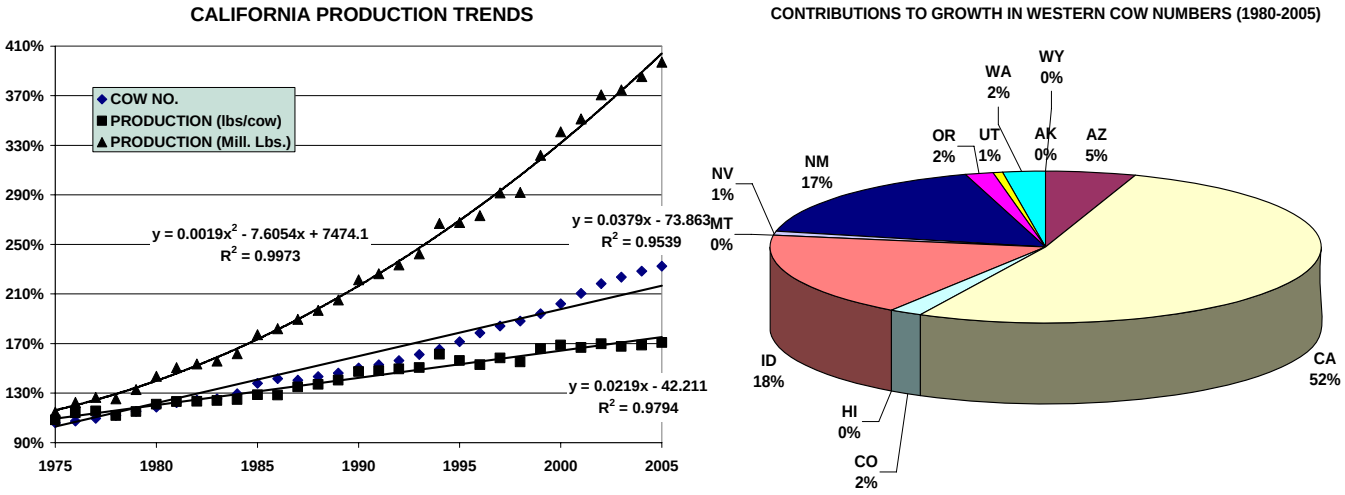

Figure 11. California dairy trends (left), and contribution of western states to the growth in western cow numbers since 1980. (USDA-Ag. Statistics Service).

Corn Silage. Corn Silage acreage in the southwestern US state have grown substantially in California, Arizona and New Mexico, but been constant or declining in the other Southwestern states (Figure 12). The acreage in NM and CA has more than doubled in 25 years. The growth of Corn silage in the major dairy states of Idaho, California, Arizona and New Mexico has been a major competitor for alfalfa hay products in dairy rations. It is likely that this trend will continue.

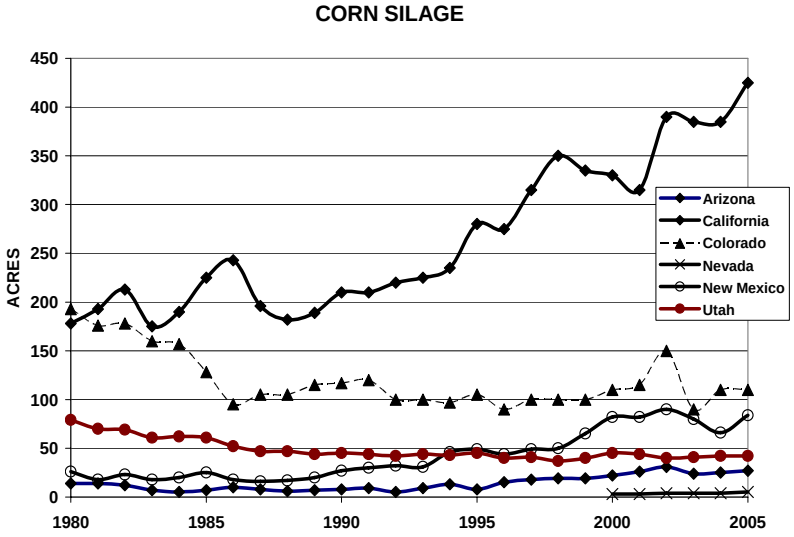

Figure 12. Change in corn silage acreage, 1980-2005, Southwestern states (USDA-Ag. Statistics Service).

Other Forages. Significant increases in miscellaneous forage crops grown for horse consumption, exports, and miscellaneous use has increased in SW states. Of these, the horse market has been probably the most interesting. Estimates of horse numbers are uncertain, but populations are clearly becoming more important in all of the Southwestern states, aided by an urbanizing population. Cool season grasses and grass-alfalfa mixtures for the horse market are important in intermountain regions. Demand for bermudagrass hay for horses from Phoenix to LA has increased interest in this crop, as well as demand for misc. hay

products for the urban and suburban regions of Las Vegas, Denver, and Salt Latke City. Alternatives to corn silage include BMR sudangrass for dairies, where corn faces disease problems. Small grain forage (oat, wheat, barley, triticale) have become significantly more important in the Central Valley of California and in other dairy regions, linked to rotations with corn silage and manure management.

EMERGING ISSUES IN SOUTHWESTERN STATES

Many issues facing alfalfa & harvested forages in the southwestern states are trends that have been accumulating for many years, although there are some suddenly-emerging trends, such as the introduction of Roundup-Ready alfalfa in 2005. There are several common themes—changes in markets, and production constraints related to water.

Arizona. Hay acreage continues to increase in Arizona from about 200,000 acres in 1995 to nearly 300,000 acres in 2006. The dairy industry is fueling this acreage increase, as well as the horse and feedlot industry to a lesser extent. This increase in acreage has continued despite an overall decrease in agricultural land due to urbanization. Urbanization is an issue with alfalfa growers due to difficulty in moving equipment and pesticide spraying limitations. Water costs have increased in the central part of the state, and some growers have resorted to one instead of two irrigations between cuttings, particularly on short cutting cycles. Alfalfa quality is a concern since the dairies are demanding higher quality hay, but not necessarily paying the increased costs associated with producing this type of hay. Some hay growers disturb the market by agreeing to sell their hay for less than it is worth. The record-keeping provision in the Bioterrorism Act is also a concern for hay handlers. Overall, prices are strong and the future bright for hay and forage growers in Arizona.

California. Forages occupy over 2 million acres of irrigated cropland in this state (not including range), and in 2005 alfalfa alone was >1 million acres, valued at over $1 billion. Alfalfa is the largest acreage crop in the state, and although CA is the largest producer of alfalfa hay in the US, it is a net importer, mostly from Nevada and Utah. Exports of alfalfa to the far East (Japan) are usually less than 2% of production (including pass-through from neighboring states), but exports of ‘other hay’ (mostly sudangrass, kleingrass and bermudagrass) are often more important. The key driving force is the growth in dairying (see above), but other factors, particularly strong demand for horse hay has been important. The drop in cotton acreage in the lower San Joaquin valley has allowed expansion of some acres, but orchards and vineyards and houses compete heavily for acreage throughout the Central Valley, and urbanization in Central Valley cities have been a significant competitor for acreage and water.

Water supply problems are significant in some regions, not at all in others, but water issues are always of major concern everywhere in the state. Alfalfa, which receives no government support, must compete for water and land with many higher-value crops in this state. The expanding universe of demand from dairies and horses is approximately counteracted by the conversion of alfalfa land to higher value crops, urbanization, and water restrictions. Water transfers from Imperial Valley, environmental restrictions in

Klamath basins, and adjudications in several locations are examples. Water supply, conflict with urban demand, transfers for environmental mitigation, and pumping costs places water on the top of the list of concerns to growers.

Water Quality Regulations have been intensifying. The California Water Quality Control Board policies have caused the organization of 'watershed groups', which have taxed farmer-members to fund water quality monitoring and mitigation measures throughout many CA regions. Alfalfa is one of the state's largest users of organophosphate pesticides (mostly for weevil control in the spring and worm control during summer), and so is under pressure to reduce use or to mitigate off-site movement of OP pesticides. Growers have developed mitigation measures for this issue.

Genetically-Engineered Alfalfa as been a significant new introduction in the past 2 years. Demand for Roundup Ready alfalfa has been strong since its commercialization in 2005, and a number of growers are planting significant acreage or are experimenting with the technology. Coexistence of the RR technology with growers (organic or export) who produce for GE-sensitive markets is an issue, particularly in several counties where anti-GE measures have passed or have been proposed. Restrictions on RR alfalfa planting are in place in the Imperial Valley, and growers of export seed and hay have expressed concern for their markets.

Pest Pressure. There have been increased pressure from summer Lepidoptera pests (worm complex) during 2005 and 2006.

Hay Quality Testing remains a key issue, since a large component of crop price is dependent upon forage quality tests. Standardization of lab methods, sampling, and the incorporation of additional analysis into the hay marketing system is an important issue for growers. It is likely that nearly 1/3 of the value of the alfalfa crop is dependent upon quality factors, and measurement, understanding, and marketing based upon quality remains a critical concern.

Loss of Market Share by alfalfa in the dairy ration has been a significant if little-recognized trend. California produced nearly 40 lbs of alfalfa/cow/day in 1980, and this was reduced to nearly 20 lbs/cow/day by 2005 (Figure 13). This trend is partly due to the rapid growth of corn silage in the dairy regions as well as increased use of by-product feeds. The relatively high cost of alfalfa hay (vs. other forages and feeds) is an important factor, as is the need for manure

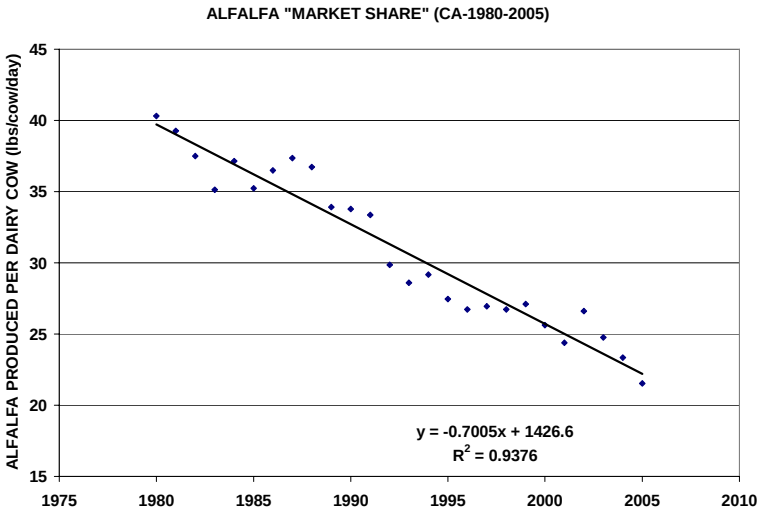

Figure 13. California alfalfa hay produced per dairy cow, expressed on a daily basis, 1980-2005 (USDA-Ag. Statistics Service)

management and its link to corn silage and small grain forage in the dairy regions. This issue is also related to issues of forage quality measurement and definition, and the ability (or inability) of growers to articulate the unique attributes of alfalfa in dairy rations.

Colorado. Hay generally ranks as one of the top three agricultural crops in Colorado in terms of value. In 2005, production of all hay ranked number one with an estimated value of $409 million which accounted for 32% of the total value of all field crops produced (Colorado Agricultural Statistics 2006). The value of alfalfa hay alone accounted for $299 million or 73% of the total value of all hay. This placed alfalfa third behind corn in terms of crop value to the state. Although the region has had generally favorable water situation for the past few years, water

Even with approximately 800,000 acres of alfalfa harvested in 2005 (Colorado Agricultural Statistics 2006), Colorado is still a net importer of alfalfa hay. The large feedlot industry and growing dairy industry have put increased demands on the need for large quantities of high quality alfalfa hay. This has put undue strain on the economics of these two industries with the increase in transportation expenditures due to high fuel costs. There is definitely room for the alfalfa hay industry to expand.

Increased urban water demands have limited the ability of producers expand, however. Alfalfa consumes large quantities of water compared to many other crops and it is one of the first crops to be cut when water is limited. Recent research in Colorado has focused on the effects of limited irrigation on alfalfa production. Part of that research relates to the fact that the city of Parker has recently purchased the water rights associated with approximately 6,000 acres of farmland in eastern Colorado. Some of that acreage is in alfalfa production and will be dried up by the year 2010. This trend has been going on for some time and will likely continue into the future with farmers selling their water rights and converting from irrigated to dryland crop production.

Organic Dairies have been a growing trend in Colorado and are associated with a demand for organic forages. Currently, most of the organic alfalfa hay used in Colorado is shipped in from Idaho with transportation costs of about $70/ton. There are a number of producers in Colorado that would like to take advantage of the premium paid for organic alfalfa, but the 3 year conversion process for certification and lack of local knowledge on how to produce organic alfalfa, such as weed and pest control, has discouraged many from undertaking the switchover.

Some producers have been reluctant to adopt Roundup-Ready technology because of the added seed costs. Additionally, whether real or perceived, there has been some opposition from the public about the use of GMOs as feed sources for livestock and the potential for the Roundup Ready gene to cross into conventional alfalfa fields or escape into wild plant populations. The latter is of special concern with the potential increase in organic alfalfa production in the state.

New Mexico. Within New Mexico several issues are pushing alfalfa production making hay supplies tight and prices fairly high. After the last five years of drought, rain in 2006

brought some relief to the region. However, increasing urban sprawl and winter visitors to the state continue to utilized limited water supplies and compete with farm land use and open space for dairies.

Dairy cow numbers within the state have increased dramatically over the past decade (see above). With land still affordable, taxes rather low and water supplies relatively cheap in price despite some limitations as compared to other southwestern states, New Mexico has continued to attract dairies and with this increase an increasing demand for forage supplies and water use. Current changes in the state are causing well metering as well as tightening irrigation supplies, which are more closely monitored. Within some irrigation districts, early water agreements between New Mexico and Texas as well as Mexico have limited irrigation supplies and placed some irrigation districts into five-year water allotment cycles such as in the Pecos River Valley. Lessening ground water supplies in the upper northeast of the state in the edges of the Ogallala aquifer region have also tapped sources to such an extent that deeper but yet less water is available for farming. Endangered species have also affected water delivery and supplies as has the drought such as the silvery minnow (endangered fish) contentions in the Rio Grande regions of New Mexico. With these political as well as water allocation and land use contests within the state, New Mexico has seen increasing pressure to work through regulatory and water right laws and regulations while growing in population. Increases in dairy numbers continue to demand alfalfa production and corn silage improvement for the state, particularly in the eastern and southern regions of the state.

Demand on water within the state is the paramount concern in New Mexico. Next in priority would be the growing pains with increasing population, urban sprawl, dairy number increase and revisions of irrigation district and well metering changes. These are occurring while existing with outdated water agreements with neighboring states and countries cause water delivery which still must be met even during cycles of drought. Endangered species demands on key above-ground water supplies that are also utilized to move irrigation water within the state also provide problems that are not yet settled.

Utah. In many regions, issues include the lack of profitability of conventional rotation crops which include cereals. There is a need to understand the fit and potential, if any, of irrigated forages as biomass or non-forage (energy, industrial feedstock) crops. Bio/homeland security regulations and record-keeping/compliance requirements are emerging issues, as well as prices of fuel, land, and water (some due to urbanization) and corresponding feasibility of starting a farming operation. The planned removal of Furadan (carbofuran) from market this year may affect some growers. Apparent success of some growers with back-to-back alfalfa raises several questions: how many cycles can this continue or is autotoxicity occurring but going unnoticed?

Adaptation of better pest resistance in alfalfa varieties is needed. We have had stem nematode damage in what are considered to be SN-resistant cultivars, and cowpea aphid in 3rd and 4th cuttings.

There has been some adoption of (but also some grower resistance to) RR varieties in our region; there are still some problem weeds that remain in RR alfalfa fields. We have seen a continuing movement away from conventional small bales except in specialty feed-store/horse hay markets, where there has been a growth of demand and opportunity in horse hay markets. There has been a trend towards large bales (4x4 or 3x4) for more effective transportation. Some limited use of wrapped unfermented bales put up at 25-30% moisture for more rapid harvesting and better leaf retention.

Lack of awareness and understanding of forage quality evaluation concepts, methods, and applications to marketing and livestock nutrition are key ongoing issues. There remains confusion and frustration regarding hay test criteria and target ranges for various hay classes. Part of this confusion stems from the use of numerous acronyms (ADF, NDF, TDN, NEL, RFV, RFQ, NDFD, RUP, ADIN, etc.) in forage testing. And from the adherence to traditional and arbitrary hay quality criteria, such as color, stem diameter, or ADF concentration. Confusion also results from reluctance to learn and adopt newer nutritionally-relevant parameters such as fiber digestibility and crude protein degradability. Confusion also results from a lack of understanding of the difference between hay test variables that are measured (or NIRS-predicted) vs. those that are calculated from measured variables. There also remains uncertainty regarding the validity and precision of results from forage testing labs. A better understanding of what NDF, NDF digestibility, CP degradability, and energy estimation from summative approaches (such as the 2001 Dairy NRC) are could help growers produce and market hay to more consistently meet particular end uses.

Nevada. Nevada faces some of the most intensive confluence of urban growth and water issues of many of the southwestern states. This is the driest state in the union, coupled with being one of the fastest growing states, and thus water issues dominate most discussions. Research and education related to water use, efficiency, alternative crops, and opportunities in these arenas are being addressed. University of Nevada Cooperative Extension has been actively engaged in working with forage producers evaluating alternative pesticide registrations. To date two products have been selected by IR-4 for further research. One product has been labeled. Additional emerging issues relate to increases in production costs tied to energy and the availability of labor. Programs relating to these issues are in the development phase.

NEED FOR RESEARCH SUPPORT

A key issue throughout western states is the need for research and extension funding for forage systems. A continued decline of support for forage research in land-grant institutions has been evident in many SW states. The nearly complete absence of USDA-ARS positions which address specific issues in this region is an important missing link. Specific needs include pest management, linkage with dairy systems (water and air quality) and biomass systems, forage quality and utilization alternatives, and especially water management and water quality related to pesticides and animal wastes and water supply. Research on critical needs of water-efficient sustainable forage systems for a water-limited future is critical to the future of forages in the West.