Presidential Address
Contributions of the Past and Opportunities in the 21st Century

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It is my pleasure to welcome you to the 52nd annual conference. Matt Ehlhardt and his program committee have worked hard putting together an outstanding program. This is an historic occasion as we enter this next century and millennium. Considerable debate has gone on about when the new millennium actually begins, but nevertheless it is important to view these dates as milestones and take this opportunity to reflect on our advances in weed control as we look forward to the challenges of the next century.

History of Weed Control

The history of weed control has been a story of slow and painful progress. From about 10,000 B.C. to 6000 B.C. man cultivated crops by primitive methods using bare hands to pull weeds as demonstrated by a member of the Orloff clan. This system is still used today in high value crops. About 6000 B.C. he fashioned hand tools to prepare land and fought weeds with hoes and digging sticks. Slash and burn agriculture is still used. And in about 1000 B.C. the use of animal-powered implements was introduced and still used today in many parts of the world such as Mexico and Pakistan. From then little progress was made until the 20 century.

Momentous accomplishments in weed control were made during this last century. Beginning in the early 1900's we saw the advent of the age of mechanization using petroleum powered tractors for tillage operations. New tillage implements were used during this time, including the rolling cultivator, sweep type cultivators, chizels, and bulldozers powered by petroleum. And in the final decade of the century we made a big jump, and now have computer guided cultivation systems under development. In the future we will see smarter sprayers. We will make even better use of computer technology. This will require greater knowledge of plant physiology and weed biology.

Chemical Weed Control

Chemical weed control has made amazing strides since its inception. Natural chemicals were used prior to the 1900’s, but contained high rates of hazardous elements such as arsenic. In the 1900-1920’s petroleum oils and sodium chlorate were introduced. The 1940’s saw the introduction of the herbicide era with the discovery of 2,4-D. This brought tremendous saving to humans in general and to the agricultural industry. The 1950’s marked the development of several new herbicides including monuron, endothol, simazine, and atrazine. In the 1960’s dinitroanilines, thiocarbamates, paraquat and diuron were introduced. In the 1970’s Roundup and selective herbicides like Hoelon and Avenge were important breakthroughs for controlling grass
weeds in small grains. In the 1980's selective grass herbicides were developed for use in broadleaf crops. Ultra-low rate herbicides also came into use and are now becoming the norm for new herbicides.

In the 1970's the “Green Revolution” occurred that had a major impact in developing countries. With advances in plant breeding at the International Center Wheat and Corn in Mexico (CIMMYT), wheat varieties were developed with 2-3 times the yield potential. This germplasm has been used throughout the world. These varieties often were more responsive to higher nitrogen and pest management inputs. A similar situation occurred at the International Rice Research Institute (IRRI) yielding new rice varieties that improved yield 2-4 times. These new short statured varieties helped growers around the world keep up with food demands and stay economically viable.

**Biotechnology**

The 1990’s marked the age of yet another weed control breakthrough, biotechnology and the introduction of herbicide resistant crops. By 1999 this technology had become so popular that there were nearly 45 million acres of agronomic crops planted with the Roundup resistant trait across the United States-38 million acres of Roundup Ready soybeans, 4.2 million acres of Roundup Ready cotton, and 2.1 million acres of Roundup Ready corn. Major cost savings were realized, particularly with BT cotton and BT corn. Cotton growers in the southern region reduced weed control costs from $80/A to $40/A and also reduced the total volume of herbicides used by approximately 40 percent. Sixty percent of the cotton belts was planted to herbicide tolerant cotton. Of this acreage 7 percent was planted to BXN cotton. In California there were over 40,000 acres of Roundup resistant cotton and 12,000 acres of Buctril resistant cotton planted in 1999.

Many of the weed management approaches mentioned are now being incorporated in an integrated weed management system. In addition to advances in weed control, we reap the benefits of this centuries’ other agricultural developments such as new varieties, laser leveling, and improved irrigation’s techniques. Because of these technological developments in agriculture, Americans spend less than 13% of their income on food while other countries spend 25 to 50 percent. Prior to 1910 American farmers produced enough food per acre to feed 7 people. Today the American farmer produces enough on 1 acre to feed and clothe 165 people. Consequently our society has healthier food choices and more disposable income. The advances in production technology have kept up with population growth during the last 2 decades, but too many still went hungry. These problems exist not because of food shortages, but because of distribution problems or war.

**Key events in weed management in this past century**

It is interesting to look back at the programs developed and issues that surfaced in this last century. Weed control as a science in California began in the late 1920’s at UC Davis. The California Weed Science Society began as a conference in Sacramento in 1949 and evolved into a society in 1994. The Growers Weed ID book was introduced in 1968. The California Weed Science Society “Principles of Weed Control in California” textbook was first published in 1985.
The 3rd edition will be published this year. The society’s members have played a major role in weed science as researchers, educators, innovators, and regulators. Personally it has been a privilege to know many of the key weed researchers and innovators. Many of these individuals have been honored by this society, and we again recognize them for their efforts and contributions.

The 1980’s began the period of food safety concerns. Parts per million became parts per trillion. We were suddenly discussing what level of risk was acceptable. We talked about how much an individual would have to eat to be at risk. Many new regulations were introduced such as mandatory reporting, plant back restrictions, pest management zones, required training and certification of Pest Control Advisors and applicators. During this period some older herbicides were lost, and new herbicides were introduced that had lower use rates and better environmental safety.

Nitrate and pesticide pollution concerns also came to the front in the 1980’s and will likely continue to increase in importance in this next century. Reduced tillage programs were implemented in many parts of the United States which reduced nitrate losses from soil erosion. This practice also brought fuel savings, reduced soil and wind erosion, and in some cases conserved moisture. This system also brought about a shift from predominantly mechanical tillage to an increased emphasis on herbicides.

Integrated pest management (IPM) was developed in the 1970’s, and became fully implemented in the 1980’s. Instead of relying solely on chemical control, this approach used herbicides as one of the tools in an overall management system. The term was confused by some who thought chemicals were not a part of this system. Fortunately we have arrived back to the correct understanding of the phrase, which is integrating cultural, mechanical, biological, chemical tools for cost effective weed control with lowest negative impact on the environment. IPM today helps to sustain the old and the new weed control technologies.

During the late 80’s and early 90’s the concept “Sustainable Agriculture” was introduced. The term was ill defined and too many people it implied that current production systems were not “sustainable”. It became associated with organic farming that really only served a niche market. This approach was a giant step backward and alienated many from both philosophical camps. Furthermore, an inability to control weeds led most growers back into conventional integrated weed management programs after trying organic farming methods.

Herbicide resistance surprised many and has developed with several weed species during the past two decades. Even the Roundup Ready system is facing resistance issues with a few weeds and are already seeing a specie shift in the southern cotton growing area where this technology has been used the longest. This challenge has forced companies and researchers to rethink weed control management strategies and has emphasized the importance of not relying on a single method of control. To this end we have seen new uses and tactics such as tankmixes, and herbicide and crop rotation.

During the 1990’s we saw the introduction of herbicide resistant crops. The potential benefits of Genetically Modified Organisms (GMO’s) are enormous however there remains many fears and unknowns as to what all scientists will do with this technology. People must feel
secure about their food and while, they don’t understand the science are very concerned about any form of gene manipulation. The next big yield increases in the near future will likely depend on biotechnology. What we have seen to date in biotechnology is only the tip of the iceberg compared with coming developments such as drought tolerance, salt tolerance, and improvements in protein or nutritional aspects of crops. Our lack of imagination may be one of the only limitations to future developments. However, on the other side, we have only seen the beginning of what will probably be a long battle over the social aspects of biotechnology. In words from a past president of this conference, UC Farm Advisor, Ron Vargas “responsible biotechnology is not the enemy but ignorance and starvation are.”

While we struggle with environmental issues and philosophical concerns over biotechnology, we still must find a way to feed an ever-growing population. The world population is expected to double in the next 50 years. China is expected to reach 1.3 billion, India- 1.7 billion, and the United States- 394 million people. However, farmland is becoming more and more scarce. In developing countries where mere subsistence farming is practiced and where firewood is needed for heating and cooking, deforestation is happening at a rapid pace. Even in California farmland is lost at an alarming rate-as much as 50,000 acres per year to non-farm uses. As the population continues to increase and farmland continues to disappear, it is imperative that we move through these challenges. Consequently, we must produce more food and fiber on the same or lesser amount of farmland.

A recent conference on Capital Hill on Oct. 18, 1999, brought together leaders from United States Congress, USDA, and consultant groups to explore ways of collaborating more closely in the fight against poverty, hunger, malnutrition and environmental decline. At this meeting U.S. Secretary of Agriculture Dan Glickman said “Science will march forward, especially agricultural science, and help create a world where no one needs to go hungry, where developing countries can become more food self-sufficient and therefore become freer and more democratic; the environmental challenges of clean air, clean water, global warming, and climate change must be met with sound and modern science”.

Dr. Norman Borlog, recognized as the father of the “Green Revolution” said at the same conference in Washington D.C. “The world must face up to the greatest challenge it has ever confronted in terms of feeding an exploding population. Forty million people are being added to the world's population every 6 months, and the vast majority of these people will be born into lives of poverty and bare subsistence”. The most effective way to help them and in so doing, help all people, regardless of where they live, is to increase agricultural productivity-In other words, what alleviates poverty is producing more food and fiber with the same or fewer inputs-and that is what leads to great prosperity.
Summary

In this next millennium weed management will continue to be a fundamental component of any agricultural production system. As Steve Orloff demonstrates in the next few slides weeds adapt to changing productions systems and will always be a problem. Challenges during the last decade will still face us in this next century. It was once stated that in the modern age, we think we’ve conquered the planet but we’re not quite the masters of the universe. As civilizations rise and fall weeds will always be with us. Nature will continue to be dynamic and clash with mankind. As Genesis 3:17-19 reads “And to Adam, God said, ‘Because you listened to your wife and ate the fruit when I told you not to, I have placed a curse upon the soil. All your life you will struggle to extract a living from it. It will grow thorns and thistles for you, and you shall eat its grasses. All your life you will sweat to master it, until you’re dying day.’”

With man’s God-given intellect we must continue to find solutions to the problems that lie ahead. We must continue to maintain and improve our weed control tools, not only to increase the productivity of farmland, but also to increase land use opportunities and productivity for things other than agriculture such as wildlife, recreation, and natural resources.

Californians must be part of the research and technology change that will improve our livelihoods and those of our neighbors around the world. We have talked about the history of weed control and have seen that the most improvements occurred in the 20th century and advanced at a rapid pace in the last two decades. As industry and researchers break new ground with new technologies, and issues arise with our urban neighbors and consumers, we must participate in the debate and get involved so we won’t be led by the ignorant. Hopefully the different groups can come together as we meet the challenges and progress forward in this next millennium. Thank you for this opportunity to serve the society as President this past year. God Bless you all and I hope you find this conference to be rewarding.