CHANGES IN ALFALFA BREEDING – WHERE IS ALFALFA HEADED?

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Alfalfa didn’t earn the title “Queen of the Forages” just because of its good looks on rolling hills or sweet smell at harvest. Alfalfa was first described nearly 2,500 years ago, in 490 B.C in the desert regions of what is now Iran. From the Middle East, alfalfa was taken into Europe and South America by invading armies, explorers, and missionaries.

Most of the basic alfalfa germ plasm presently used in the U.S. originated from nine sources. Alfalfa first made it’s way to the U.S. in 1736 via European colonists settling the east. Spanish alfalfa varieties, from South America, moved north into the southwestern U.S. around 1850 and later found their way to northern California and east to Kansas. Three non-dormant varieties were introduced from Peru (1899), India (1913 and 1956) and Africa (1924). Two intermediate winter-hardy types came from France (1947) and the area of southern Russia, Iran, Afghanistan, and Turkey (between 1898 and 1925).

From noble beginning, plant breeders have continued to produce improved alfalfa varieties over the years. Today’s varieties boast several key attributes, which can be categorized as:

Nutritional: Low fiber, high protein, high potassium, high calcium

Economical: Yield boost for following crop

Reduced Risk: Rugged crop, improved winter hardiness and disease resistance; deep root system allows better production under droughty conditions; a dependable crop for grazing alfalfa or alfalfa-grass mixtures

Environmental: Nitrogen fixation, reduced soil erosion, groundwater protection, added manure management options, absorbs and uses municipal and animal wastes. Alfalfa fields host more than 400 species of insects. Single largest crop source used in honey production in U.S. Houses and feeds many species of birds, such as Western Meadow Lark as well as small beneficial mammals and reptiles. Alfalfa can be used as source of renewable fuel; the leaves are harvested and used as feed while the stems are burned to make energy.
This is alfalfa is today, but what about alfalfa in the future? To develop an understanding of where alfalfa could be headed, it is beneficial to consider three things:

How do alfalfa acres compare globally to other crops?
Who has bred alfalfa and made the improvements seen over the past 40 years and who is breeding alfalfa today?
What impacts will today's changing seed industry sector have on alfalfa R &D?

Once we have a common understanding of these key market drivers, we can better speculate on where alfalfa might be headed.

No one has a definitive answer as to where alfalfa will be 20, 10 or even 5 years from now, but I hope to leave you with some new information and spark your imagination to think of some future possibilities. We need to answer some basic market questions before we start looking to the future.

Where is alfalfa grown? The United States dominates world alfalfa acres with nearly 24 million acres or 32% of the world’s alfalfa acres. Argentina represents nearly 24% of the world alfalfa acres, followed by Australia and Italy at a distant 3rd and 4th each with close to 3% of the world acres.

How does alfalfa compare with other crops in terms of harvested acres?
Globally, alfalfa acres ranks 4th in acres, behind wheat, corn and soybeans. In North America, alfalfa is also the fourth most widely grown crop in the United States behind corn, wheat and soybeans.

Why is this information important? The fact that the U.S. dominate world alfalfa acres helps explain why the U.S. is the leading source of improved alfalfa varieties. It is also noteworthy to know if alfalfa can benefit from scientific advances in other crops and speculate on future alfalfa research and development. In general, the larger volume, profitable crops are the first to benefit from new technology.

Since the U.S. has been key in alfalfa variety breeding, let’s take a look how U.S. alfalfa breeding has evolved. Nearly 40 years ago, the National Certified Alfalfa Variety Review Board (Review Board) was organized to review research results and determine that varieties were distinctive and merit certification. Applications to the Review Board came from these breeding sources:

Public programs (USDA Agriculture Research Stations and universities)
Private programs (Private or commercial seed companies and co-operatives)
Historical information from the Review Board was used to look for trends over the past four decades. In a typical year during the 60’s, one or two varieties per year were submitted from USDA and university breeding programs while an average of two private-breeding companies would submit 4 varieties. Public (USDA and university) programs were supplying about 40% of the germ plasm and private-breeding programs contributed the remaining 60%.

During the 70’s, the Review Board was looking at around 10 new varieties per year. A change from the 60’s was an increase in the number of varieties from private programs while university-bred varieties tended to drop off. USDA ARS continued to submit on average, 1 variety per year.

During the 80’s, the average number of varieties passing through the Review Board doubled to 22 varieties per year. This increase was again due to an increase in the number of varieties submitted from private breeding programs. This trend continued in the 90’s as the number of varieties reviewed once again doubled to 55 a year.

For the first 27 years of its existence (from 1962 to 1979) a total of 155 varieties received favorable action from the Review Board. That averages only 8 new varieties per year. In 1998 alone, the Review Board acknowledged 79 varieties, primarily from private breeding programs. Today there are more than 265 varieties listed in Fall Dormancy & Pest Resistance Ratings for Alfalfa Varieties.

Most of the new varieties released in the 90’s came from six private breeding programs. Just two companies generated 51% of the varieties. From 1991 - 1997 ABI Alfalfa and Forage Genetics led the way with 59 and 58 varieties favorably reviewed. AgriBioTech/WL (ABT) contributed 21 varieties, while Dairyland, Pioneer Hi-Bred and Cal-West had 19, 18, and 15 varieties respectively. During this same time period the University of Georgia, University of California and Cornell contributed a total of 8 varieties.

What led to this dependence on just a handful of breeding organizations? Perhaps it is best understood by looking at the changing agricultural landscape, focusing on seed companies and co-operatives. Merger has been the name of the game in the 90’s. What was once a rather straightforward system of seed companies has evolved into a complicated combination of merged ag protection, pharmaceutical, seed conglomerates and strategic alliance partners.

Why has there been so much consolidation? One reason is that mature markets (U.S. agriculture is a mature market) swing between market fragmentation and market consolidation. Fragmentation is brought about by competition and consolidation is brought about by innovation. For the past 15 to 20 years, biotechnology has been the key innovation that has driven consolidation.
So, with all of this history and background, who will be producing alfalfa varieties in the year 2010 and beyond? What traits will these new varieties have? What is the future for biotechnology? Will consumers accept milk and meat produced from genetically enhanced organisms?

We can expect alfalfa varieties with Roundup resistance available for sale between 2004-06. If consumers accept genetically enhanced plants (GMO’s), improvements in disease and pest resistance can be reached faster with the use of biotechnology tools. You could expect sclerotinia and alfalfa weevil resistance to be on the list of new traits. Perhaps the nutritional quality and digestibility of alfalfa can be improved. Also, think about agronomic traits you would like to see enhanced. Can alfalfa actually be made to resist whatever Mother Nature throws at it? What about all the protein in alfalfa? Can an alfalfa plant become a cost-effective protein-manufacturing site capable of producing lifesaving pharmaceuticals?

There are many possibilities for alfalfa but new product development comes at a cost. The speed and scope of new alfalfa introductions depends on the ability of breeding organizations to focus financial and scientific resources on developing traits producers and consumers will value, be comfortable with and purchase.

Albert Einstein once said, "Imagination is more important than knowledge." I’d like to add that imagination, combined with knowledge and careful use of new scientific tools can turn dreams into realities. There are folks out there with imagination. The most final question becomes...who will take on the challenge? Will it be the folks breeding alfalfa today, or will new players emerge as they did over the past 20 years? I look forward to the year 2020 and the 40th Kentucky Alfalfa Conference when we can look back at today and see what advances were made to alfalfa...the Queen of Forages.

REFERENCES

Alfalfa Makes Sense Four Ways

National Certified Alfalfa Variety Review Board

North American Alfalfa Improvement Council
