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FROM THE GROUND UP
Agronomy News

Improve Profitability of Bean Production

Tending to these ten factors can reduce inputs, increase selling price of dry beans, and reduce losses.

In Colorado, commercial dry bean production has occurred for more than 100 years. During that time, the industry has changed a great deal, from both a cost of production and return on investment perspective. The USDA began statistical record keeping on pinto bean production in 1919. At that time, total US pinto production was less than 10,000 cwt, whereas today, total US pinto production ranges from 10 to 14 million cwt, and Colorado alone produces 2 to 3 million cwt. The greatest degree of change in production occurred between 1978 and today due to increased acreage in the Great Plains and North Dakota. In North Dakota alone, planted acres approximately tripled from 1981 to today.

Given the tight margins between the cost of production and gross income, it is difficult for producers to profit from the pinto bean crop. Some

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Colorado State University
Knowledge to Go Places

Improve Profitability of Bean Production (continued)

factors other than net return should also be considered in the decision to plant beans in the rotation with cereals. Beans area important in crop rotations because they allow diversity in a farming system, enable growers to diversify herbicide use, and require less nitrogen inputs into the system because they can fix some atmospheric nitrogen. They also allow the producer to take advantage of the times in the price cycle when bean prices are high due to limited supply or increased export demand in the world market.

This article (and associated graphics) will summarize some ways to improve profitability of the bean crop by good management and reducing inputs where appropriate. I suggest ten ways to enhance profitability.

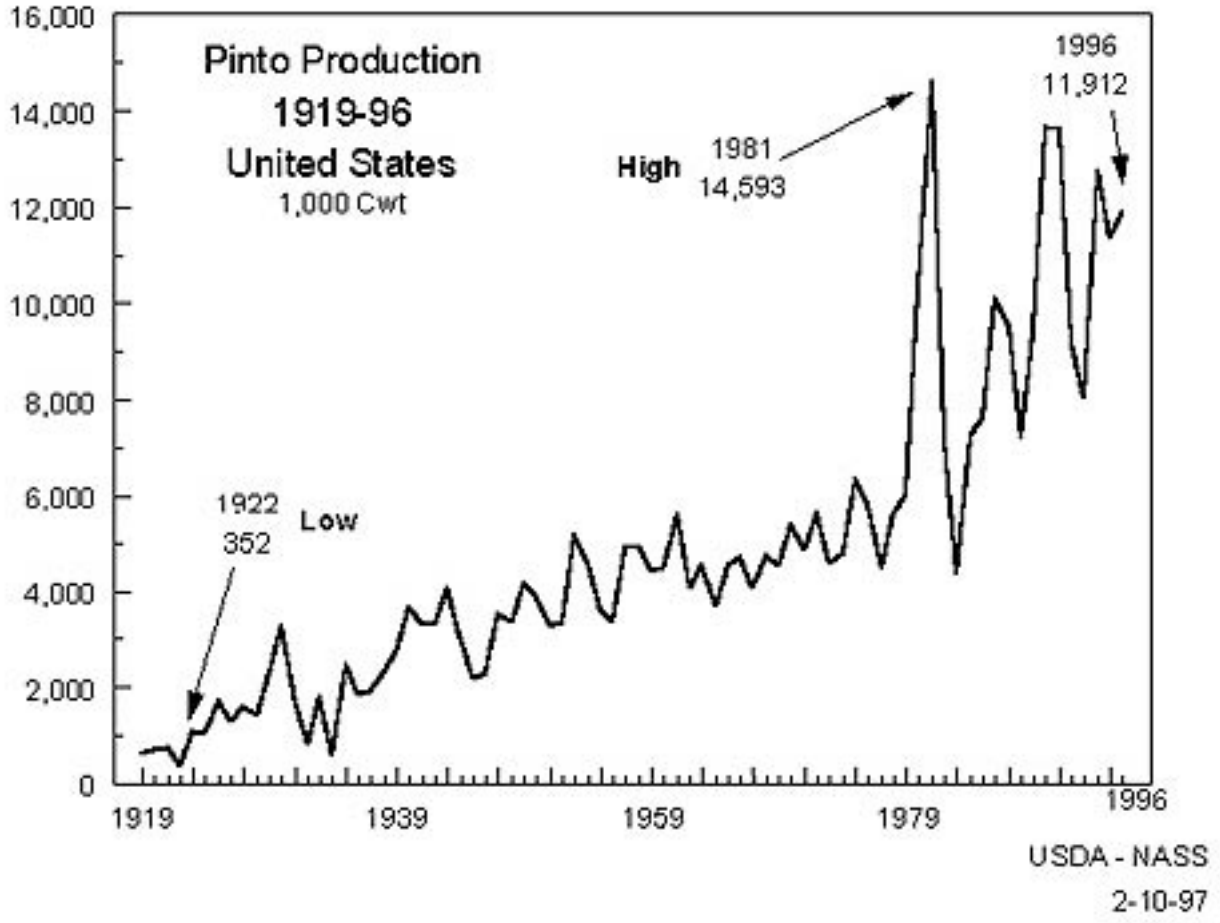

Figure 1. Pinto bean production in the United States from 1919 to 1996.

FROM THE GROUND UP

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Web Site: http://www.colostate.edu/Depts/SoilCrop/extension/Newsletters/news.html

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Improve Profitability of Bean Production (continued)

First, **choose a suitable field for production of dry beans**. Beans require better field conditions that other traditional crops grown in Colorado such as wheat or corn. Because beans are more sensitive to salinity and excessive N, choose a field that has near normal pH and is free from salinity problems.

Improve Profitability
1. Choose suitable fields
- Near normal pH
- Free from salinity problems
- Rotate beans with other crops
- No serious weed problems

Improve Profitability
2. Choose a high yield adapted variety
- Conduct strip trials in your fields
- Consult Colorado Dry Bean Test report for variety results
- Attend Bean Field Days
- Diversify varieties if production is more than 40 to 60 acres

Second, **choose a high yielding variety** that is adapted to your growing conditions. You can determine the most profitable bean variety or varieties by testing varieties on your farm in strip plots, consulting public variety test reports, and attending Colorado Dry Bean Field Days organized by the Colorado State University Crop Testing Program each year. Do not purchase seed just because it is cheaper; good seed and high yielding varieties return many fold more than the investment.

Third, **evaluate for the presence of soil compaction and alleviate it when it occurs**. Probe the soil in the fall or early spring prior to planting with a tensiometer or steel rod to detect compaction. If a compacted layer is found in the upper 24 inches of the soil profile, deep rip prior to planting, or at a minimum, over the row at planting.

Improve Profitability
3. Alleviate soil compaction
- Probe the soil with tensiometer or steel rod
- Deep rip diagonal to the row
- Deep rip at planting over the row if possible

Improve Profitability of Bean Production (continued)

Improve Profitability

4. Sample soil every time you plant

- Valid soil sample
  - 3-5 samples per acre
  - Bulk and mix
  - Evaluate
- Sample to 12 inches
- Choose dependable lab

Fourth, **take a valid soil test and analyze for N, P, K., and zinc and iron** if the field is composed of weathered soil or is very low in organic matter. Application of fertilizer without a valid soil test is usually a waste of money because over-application of nutrients cost money that will not provide a return on the investment, and under-application may limit yield potential.

Improve Profitability

5. Base fertilizer on soil sample results

- Adjust based on yield goal and production history
- Apply Rhizobium inoculant if needed
- Band apply where necessary

Therefore, (fifth) **apply the correct fertilizer amount and blend** based on the soil test results. Adjust fertilizer rates based on yield goals and past history of production in the field. Poor soils, such as those that are high in salinity or low in organic matter do not respond as well to fertilization, and application of fertilizer should be limited. Whereas, highly productive deep, well-drained soils respond to high applications of fertilizer. Band apply fertilizer where appropriate as it results in greater crop-use efficiency.

Improve Profitability

6. Irrigate root zone at 40-50% available soil moisture

- Avoid too-frequent irrigations
- Avoid irrigation during the heat of the day
- Cease irrigation 10-14 days prior to undercutting

Sixth, **monitor soil moisture every week during June, then twice a week or more during July and early August**. Apply water when the available soil moisture has depleted to 40-50 %, and apply a sufficient amount to refill the entire root zone. Too frequent irrigation reduces yield by increasing root disease, reducing soil aeration, and preventing deep rooting. If possible, irrigate when the air temperature is below 700 to prevent temperature shock that can cause floral abortion.

Improve Profitability of Bean Production (continued)

Seventh, **scout the field twice weekly**. Carefully observe both upper and lower leaf surfaces for disease or insect pests. Dig the plants to inspect rooting patterns, soil moisture, nodulation and the general health or the root system. Be especially aware of patterns in the field that could indicate early disease infection, poor water distribution or other problems that can be addressed in a management program including the timely application of effective pesticides.

Improve Profitability

7. Scout fields twice weekly

- Upper and lower leaf surfaces
- Root zone
  - Disease
  - Nodulation
  - Compaction
- Pattern means problems
- Apply pesticides judiciously

Improve Profitability

8. Prevent shatter losses

- Undercut at 80% pod color
- Undercut with dew on crop
- Windrow when dew on crop

Eighth, **limit irrigation during late pod fill**, and undercut when 80% of the pods have turned form green to brown to prevent shattering and crop loss. Windrow when there is dew on the crop, also to prevent pod shattering.

Ninth, **prior to entering the field with the combine, test seed moisture** (it should be between 15 and 18%), slow the cylinder, and use an appropriate bean concave. Immediately after threshing one round, inspect the field for losses and the seed for damage. Use the seed soak test to properly evaluate for seed loss and seed damage. A properly adjusted combine will leave minimal seed in the field and damage less than 5% of the seeds.

Improve Profitability

9. Harvest equipment care and use

- Clean combine and handling equipment
- Combine at 16-18% seed moisture content
- Scout field losses throughout threshing
- Adjust combine frequently

Improve Profitability of Bean Production (continued)

Improve Profitability

10. Take advantage of early market prices: Harvest early

- Plant by May 25
- Select varieties that mature in 95 days
- Discontinue irrigation early to hasten maturity
- Avoid fields with high residual soil N

Tenth, **plan your crop for an early harvest**. This includes planting prior to May 25, limiting N application to account for residual N from the previous crop, managing irrigation water efficiently, and undercutting early. This will allow you to capitalize on the early pinto crop in which processors often pay premium; the premium often disappears after September first.

In summary, profitability of the pinto bean crop has become more difficult in recent years due to declining bean prices and increase operating costs. Monitor every aspect of the crop to maintain profitability. There are areas in the management, where fewer inputs will enhance economic return, where, other inputs such as seed, soil tests, and other management efforts should not be reduced to maintain profitability. Also consider the value of the bean crop to your rotation and the opportunity to take advantage of high bean prices when they occur. A profitable bean crop enhances your farming operation, however it takes diligence and careful planning during the entire crop season.

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Colorado State University

For past issues of the Agronomy News on agricultural topics such as:

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- Research and Outreach Summaries
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- Biotechnology
- Forages
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Reduce Harvesting and Handling Losses

Improved combines, equipment adjustments, and seed handling techniques can reduce seed damage.

Production of dry edible beans, like most other North American field crops, currently exceeds same-year sales, resulting in large carryover and depressed market prices. To develop a niche in this over-produced market, some dry bean production groups are increasing their focus on higher quality seed. Higher quality seed often returns a higher selling price, or at least secures a sale when competing with lower quality seed. The dry bean industry must strive for production practices that result in higher quality seed while keeping an eye on input costs. Higher quality seed requires improved design, operation, and adjustment of the combine and gentler handling of the seed after harvest.

Combine choices

Arguably, the standard among multi-crop combines in the past 15 years is the Case-IH Axial Flow series. It provides a consistent high quality and high capacity for a multi-crop design. Several years ago, Caterpillar introduced the Lexion series combines in partnership with the German manufacturer Claas. When first introduced in the U.S. bean crop, this combine series had very high capacity, but seed damage was higher than desired. More recent reports on the use of this combine in edible beans suggest it can harvest quality seed with proper accessories and attention adjustments.

In late 1999, Deere and Company to introduced the "50" series combines, including the STS models which utilize a form of rotary cylinder. Initial testing of this machine in edible beans in 2000 suggests high capacity and potentially good seed quality. Additional work on accessories and adjustments specific for the edible bean crop is expected to further improve seed quality.

In addition to choices among multi-crop models, the edible bean producer can also choose between a dry bean specialty combine and a multi-crop machine in pursuit of high quality bean seed. The Lilliston pull-type dry bean combine has been a popular specialty machine for many years, but it currently is not in production. Bob Equipment Co. has produced a pull-type dry bean combine that has been well accepted in growing areas where high quality bean seed is required. This machine is available in several sizes, with capacity comparable to medium sized multi-crop combines. It features threshing and seed conveying components designed for gentle seed handling.

In 1999, Amadas Industries introduced both pull-type and self-propelled edible bean combines with unique threshing and cleaning mechanisms. These machines have demonstrated both high capacity and high seed quality. Pickett Equipment Co. introduced a dry bean combine model in 2000 named Doublemaster Plus based on a Brazilian design. First year testing of this pull-type combine suggests it will have a place in the high quality dry bean industry.

Reduce Harvesting and Handling Losses (continued)

Operating choices

Combines, particularly the modem self-propelled multi-crop models, are very complicated machines designed to harvest a range of crops under a wide range of conditions. The result is that the operator has many choices for accessories, adjustments, and operation practices that must be made to attain maximum performance. Details make the difference between an ordinary combine and a combine that will produce a high quality bean seed. Each individual model has specific details that be addressed, but there are general guidelines that apply to almost all machines.

Seed moisture

Seed moisture content is one of most important factors in minimizing seed damage within the combine. Harvest at the highest seed moisture content allowed by the bean purchasing facility to reduce seed damage. If high seed quality is your goal, there may be times of the day when seed moisture is too low and you will need to stop combining or move to another field. If all other things are equal, you will get substantially less mechanical seed damage at 18% seed moisture than at 14%, and substantially less damage at 14% than at 10%.

Cylinder or rotor speed

Most seed damage within a properly maintained and adjusted combine occurs in the threshing area. The damage within this area is directly related to the rotational speed of the cylinder or rotor. The faster the speed, the more seed damage. Always use the slowest cylinder or rotor speed that will provide acceptable threshing.

Always start with the slowest available cylinder or rotor speed and reduce the clearance between the concave and cylinder or rotor to improve threshing. If concave clearance does not provide acceptable threshing, increase cylinder or rotor speed in small steps to improve threshing.

Transition devices

Several of the newest combine models have an impeller or rotating device between the feeder house and the cylinder or rotor to transition the flow of material into the threshing area. Examine this transition device carefully. Because of the rotating speed or shape of the blades, this rotating device may do more damage to bean seed than the threshing section of the combine itself. Most combine models with this feature have a slow-down option and optional blades for this impeller.

Dry bean package

Most multi-crop combine models now have a dry edible bean package. Check with your local dealer because it might not be described in the advertising material or in the operator's manual. These packages often include such options as a slow down kit for the clean grain cross auger and clean grain elevator, slow down kit for the cylinder or transition impeller prior to the cylinder or rotor, special lugs and vanes for the rotor area, special concaves that are smooth and open, and screens to eliminate soil under the feeder house or clean grain cross auger.

Pinch points

Watch for pinch points as the combine accumulates hours. Certain components wear or require adjustment after use to prevent increased seed damage. When flighting (on the header auger, clean grain cross auger, or on augers in the tank and unloading system) begins to wear, sharp edges can increase seed damage. Replace flighting when the edges become sharp or the flighting becomes too short. Check clearance between the auger flighting and the mating sheet metal. This distance should either be very close so it does not pinch beans (including when under load, nearly empty, or full), or far enough apart so that a dead layer of bean seed exists. Make sure elevator chains are tight enough to avoid pinching bean seeds between the sprocket and the chain.

Pay attention to these harvesting factors

- Seed moisture
- Combine cylinder or rotor speed
- Transition devices
- Dry bean accessory package
- Pinch points in the combine
- Tailing returns
- Damaged bean seed in the tank

Reduce Harvesting and Handling Losses (continued)

Tailing returns

Typical recommendations for bean combines include minimizing tailing returns. What does "minimize" mean? The tailing returns on many combines enter the threshing area directly on top of the cylinder or rotor. Any threshed bean seed has a high chance of damage when dropped directly on rotating cylinder or rotor. Adjust the cleaning system (fan speed, air deflectors, sieve openings) to eliminate any unthreshed bean seed in the tailings system. The contents of the tailings system should include only unthreshed pods and miscellaneous foreign material.

Inspect often

Inspect the grain tank often for damaged bean seed. You cannot make changes in combine operation to correct a problem unless you know you have a problem. Field conditions can change quickly. Changes in field conditions will often affect seed damage. Check the quality of seed in the tank often during harvest. Carefully check two or more samples of 100 seeds to determine your percent damage.

Post-harvest

Although most of the dry edible bean crop is delivered directly from the combine to the bean processor, bean seed must be handled very carefully from the time it leaves the combine unloading auger.

Avoid long drops

Bean seed can be damaged when dropped a distance as short as four feet directly to a flat, hard surface. Where possible, avoid long drops into the truck when unloading the combine tank. Fill the truck by unloading onto two or three piles within the truck instead of dropping beans directly from the unloading auger into the full length of the bottom of the truck. If beans must be dropped for more than four "feet, consider using some type of "bean ladder" to slow the rate of fall.

Avoid augers and elevators

Augers and paddle elevators can damage seeds, too. If you must convey bean seed, use slow moving belt conveyors, or slow moving bucket elevators.

Avoid grain carts

Grain carts are designed for capacity and use high-speed augers. Instead of using a grain cart, unload the combine directly into a truck to avoid one more chance for seed damage.

Restrict handling

Avoid handling beans when temperature is low or moisture content is low. When seed moisture content is below 12% or seed temperature is below 40 degrees F, bean seed is easily damaged.

Dry with care

Use caution with drying systems. The seedcoat expands and contracts with changes in temperature and moisture content differently than the seed layers directly under the seedcoat. The result is that stress fractures in the seed coat can occur with rapid or large changes in either temperature or moisture content. Avoid drying if possible. If necessary, dry bean seed very slowly, and with air temperatures not more than 20 degrees F higher than the temperature of the been seed.

Bean seed is very fragile. Handle care within the combine and in any subsequent operations or transportation to ensure the highest possible seed quality, and perhaps improve net returns.

John A. Smith
Machinery Systems Engineer
University of Nebraska

Avoid these after-harvest damage points:

- Long drops
- Augers and paddle elevators
- Grain carts
- Handling when temperature is low
- Handling when moisture content is low
- Drying systems

Can the Colorado Bean Industry Survive?

Increasing production costs and competition challenge growers with issues of net return, access to market, and diversification of crop.

Dry edible beans, especially pintos, have been an important crop in Colorado agriculture since production statistics were first compiled in 1909 for dry beans. At that time, 5000 acres averaged 580 lb/A with a price of $ 3.60/cwt. The industry enjoyed steady growth throughout the 20s and saw a record high in 1943 with 460000 harvested acres, with an average yield of 525 lb/A and a price of $ 5.70/cwt. Since 1970, acreage has fluctuated between 120000 to 225000 acres, yields have steadily increased to more than 1800 lb/A, and price has varied from $ 8.60 to $ 31.20/cwt (please see figures).

Economic Reality

Average gross income/acre has fluctuated from $ 87 in 1971 to $ 514 in 1988. The past 5-yr average is $ 325/A with declining returns noted each year from $ 405 in 1996 down to $ 298 in 1999. In 1999, northeastern Colorado irrigated pinto bean crop production estimates were $ 285 for pre-harvest operating costs (more than 35% related to irrigation expenses), with an additional $ 70/A penciled in for property and ownership costs at a total of $ 358/A. CSU Agr. Economist Dennis Kaan estimated that a pinto grower needed to yield at least 30 cwt/A @ $ 15/cwt or 25 cwt/A @ $ 18/cwt to break even. Therefore, using 1999 statistics a Colorado grower with an average yield of 18.5 cwt/A and a price of $ 15/cwt grew pinto beans at a net loss of - $ 7/A with NO return for property and other ownership costs.

Production Challenges

Our region's bean industry continues to face increasing production costs (energy, chemicals, equipment, labor) and stiff competition from other production regions such as MinDak, Canada, and even China for limited international markets for pintos and other market classes including great northern and light red kidney. These new areas have exploded in recent years and have brought literally millions of "new" production acres (mostly rain fed) into the picture as their growers also struggle to improve their economic fortunes which were based primarily upon low input crops such as wheat. The Canadian provinces (e.g., Alberta, Saskatchewan, Ontario) are committed to an aggressive program and long-term investment in the development of adapted, productive and high quality pulse crops such as dry bean, field pea, and lentils for their growers. They are focusing upon reduced inputs (fertility, pesticides, irrigation) to give their growers an economic advantage so they can net a few more dollars per acre from large acreages. This competition from Canada has the MinDak and Michigan bean industries worried, and Canadian trade and transportation advantages (e.g., provided by NAFTA) allow their industry to ship quality beans from Canada through the United States to U.S. domestic and Mexican markets at the disadvantage of U.S. and certainly the High Plains bean industries. And the Mexican government and industry have even sent experts to China to help them improve bean quality and secure future markets for export to

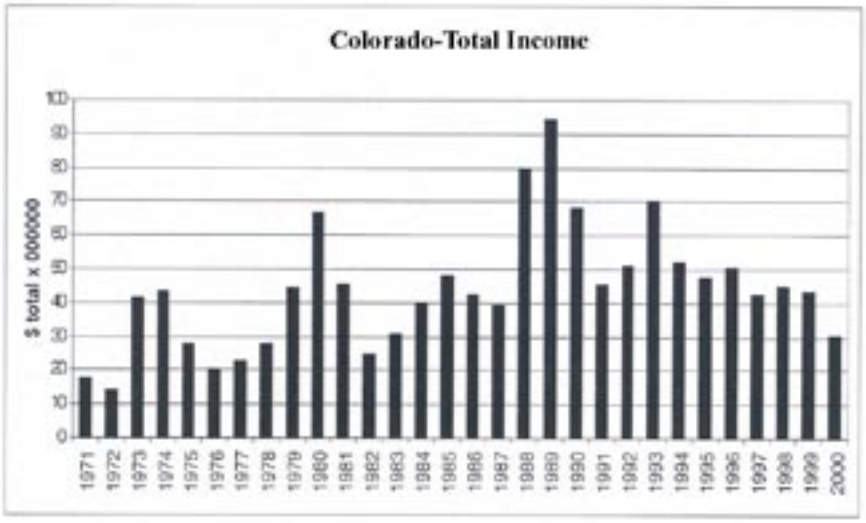

Figure 2. Total Colorado income from beans from 1971-2000.

Can the Colorado Bean Industry Survive? (continued)

demanding consumers in Mexico.

What is Our Future?

So, where does this leave us in Colorado and the High Plains? Based on production trends outside Colorado during the last 10 years, it is unlikely that bean prices (especially for pintos) will exceed $ 20/cwt very often. We know that we can count on increasing production costs (especially energy, equipment, labor) and expanding competition for limited export and even domestic markets, as cheap Canadian beans continue to stream into the U.S. for packaging and marketing even at the local scene. So with this bleak outlook, do we throw in the towel and watch our Colorado bean industry dwindle down to a non-functional level in the next few years? Or do we accept the challenges ahead and invest our collective energies and resources to emerge even stronger after overcoming these challenges?

- Can we improve net economic returns to our bean growers and industry by reducing inputs and costs, while maintaining acceptable yield and seed quality?
- Can we improve access to a larger share of existing or new pinto markets willing to pay for high quality beans?
- Can we pursue new bean classes with domestic and/or international market opportunities?

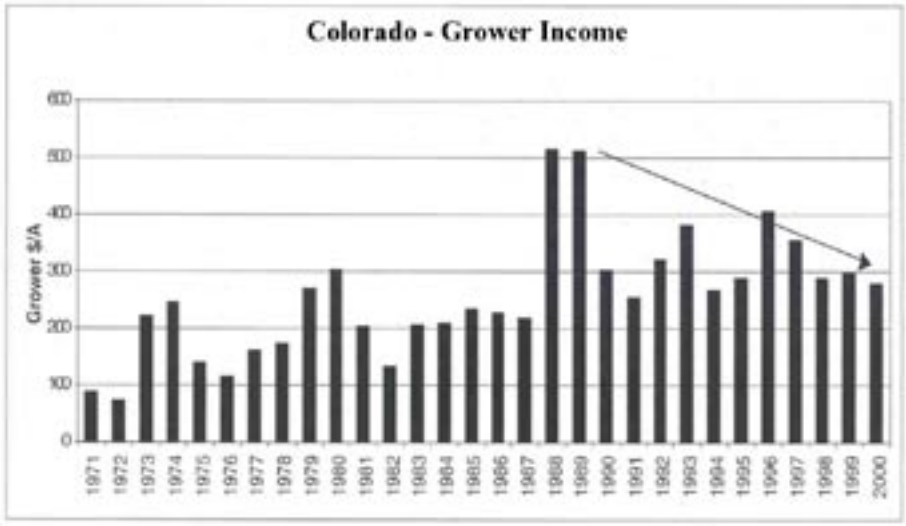

Figure 3. Colorado grower income from beans from 1971-2000.

Challenge - Improve Grower Net Return

Identify and prioritize manageable components contributing to bean production and costs, develop education and/or research projects that reduce the economic impact of these costs while maintaining acceptable yield and seed quality within the next 1 - 3 years. For example, the following issues could be addressed with university, USDA and private sector resources:
(a) Production Input Responses - investigate and quantify agronomic and pest management issues that respond to varying levels (low to high) or types of inputs;
(b) Varietal Improvement Responses - increase resources for ongoing breeding efforts to improve traditional varieties of pinto, great northern, light red kidney, and black for key production and marketing traits.

Challenge - Improve Access to Pinto Markets

Identify and prioritize means to market Colorado and High Plains pinto beans in domestic and international markets during the next 1 - 3 years. For example, the following issues could be addressed with private (growers, dealers and their organizations) and public (state and federal agencies involved with promotion and marketing of agricultural commodities) sector resources:
(a) Reduce Marketing Costs;
(b) Improve Cooperation Between Local Bean Industry Personnel
(c) Enhance Market Access

Challenge - Diversify Bean Types

Identify and prioritize other bean market types that could enhance and diversify Colorado and High Plains pinto and great northern bean production in the next 3 - 10 years. For example, the following issues could be addressed with university, USDA and private sector resources, especially bean processors that are willing to diversify and enhance their receiving and handling operations:
(a) Select within current germplasm and varietal releases, and/or breed new releases of diverse market types including light red kidney, black, and other niche-market bean types (cranberry, yellow, Flor de Mayo) that are adapted to growing

Can the Colorado Bean Industry Survive? (continued)

conditions in Colorado and the surrounding region;
(b) Conduct wide-spread testing of promising entries at experiment stations and in grower fields, emphasize early-generation production of certified seed in western regions to support commercial production of priority market types / varieties as quickly as possible;
(c) Develop a complete production / pest management package for each new release to provide growers with the most efficient and economical strategy fine-tuned for that unique market type.

Get Involved Now!
The basic problem today is a lack of bean community concern for or articulation of this problem. Action is needed today, and any further delays will signal the demise (sooner than later) of the dry bean industry in Colorado and surrounding region.

by Howard Schwartz
Professor

Mature pinto beans

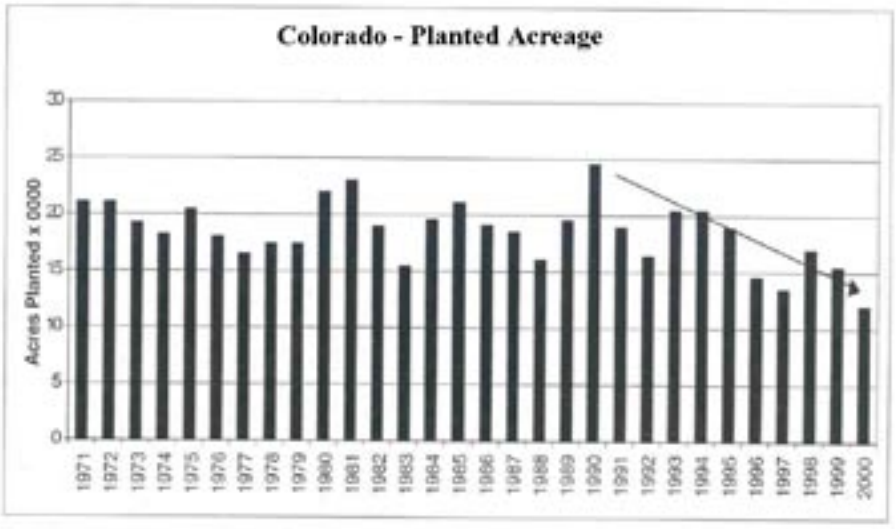

Figure 4. Colorado acreage planted in beans from 1971-2000.

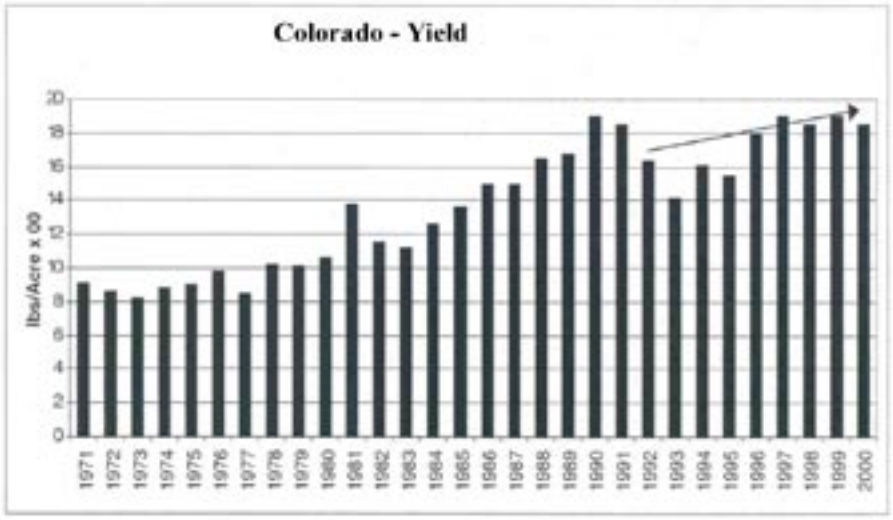

Figure 5. Colorado bean yield figures for 1971-2000.

CSU Fusarium Wilt Resistance Research

Project identifies a major locus for resistance to this destructive fungal disease the in common bean.

Fusarium Wilt
Yellowing and wilting of bean
(photo by H. F. Schwartz, CSU).

Fusarium wilt is a fungal disease of common bean that causes plant yellowing, wilting, stunting and early maturity. These symptoms are caused mostly by inhibition of water transport in the plant due to the growth of the fungus in the water conducting vessels. This disease problem is increasing in the high plains region of the U.S. where yield losses greater than 10% have been reported (Salgado et al., 1995). This disease is difficult to control using chemical or cultural methods because the fungus produces spores that persist in soil for long periods, and can survive and increase in non-host plants without causing disease. Currently, the best method to control Fusarium wilt is through the use of resistant cultivars. Genetic resistance to this fungus has been identified in a variety of common bean germplasm.

Recently, a study was undertaken to identify regions of the common bean genome (loci) that are responsible for resistance to Fusarium wilt. This was accomplished using a technique called quantitative trait locus (QTL) analysis on individuals of a population developed from a cross between a resistant and susceptible bean cultivar. Briefly, this technique identifies statistical associations between differences in the DNA of individuals and the level of disease severity in those individuals. Using this method, a single locus was found to be responsible for nearly 70% of Fusarium wilt resistance in this population. This means that there is likely to be a major gene at this locus that confers resistance to the pathogen. This study also showed indications that additional loci with smaller effects may be involved in resistance.

This resistance locus is a good candidate for use in Marker-Assisted Selection (MAS) during variety development. Marker-assisted selection is a tool that can be used by breeders to select resistant individuals based on molecular markers. This type of screening is theoretically more efficient and reliable than disease severity assays, which are lengthy and can be greatly influenced by environmental factors. In MAS, DNA is extracted from an individual and screened using a molecular marker that targets the locus or gene of interest. Each individual can then be saved or discarded based on its actual genotype rather than on its disease phenotype. Such a marker is currently under development for the Fusarium wilt resistance locus found in this study. This study focused predominantly on resistance to a highly virulent strain of the fungus that was isolated from a bean field in Colorado (Salgado and Schwartz, 1993). However, preliminary experiments indicate that this locus also confers resistance to strains of the pathogen from Colombia and Spain. This is especially exciting because it means that this region of the bean genome may provide horizontal resistance to many strains of the pathogen, which will greatly simplify the process of breeding Fusarium wilt resistant cultivars. In addition to MAS breeding, traditional breeding methods are also being explored to transfer this resistance locus from the resistant bean parent into desirable bean varieties.

by Amy Fall and Patrick Byrne
Graduate Student and
Assistant Professor

meet...

Dr. Jack Fenwick

Dr. Fenwick teaches the introductory course in General Crops as well as Crop Response to Environment. His area of research is crop ecology, production, and management with emphasis on corn, wheat, and barley. He holds the Ph.D. in Agronomy from Purdue. He has received several teaching awards at Colorado State University.

Bean Information on the Web

http://www.colostate.edu/Depts/SoilCrop/extension/CropVar/index.html
Variety performance test results for Colorado crops, including beans.

http://www.colostate.edu/Orgs/VegNet/vegnet/beans.html
Information on dry bean production including growth stages, pest management decision strategies, and annual reports. Updated weekly during growing season.

http://beangenes.cws.ndsu.nodak.edu
Bean Genes web site contains information on genome project, bean pedigrees and bean variety performance trial results.

http://www.nebraskadrybean.com/promotion.htm
National Dry Bean Council page with information on national and international production and marketing.

http://www.nebraskadrybean.com/index.html
Nebraska Dry Bean Commission home page with information on the commission, Nebraska and US Bean production, nutrition, research, and promotion.

http://www.nebraskadrybean.com/domestic_promotion.html
American Dry Bean Board page with national marketing information

http://www.csuag.com
Links to many agriculture web sites.

http://www.ext.colostate.edu/pubs/crops/00539.html
You can download or print a copy of the Colorado State University Cooperataive Extension Fact Sheet no. 0.539, Fertilizing Dry Beans, by J.J. Mortvedt, M.A. Brick and R.L. Croissant.

http://www.ext.colostate.edu/pubs/crops/00500.html
You can download or print a copy of the Colorado State University Cooperataive Extension Fact Sheet no. 0.500, Soil Sampling, by J.R. Self and P.N. Soltanpour.

http://www.ext.colostate.edu/pubs/crops/00501.html
You can download or print a copy of the Colorado State University Cooperataive Extension Fact Sheet no. 0.501, Soil Testing, by P.N. Soltanpour.

http://www.ext.colostate.edu/pubs/crops/00502.html
You can download or print a copy of the Colorado State University Cooperataive Extension Fact Sheet no. 0.502, Soil Test Explanation, by P.N. Soltanpour and R.H. Follett.

2001 Colorado Dry Bean Variety Performance Trial Results

http://www.colostate.edu/Depts/SoilCrop/extension/CropVar/beans/01pintoresults.html