FROM THE GROUND UP

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AGRONOMY NEWS

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MEET PAMELA CHASE

Pamela came to our office May 1, 1996 as the new Administrative Assistant.

She was born and raised in Great Britain, and came to the USA at age 14. She has lived in Milwaukee, Wisconsin, New York City, and San Jose, California. Though she has been in Colorado almost 20 years, she still calls California home, with Santa Fe, NM coming in second since that is where her almost three-year-old granddaughter resides.

Campus life has included a stint in the CSU Football Office, Education, and Mechanical Engineering. She came to Extension Soil and Crop Sciences from the Environmental Health Department, where she worked primarily with undergraduate and graduate students.

Hobbies include traveling , working in her garden, listening to classical music, and talking about Taylore, her granddaughter.
☛Chase

1995, NOT A GOOD YEAR FOR QUINOA YIELDS BUT A BETTER YEAR FOR QUINOA QUALITY

Quinoa, Chenopodium quinoa Willd. Became the hallmark of the new crops project with its development initially in 1983. Quinoa seems to have lanquished since that time but lanquishing is relative. The crop in the San Luis Valley is as active as it has ever been with 500 to 800 acres planted every year. What has changed is the world is catching up with Colorado. Currently, the U.S. produces about 200 tons of quinoa annually. About half of that crop is exported to Europe. In turn, the U.S. imports approximately 400 tons from Bolivia, 100 tons from Peru, and 300 tons from Canada. The use of whole grain quinoa has become focused on what is called the "Real" (Spanish: "REE-al") type which is large seeded, white and soft. This is unlike the

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quinoas we grow in Colorado limiting our markets. The Bolivian and Peruvian (and Ecuadorian and Columbian) types are very daylength sensitive and frequently do not flower until late September. The Chilean seed we began with is generally daylength neutral and is well adapted to Colorado, but the seed is small, dark (actually translucent) and hard, everything the consumer does not expect. To compensate, the quinoa program at CSU has begun to focus on developing a Real type adapted to our conditions.

Crosses of our Chilean quinoas to Bolivian Reals have provided medium grained, white quinoas with a yield potential that surpasses the current varieties.

While 1995 was not our best year (in fact, it was our second worst year since the start of the program) it provided us with some very serious encouragement. The rule of thumb is that the trait you want is generally linked to lower yields. Not this time. Crosses of our Chilean quinoas to Bolivian Reals have provided medium grained, white quinoas with a yield potential that surpasses the current varieties. Following is a summary of the 1995 yield trial. On the long term average, our quinoa trials at Center have averaged 1,105 lbs/A.

1995 Quinoa Trials

Entry	Yield (lbs/A)	Seed Color
Chugwalla	568 a	Tan
Isluga Yellow	546 a	Cream/Yellow
Cahuil	465 ab	Mixed
Apelawa	424 ab	Cream/Yellow/Black
CO 87027	395 ab	Yellow
Sangria	365 ab	Red/White/Black
Tango	294 b	Yellow/Cream
CO 88028	259 b	Orange/Yellow
CO 99010	237 b	Cream
New Entries	**Yield (lbs/A)**	**Seed Color**
CO 95026	666	White
CO 95027	426	White
CO 95210	222	White
CO 95213	544	White
CO 95214	637	White
CO 95217	1056	White
CO 95038	53	White
CO 95317	991	White
CO 95044	301	White
CO 95410	71	White
CO 95412	336	White
CO 95416	624	White
New Entry	**Yield**	**Seed Color**
CO 95419	17	White
CO 95053	579	White
CO 95054	119	White
CO 95055	180	White
CO 95511	113	White

The advanced nursery yielded 395 lbs/A of clean quinoa. The new entry nursery, with yields in some cases exceeding 1,000 lbs/A in this year, gives some hope that we will regain some additional market share from the ancient and the newest world competitors for quinoa.

The old style quinoas are still superior in flavor and will continue to be developed for niche markets and for use in whole grain processed products such as cereals and pastas. Quinoa is also currently being used in Europe as the base starch in manufacturing fat-free cream substitutes and in cosmetics. The reason is that quinoas and amaranths produce an extremely small starch granule which gives cream substitutes a smooth texture unattainable with wheat or potato starch.☛DJohnson

CROP RESIDUES: FRIEND OR FOE?

Keeping a protective cover of crop residues on the soil surface has many benefits, but can also have disadvantages depending on the objectives of the individual producer. The benefits of residue cover include reduced water and wind erosion, improved surface water quality due to reduced sedimentation, and increased water infiltration into the soil. In addition, crop residues aid in maintaining soil organic matter levels and trap snowfall to increase soil water storage. However, for crop residue to result in all of these benefits, it must be uniformly distributed, rather than clumped or windrowed, as excessive residue can clog tillage or planting implements. Too much residue can interfere with herbicide incorporation and slow soil warmup in the spring, resulting in delayed planting and seed germination. However, management techniques such as chopping or shredding residues can minimize many of the disadvantages associated with increased levels or crop residue on the soil surface.

Corn has the greatest percentage of conversation tilled acres, and fall-seeded small grains have the lowest percentage of conventionally tilled acres.

As conservation tillage has spread across the U.S., where has this brought Colorado in its residue management? Since 1989, the percent of cropped acres has fluctuated little (Table 1). About one-quarter of the land is under conservation tillage (>30% of soil surface covered with crop residue), and one-third of the land is under reduced tillage systems (15-30% residue cover).

Table 1. Changes in conservation tillage acreage in Colorado from 1989-1995.

Year	Conservation Tillage (%)	Reduced Tillage (%)	Conventional Tillage (%)
1989	21	30	49
1990	23	34	43
1991	23	34	43
1992	20	37	42
1993	21	33	46
1994	26	33	42
1995	22	33	46

Although there hasn't been much change in percent of acreage in Colorado in recent years, use of reduced and conservation tillage systems varies with crop (Table 2). Corn has the greatest percentage of conservation tilled acres, and fall-seeded small grains have the lowest percentage of conventionally tilled acres. The only crops with more than half the land still conventionally tilled in Colorado are spring-seeded small grains and the "other" crops. Unfortunately, the Conservation Technology Information Center does not break out the other category into specific crops. Other crops include everything that's not corn, small grains, or sorghum--beans, onions, potatoes, sugarbeets, sunflowers, etc.

Table 2. Tillage systems as affected by crop.

Crop	Conservation Tillage (%)	Reduced Tillage (%)	Conventional Tillage (%)
Corn	37	25	38
Spring-Seeded Small Grains	22	19	59
Fall-Seeded Small Grains	21	45	34
Grain Sorghum	20	37	43
Other	15	21	65

The crop distribution within the state is reflected in the distribution of conservation tillage acreage as well (Table 3). The lowest acreage of conservation tillage is in the Northwest and Mountains and Southwest regions. The San Luis Valley also has more than half of its acreage in conventional tillage; however, these three regions each have less than 400,000 acres of highly erodible land, and the Northeast and Southeast regions both have about 2,000,000 acres. Therefore, it makes sense that the East Central region has less than 30% conventionally tilled land, and the Southeast and Northeast have a little over 40% conventional tillage. In addition, the acreage in the Conservation Reserve Program is negligible in the San Luis Valley, but CRP acreage is higher than the acreage of highly erodible land in both the Southwest region and the Northwest and Mountains region. The CRP acreage in the Southeast is double that in the East Central and Northeast regions (as a proportion of highly erodible land), primarily due to economic reasons. The potential for profit from row crops as contrasted with CRP increases with precipitation and irrigation availability.

Have we gone through the tillage revolution and come to the equilibrium or are we stuck in practices from the past?

So where do we go from here? First of all, we need to develop and encourage reduced tillage systems for spring-seeded small grains and the "other" crops. Secondly, we should focus our efforts on crop residue management where they will have the greatest impact, i.e., land which is highly erodible and areas where water conservation can result in economic yield gains. Thirdly, we need to ask ourselves why hasn't there been much change in recent years? Have we gone through the tillage revolution and come to equilibrium or are we stuck in practices from the past?

Table 3. Distribution of tillage systems, highly erodible land, and conservation reserve program acreage by region within Colorado

Region	Conservation Tillage (%)	Reduced tillage (%)	Conventional Tillage (%)	Highly Erodible Land (HEL) (acres)	Conservation Reserve Program (CRP) (acres)
East Central	27	45	27	4,966,744	908,511
Northeast	16	37	46	1,852,989	270,130
Southeast	38	20	42	2,087,497	755,196
Southwest	4	14	82	354,591	486,454
San Luis Valley	29	10	62	356,357	2,261
Northwest & Mountains	2	25	73	107,143	319,518

(Information for this article came from the 1995 National Crop Residue Management Survey, a product of the Conservation Technology Information Center.) ☛Davis

COLLABORATIVE AND REGIONAL ON-FARM TESTS OF PINTO BEAN VARIEITIES

We recently organized a pilot testing program in collaboration with the University of Nebraska, Scottsbluff researchers to assess the performance of new pinto bean varieties under farmers' conditions. Mark Brick, Howard Schwartz, and Jerry Johnson are working together to organize the trials on this side of the border and David Nuland is heading the effort on the Nebraska side. Colorado State University Cooperative Extension agents Ron Meyer, Bruce Bosley, Jerry Alldredge, and Gary Lancaster will each identify two growers who volunteer to conduct the single replicate tests of the five varieties grown in long, side-by-side, drill strips. Industry representatives Jerry Haynes (Jacks Bean) and Bill Newth (Trinidad Bean) have also identified collaborating growers who will conduct the tests near Holyoke and Sterling, respectively. Jim Zizz, Cooperative Extension pathologist in the Golden Plains Region, will supervise the trial conducted in the Holyoke area.

Three seed companies have each donated the 900 lbs of seed necessary to conduct twenty locations in Nebraska (20 lbs of seed per variety per location) and ten locations in Colorado (50 lbs of seed per variety per location). Seed for the Idaho Seed Bean Company variety, Apache, has been donated by Jacks Bean. Apache is an early maturing, high yielding, and rust-resistant variety. Asgrow Seed Company donated the seed for Vision, a full-season, rust-resistant variety. Rogers Brothers is furnishing the seed of ROG179, a full-season, high yielding variety that is also resistant to brown spot. The seed of Chase and Bill Z, two public varieties, was provided by the Nebraska researchers. Chase has topped Colorado variety trials in the past and is a full-season, rust resistant variety with considerable promise. Bill Z is an industry standard in Colorado, but none of the other varieties have been grown widely in this state. It is susceptible to certain races of rust.

We feel privileged to be able to look at so many new varieties under variable growing conditions in Colorado and to work together with Nebraska researchers to solve common problems. In future years we would like to include other parts of Colorado, like the Arkansas Valley and the West Slope. It is hoped that on-farm testing will improve the overall bean variety selection process. More new breeding lines can now be tested in the three small-plot trials thus improving the probability of identifying truly superior entries that would subsequently be assessed in on-farm trials.☛JJohnson

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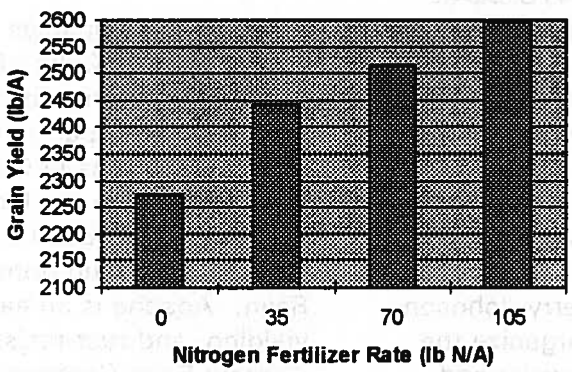
RHIZOBIUM INOCULANT AND NITROGEN EFFECTS ON DRY BEAN YIELDS



Optimum management of crop nitrogen (N) nutrition is essential to maximize grain yields and minimize potential for environmental contamination. Dry bean is a leguminous crop species, and thus is capable of forming a symbiotic relationship with soil bacterium of the rhizobium genus, producing root nodules which have the potential of fixing free atmospheric N. This relationship is responsible for fixing large quantities of N in alfalfa, providing nearly all of the crop's N requirements. Each leguminous crop reacts with unique rhizobium species. It is generally recognized that dry bean has less potential for fixing atmospheric N than alfalfa. Dry bean producers have observed the ineffective N-fixing capacity of dry bean, and frequently apply N fertilizers to supply the N requirements of the crop. However, as fertilizer costs increase and concerns mount over groundwater quality, producers are interested in knowing if there are commercial rhizobium inoculant treatments which might be effective.

A study involving inoculation and N fertilizer treatments was undertaken at 7 sites in northeastern Colorado and western Nebraska in 1994 and 1995 to address inoculant effectiveness. Soil nutrient analysis was conducted to identify N responding sites. The pinto bean variety 'Bill Z' was used at the Colorado sites and the great northern bean variety 'Beryl' was used at the Nebraska sites. The experimental treatments consisted of a combination of 4 N rates (0, 35, 70, and 105 lbs N/A) and 4 rhizobium inoculant seed treatments. The seed treatments consisted of 1) control or no inoculation, 2) Enfix (Agrium, Inc), 3) HiStick (Microbio, Inc.), and 4) Sowfast (Loveland Indust.) Inoculant was applied to seed just prior to planting as per manufacturer recommendations and plots seeded at recommended seeding rates. N treatments (ammonium nitrate) were top dressed on plots after planting.

Irrigations were applied as needed. Soil nitrate levels indicated that all sites should have responded to N fertilizer

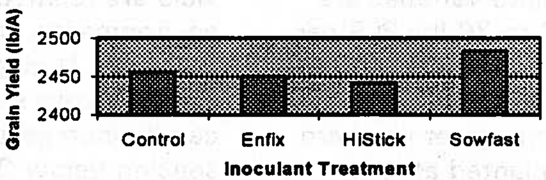


Figure 2. Yield response to inoculant treatments.

application as well as to rhizobium inoculation. Overall, yields responded significantly to applied N (Fig. 1), exhibiting a 15% increase in yields at the highest N rate. However, there were no significant differences in yield among the inoculant treatments (Fig 2). These results indicate inoculated treatments did not benefit yield at any level of N. It is difficult to explain these results. One would have expected an inoculant response at the N responsive sites. Perhaps native rhizobium populations existed at all sites. Visual differences in nodulation between control and inoculated treatments were noted, but apparently these difference did not translate into yield differences. This study is being continued in 1996 to further evaluate effectiveness of inoculant treatments.☛Shanahan

Overall, yields responded significantly to applied N (Fig. 1), exhibiting a 15% increase in yields at the highest N rate. However, there were no significant differences in yield among the inoculant treatments (Fig 2).

SEEDING TIPS FOR DRY EDIBLE BEANS

Good seedbed preparation is necessary for a successful bean crop. Dry bean seeds should be planted in a firm non-compacted seed bed after early morning soil temperatures reach approximately 60° F at planting depth. This temperature is generally reached between May 25 and June 5 in most parts of Colorado. Planting much earlier than May 25 should be avoided, because low soil temperatures delay emergence, increase plant problems with soil-borne pests and aggravate plant damage from chemical residues.

Seed Placement

Optimum seed placement will vary with soil texture and soil moisture conditions. Planters should place the seed 2 to 3 inches deep and follow with a packer wheel to ensure good soil to seed contact. Seeding depths in excess of 3 inches may be warranted when planting in light textured soils or when the upper soil profile is extremely dry, but planting in excess of 4 inches should be avoided because it can hinder seedling emergence and accentuate problems with soil crusting, if it occurs.

Seeding Rate

The optimum seeding rate will depend on several factors, including: viability of the seed stock, seed size, growth habit of the variety, row width, soil moisture content and other factors. Producers should consider seeding rates based on the number of viable seeds needed to obtain a desired target plant population, rather than a set quantity or volume of seeds per acre. The viable seed content of a seed lot is equivalent to the pure live seed (PLS) content, calculated as the product of germination and purity percentages divided by 100. For example, if the germination of a seed lot is 95% and the purity 98%, the PLS content is 93.1% [(95 X 98) ÷ 100 = 93.1%]. A 50 lb bag of seed with a PLS content of 93.1% would contain 46.6 lbs of viable seed (.931 X 50 = 46.6).

The desired or "target plant population" will determine the amount of PLS to plant. The optimum target plant population varies among varieties and market classes due to differences in seed size and plant growth habit. In general, most producers strive to achieve 60,000 to 90,000 plants per acre under irrigated production and 18,000 to 30,000 plants per acre under non-irrigated production. Indeterminate semi-vine (Type III) pinto varieties are usually planted at 60 to 70 lbs PLS per acre, to provide approximately 72,000 to 84,000 plants per acre. Indeterminate semi-vine great northern varieties are usually planted at lower rates than pintos due to their smaller seed size, however the target plant populations are similar. Higher target plant populations are often used for determinate bush (Type I) and indeterminate upright (Type II) varieties, because they have a more compact growth habit (see Chapter 1). Light red kidney and black bean varieties, that posses Type I and II growth habits, are usually planted to achieve a target plant population of 75,000 to 90,000 plants per acre. To obtain approximate PLS seeding rates for a desired number of plants per linear foot of row or plant population of varieties that differ in seed size, refer to Tables 1 and 2, respectively.

Studies conducted in Colorado, Michigan, New York and North Dakota suggest that seed yield can be increased by reducing the row spacing below 30 inches.

The effects of increasing the seeding rate varies with varieties, cultural practices and row spacing.

Row Width

The effects of row or bed width on seed yield are relatively consistent across environments. Studies conducted in Colorado, Michigan, New York and North Dakota suggest that seed yield can be increased by reducing the row spacing below 30 inches. Planting double rows on conventional 30-inch beds has also been shown to significantly increase yield. The effects of increasing the seeding rate varies with varieties, cultural practices and row spacing. In general, seeding rates above 70,000 to 80,000 plants per acre for semi-vine type varieties have not been shown to increase seed yield using conventional 30-inch row width. Under narrow row culture or double row arrangement, seed yield has been shown to increase at 10 to 30% higher seeding rates in some of the studies.

Table 1. **Pure live seeding (PLS) rates at 22 and 30 inch row spacing to achieve a specific plant density per linear foot of row for varieties that differ in seed size (number of seeds/lb).**

Row Width Inches	Plants /foot No.	Plants /acre No.	No. Seeds/lb of Seed Stock					
			800	1200	1600	2000	2400	2800
			----Seeding Rate in Lbs PLS/acre†					
22	6.0	142.560	178	118	89	71	59	51
	5.0	118,800	149	99	74	59	50	42
	4.0	95,040	119	79	59	48	40	34
	3.0	71,280	89	59	45	36	30	25
	2.4	57,024	71	48	36	29	24	20
	2.0	47,520	59	40	30	24	20	17
30	6.0	104,544	131	87	65	52	44	37
	5.0	87,178	109	73	54	43	37	31
	4.0	69,696	87	58	43	35	29	25
	3.0	52,272	65	43	33	26	22	19
	2.4	41,818	52	35	26	21	18	15
	2.0	34,848	44	29	22	18	15	13

†Rates are rounded to nearest pound.

Table 2. Pure live seeding (PLS) rates to achieve a specific target plant populations for varieties that differ in seed size (number of seeds/lb).

Target Plant Population Plants/acre	No.Seeds / lb of Seed Stock					
	800	1200	1600	2000	2400	2800
	------------------Seeding Rate in lbs PLS / acre†-----------------					
20,000	25	17	13	10	8	7
40,000	50	33	25	20	17	14
60,000	75	50	38	30	25	21
80,000	100	66	50	40	33	29
100,000	125	83	63	50	42	36

† Rates are rounded to nearest pound.

☛ Brick\Shanahan

Sincerely,

John F. Shanahan
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