

FORAGE DAY

Tuesday, February 10

7:00 BREAKFAST

Sponsored by: Monte Vista CO-OP

Alfalfa Management Seminar

Page No.

**** 8:00 Alfalfa Fall Cutting Management, Merlin Dillon, Area Extension Agronomist, SLVRC, Center, CO. 5**

**** 8:20 Alfalfa Production Management, Calvin Pearson, CSU Research/Extension Specialist, Western Colorado Research Center, Fruita, CO. 6**

9:10 Controlling Weeds in Alfalfa, George Beck, CSU Research/Extension Specialist, CSU Ext, Ft. Collins, CO.

10:00 Refreshment Break (Trade Fair)

10:20 Hay Testing: What the Numbers Mean and How To Improve Them, Joe Brummer, CSU Forage Crops Specialist, CSU Ext, Ft. Collins, CO.

11:10 Controlling Noxious Weeds in Alfalfa, George Beck, CSU Research/Extension Specialist, CSU Ext, Ft. Collins, CO

**12:10 LUNCH And VISIT TRADE FAIR
Sponsored by: Farm Credit of Southern Colorado**

Soil Management Seminar

**1:30 Part I: New Alternative Sustainable Crops for SLV; Part II: Soil Management Systems, Calvin Pearson, CSU Research/Extension Specialist, W.Colo.Res.Ctr, Fruita, CO
Sponsored by Rio Grande Conservation District**

**** 2:10 Improving Soil Health and Productivity, Jessica Davis, CSU Research/Extension Soil Specialist, Ft. Collins 11**

3:00 Refreshment Break

**** 3:15 Green Manure and Cover Crops for a Purpose, Richard Sparks, NRCS Regional Agronomist, Center, CO. 13**

3:50 Qualifying Farming Practices for Carbon Credits, Tony Franks, Rocky Mountain Farmers Union, Renewable Energy Development., Greenwood Village, CO.

4:30 SOCIAL HOUR (4-H Barn) Growers &Speakers

Sponsored by: A & L Coors, Alamosa, CO.

**** Designates articles included in this Proceedings**

POTATO DAY

Wednesday, Feb. 11

7:00 BREAKFAST

Sponsored by: SLV Rural Electric CO-OP

Sustainable Potato Management Seminar

Page No.

8:00 Opening Comments, Rob Davidson, *Extension Seed Potato Specialist, CSU Ext, SLVRC, Center, CO.*

8:10 Screening Potato Germplasm for Powdery Scab Resistance, Andrew Houser, *CSU Research Associate, SLV Research Center, Center, CO.* **20**

8:50 New Cultivars Improve Sustainability and Enhance Profits, David Holm, *CSU Potato Research Scientist, SLV Research Center, Center, CO.*

**** 9:25** Preventing Physiological Disorders in Potato Storage Sastry Jayanty, *CSU Post Harvest Research Scientist, SLV Research Center, Center, CO.* **24**

10:00 Refreshment Break (Trade Fair)

10:30 Fresh Demand Working Group, Jim Ehrlich (+)

11:00 Potato Rotations for Sustainable Production, Wayne Honeycutt, *USDA-ARS Research Leader, Orono, ME.*

12:00 LUNCH And VISIT TRADE FAIR

Sponsored by: First Southwest Bank

**** 1:30** Alternative Potato Crop Management for Sustainable Tuber Yield and Quality, Samuel Essah, *CSU Potato Research Scientist, SLVRC, Center, CO.* **27**

2:20 Risk Management to Improve Sustainability and Profitability in Potato Production, Rob Davidson, *CSU Extension Seed Potato Specialist, SLVRC, Center, CO.*

3:00 Refreshment Break

**** 3:20** New Directions in Potato Certification, Kent Sather, *Manager, Colo. Potato Certification Service, SLVRC, Center, CO.* **35**

3:50 Economics of Potato Production, Dwight Freeman, *United Potato Growers, Monte Vista, CO.*

4:30 SOCIAL HOUR (4-H Barn) for Growers & Speakers.

Sponsored by: A & L Coors, Alamosa, CO.

**** Designates articles included in this Proceedings**

GRAIN DAY

Thursday, February 12

7:00 BREAKFAST

Sponsored by: Sunflower Bank

Small Grain Management Seminar

Page No.

8:00 Making Better Variety Decisions, Merlin Dillon, *SLV Area Extension Agronomist, SLVRC, Center, CO.*

8:50 Controlling Disease in Wheat and Barley, Ned Tisserat, *CSU Extension Plant Pathologist, CSU, Ft. Collins, CO.*

9:40 Refreshment Break (Trade Fair)

10:20 Barley Facilities and Storage Management, Judy Jolly, *Agronomist, Miller-Coors, Monte Vista, CO.*

11:10 Controlling Weeds in Small Grains, an Update, Charlie Hicks, *Field Development Rep., Bayer CropScience, Ft. Collins, CO.*

12:00 LUNCH and VISIT TRADE FAIR

Sponsored by: Community Banks of the Rockies

**** 1:30 Crop Insurance Changes for 2009, Craig Dresher, *Rain and Hail Insurance Co.* 38**

**** 2:15 FSA New Farm Bill Update, CED's Russell Valdez Kevin Reeves, Don Greenstreet, *USDA-Farm Service Agency, La Jara, Alamosa, Center-Monte Vista, CO.* 44**

3:00 Refreshment Break

3:30 Keynote Speaker, Lowell Catlett, economist and futurist extraordinaire.

Sponsored by: Farm Credit of Southern Colorado; Colo. Potato Admin. Committee and CSU Extension.

4:30 SOCIAL HOUR (Growers & Speakers in 4-H Barn)

Sponsored by: A & L Coors, Alamosa, CO.

5:30 CPAC Area II Annual Meeting Extension Meeting Room, Ski Hi Park

**** Designates articles included in this Proceedings**

WATER DAY

Friday, February 13

7:00 BREAKFAST

Sponsored by: San Luis Valley Federal Bank

Water Management Seminar

Page No.

8:00 Use Every Drop, Strategies to Reduce Crop Water Use, Richard Sparks, *NRCS Regional Agronomist, Center.*

**** 8:50 Enhanced CRP (CREP), Tim Davis, *Ag Conservation Consultant, Sterling, CO.***

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**** 9:30 Establishing CREP Grassland, a Research Project, Merlin Dillon, *SLV Area Extension Agronomist, SLVRC, Center, CO.***

9:50 Refreshment Break (Trade Fair)

10:10 Water: Glancing Back and Looking Forward, Craig Cotton and Mike Sullivan, *Division of Water Resources, Alamosa and Denver, CO.*

11:00 Formation of Groundwater Sub-Districts and Status of Sub-District No.1, David Robbins and Board Members of Sub-District No. 1.

12:00 LUNCH and VISIT TRADE FAIR

Sponsored by: Mountain View Restaurant

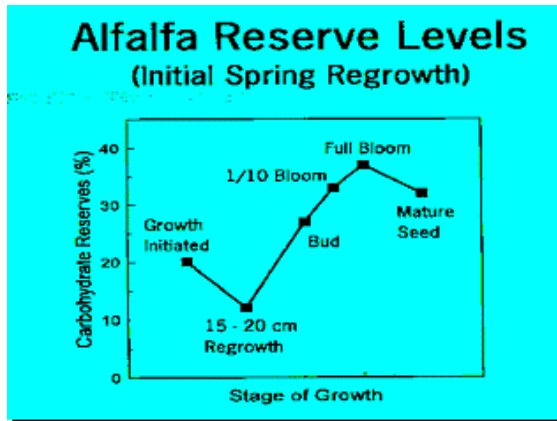
Adjourn: See You Next Year!

** Designates articles included in this Proceedings

8:00 Tuesday, Feb 10

Alfalfa Fall Cutting Management

Merlin A. Dillon, Area Extension Agronomist
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Certain areas of the upper mid-West recommend a “no-cut” period for preserving the winter survival of alfalfa. Other areas such as Oklahoma have no such recommendations. Does the San Luis Valley fit with the harsh winters of the upper mid-West or with the more temperate winters of Oklahoma?

Carbohydrate root reserves are important in maintaining the health and winter survival of alfalfa. Root reserves drop after each cutting and after about two weeks start to rebuild (see chart). Root reserves drop until the alfalfa has grown to a four to six inch height. Then the root reserves start to rebuild and continue building until the crop reaches full bloom.

The same principles are true for fall regrowth. If the alfalfa is cut in early September so that it regrows to a 4-6 inches height; then, the root reserves would be very low going into winter. This amount of regrowth does not happen very often in the high altitude San Luis Valley.

Fall dormancy Ratings vs. Winter Survival Index

Variety	Fall Dormancy	Winter Survival
Spredor 3	1	--
Spredor 4	2	--
A 30-06	3	2
DKA 33-16	3	1
FSG 351	3	2
Integra 8300	3	1
Lariat	3	2
Garst 6415	4	1

Another characteristic that affects winter survival is dormancy. Dormancy is a rating based on measuring the height of the fall growth. Very dormant alfalfa simply stops growing in September. This protects the plants because the root reserves are not used up. In the past, dormancy was equated with winterhardiness because the varieties that stopped growing were more winter hardy. Recently, varieties have been developed which are winter hardy without being so very dormant. This is important in the San Luis Valley because we need varieties that continue to grow during September in order to produce higher yields.

Winter Survival index (WSI) ratings give varieties with the best survivability lower numbers (see examples in chart below). We should choose varieties with a good winter survival index of 1 or 2. The more winter hardy, the better. You can see varieties with Fall Dormancy 4 and WSI of 1.

Varieties in Dormancy Group 2, such as Vernal, stop growing in early September in the San Luis Valley. Growers going for three cuttings should choose varieties from Groups 3 or 4. In summary, select from the improved cultivars with a dormancy rating of 3 or 4 and a Winter Survival Index of 1 or 2.

Tuesday, 8:20 am

AIFALFA HAY PRODUCTION MANAGEMENT

Calvin H. Pearson, Professor/Research Agronomist
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Introduction

Producing high quality hay should be the goal of every hay grower. High quality hay is a better product, is easier to market, brings a higher selling price, creates a good reputation for the seller, and encourages repeat customers by meeting consumer needs. Most importantly, high quality hay brings increased profits and, as a feed, increases animal performance.

Fundamental to good haymaking is obtaining maximum plant mass recovery from the field and producing an economically valuable product for use on the farm or that can be sold. What this means is efforts should be directed at keeping leaf loss to a minimum while at the same time producing a profitable crop. Alfalfa leaves dry more quickly than stems, and leaves are more likely to be damaged than stems. Growers should identify how each haymaking practice affects leaf loss and how they can improve their haymaking practices to increase leaf retention while at the same time producing hay that stores well and doesn't spoil or experience other costly losses while in storage.

The Haymaking Process

Ideal haymaking conditions and, thus, ideal hay are not always attainable; however, having a sound understanding of the haymaking process will increase the ability of growers to manage production more precisely under changing conditions and therefore increase the likelihood of obtaining high quality hay more consistently. The haymaking process can be separated into four general operations: 1) Swathing and cutting, 2) Curing, 3) Packaging, and 4) Hauling and storing.

Swathing and Cutting

Swathers are the most widely used piece of equipment for cutting grass and alfalfa hay. Years ago, sickle mowers were used extensively for cutting alfalfa and grass hay, but nowadays, sickle mowers are used very little for alfalfa and only occasionally for grass. There are various types of cutting devices used for hay crops. Sickles blades continue to be widely used for cutting hay crops, although disc

blades are gaining in popularity.

The hay conditioner, sometimes also referred to as a “crimper,” is designed to crush and bend alfalfa in several places along the length of the stem. Hay conditioning bends and crushes the stem which allows internal stem moisture to escape more readily. Proper conditioning speeds plant drying. Hay conditioners should be checked regularly and adjusted for optimum performance. This includes setting the proper tension on the conditioner rollers. Rollers set too tight can cause excessive leaf loss with no improvement in stem conditioning.

The cutting schedule for alfalfa can be based on a fixed interval, stage of maturity, or crown shoot development. With a fixed interval, cutting is done every 28 to 33 days. A fixed interval for cutting alfalfa may be useful for planning, but it is difficult to stay on schedule when adverse weather conditions or other interferences delay harvest.

Forage yield and quality are inversely related, which means harvesting alfalfa at an immature growth state will result in reduced yields and high forage quality. Waiting to harvest at a more mature growth stage will result in high forage yield and reduced forage quality.

At least two schemes have been proposed to address the yield/quality tradeoff in alfalfa production. The first scheme is based on the sequence fields are cut for each cutting. A field cut in the middle or end of the field sequence would be cut first in the next cutting. This approach helps ensure that some fields will be cut at immature stages and thus have high forage quality, while fields cut first during one cutting and last during the next cutting will likely have lower hay quality and a higher yield, along with increased root reserve replenishment. This scheme is applicable for production operations that have numerous fields and large acreages.

Another harvest timing scheme is based on the plant growth and development of alfalfa as it is affected by each cutting during the growing season. Balancing between high forage yields and high quality can best be achieved by performing each cutting at different stages of maturity. The first cutting should be at the bud stage. Generally, the first cutting of the growing season is the largest with thick stems. Cutting early will increase quality and slightly lower the size of the cutting. The second cutting should be at midbud, and the third and fourth cuttings should be at 10 to 25% flowering. As with the first cutting, the second cutting is designed to obtain high yields and high quality. Allowing the third and fourth cuttings to flower increases root reserves and promotes increased stand persistence. Stems are smaller in the third and fourth cuttings, thus, the leaf-to-stem ratio is increased and hay quality can be high. The smaller forage yields of late summer cuttings also allows for good drying times under favorable environmental conditions.

The configuration of the windrow affects drying. Alfalfa in the windrow should lay evenly. “Clumpy” windrows slow drying. Alfalfa should not lay flat in the windrow. Windrows should be shaped so that they are peaked and plants are loosely intertwined. Peaked windrows permit air to circulate more readily through plant material in the windrow, which results in faster drying.

Windrows should be as wide as possible and still allow for unrestricted baling. Alfalfa in wide, fluffy uniform windrows dry faster than narrow, dense uneven windrows; however, keep in mind fluffy windrows may be more susceptible to scattering by wind.

Curing

The moisture content of alfalfa growing in the field ranges between 75 and 80%. Following cutting, the moisture content of the alfalfa must be reduced to 15 to 20% before baling can begin. Cut alfalfa must lose large quantities of water as rapidly as possible to promote good hay curing. Curing time is affected by humidity, temperature, soil moisture, sunlight, wind speed, swath configuration and size, weeds, and plant-related characteristics such as yield and growth stage that affects stem diameter and leafiness. Alfalfa dries most rapidly under low humidity, high temperatures, dry soil conditions, and moderate winds that do not scatter windrows.

The loss of moisture from alfalfa over a 24-hour period is not constant. The amount of moisture lost from cut alfalfa is highly dependent on environmental conditions. During the day when temperatures are high and air humidity is low and conditions are favorable, moisture loss from plant tissue can be high. At night, temperatures often decrease, air humidity increases, and conditions are not favorable for moisture loss from plant tissue causing moisture loss from plants to be low. In fact, at night it is not uncommon for plant tissue to gain some moisture back. This is evident when dew forms on swathed plants.

Sometimes alfalfa is swathed onto wet soil. Longer drying times are needed when windrows are formed on wet soils. If plants are swathed onto wet soil, the field should be monitored and once the hay in the windrow and the soil between the swaths is dry enough, windrows should be moved onto the drier soil.

The moisture content of alfalfa must be actively managed to promote fast drying while at the same time maintaining the highest quality hay possible. To promote fast curing of alfalfa and grass hay, various pieces of equipment can be used, including rakes, tedders, inverters, and fluffers. Side delivery rakes were used for several decades, but their use has dwindled over the years in many areas. Leaf loss is often high because PTO-driven side delivery rakes often twist the windrow into a “rope,” which does not promote fast drying. Because of a high operating speed and vigorous raking action, PTO-driven side delivery rakes also cause considerable leaf loss. Whatever implement is used to manipulate windrows it must be gentle on the hay to minimize leaf loss.

If plant stem moisture is too low, then dew moisture is needed to increase leaf retention during baling. If baling is performed with too much stem moisture, spoilage can occur. Baling with stem moisture is generally only warranted when humidity is expected to be so low that little or no dew will form. Baling alfalfa hay with stem moisture without causing spoilage in bales can be challenging. Generally, if alfalfa is to be baled with stem moisture, the use of an effective hay preservative is advised.

Hay moisture should be checked at the end of the drying day but before dark and before dew moisture sets in. Late afternoon or early evening is a good time to check hay moisture. In preparation for baling, monitoring hay should begin once plant moisture drops below 30 to 40%. Hay should not be baled when it is too wet. For example, on the night of Day 3 alfalfa may be too wet for baling but during the night of Day 4 alfalfa will become too dry. Growers must wait and bale when the hay is slightly dry during the night of Day 4. It is better to bale hay when it is on the dry side than it is to bale hay when it is too wet for safe storage.

Packaging

Baling is a critical step to good haymaking. Numerous factors that affect haymaking, particularly those related to weather conditions, are mostly beyond human control; however, the baling process is subject to a high degree of management. Using good management during the baling process will increase the likelihood of achieving the highest yields and highest quality hay possible.

The goal of good baling management should be to package hay at moisture contents that will achieve high leaf retention without damaging the product through loss or spoilage.

To accurately determine the optimum time for baling, stem moisture must be quantitatively monitored. A moisture meter must be used to determine stem moisture content as hay dries in the windrow. Determining the moisture content of stems, rather than the leaves, is important because leaves dry quicker than stems; thus, the moisture content of stems, not the leaves, is the limiting factor for baling.

There are several methods for determining hay and stem moisture in the windrow. See the owner's manual of your hay moisture testing meter for the manufacturer's recommended procedure for determining hay moisture in the windrow.

The weight of bales produced is an important aspect of the haymaking process. A bale that is 55 lbs or less coming directly out of a 14 x 18-in. bale chamber is considered to be light. Acceptable bales should weigh 60 to 70 lbs from a baler of this size. Bales that weigh more than 70 lbs from a 14 x 18-in. bale chamber may have moisture contents that could cause hay to spoil. Bales from a baler with a 16x18-inch chamber may weigh up to 80 lbs and not spoil.

Generally, hay moisture contents will be too high if the bales are so tight that the twine breaks. In actuality, hay moisture contents are often too high long before twine breaks.

Ideal hay is bright green in color, has high leaf retention (leaves remain attached to the stem), has a soft texture and flakes separate easily, shows no evidence of heat damage (discoloration, mold, or undesirable odor), and contains no foreign material.

It is difficult to make well-formed, uniform alfalfa bales from dry hay. Hay bales formed with dry hay can be lightweight, difficult to transport, and transportation losses are likely to be higher.

Growers are limited by the amount of time that hay is at the ideal moisture content for baling. Under many conditions it is not possible to bale alfalfa for extended periods and have high quality hay in all bales made during a long baling session.

For most situations, baling small rectangular bales should not begin until no single stem is found to have a moisture greater than 16%. Once baling has started and a few well-formed (proper density, shape, and length) bales are made, the moisture content of bales should be checked. Bale moisture must be quantified by probing bales with a hand-held hay moisture probe. Each bale must be probed several times to determine the uniformity of moisture in the bale. The range of hay moisture content must be determined, paying particular attention to the high moisture content readings.

Average bale moisture should not exceed 15%. Bales should be probed equidistantly along the length of the bale in six places. Any one of the six readings on a bale should not exceed 18% for big bales, and one or more of the six readings in a small bale should not exceed 20% moisture content.

Under many climatic conditions, the amount of baling time is longer when dew is forming than when dew is evaporating. In other words, it takes longer for dew to form to a level that is too high for baling than it takes for dew already formed on the surface of the hay to evaporate and for the hay to become too dry for baling. Changes in hay moisture from evaporating dew can occur rapidly. Within a matter of minutes, hay moisture contents can drop 4 to 5 percentage points.

Hauling and Storing

Once bales are out of the field and in the stack, it is easy to mistakenly think concerns about further crop losses are over. Hay losses while in storage can be substantial. Hay should be adequately protected during storage. Hay, baled at the proper moisture content, can be covered directly after baling under most conditions. Hay stacks can be covered with a top layer of straw bales, covered with hay tarps, hay roofs, or stored in buildings.

Structures used for storing hay range from sheds with only a roof to those that are fully enclosed. Hay roofs vary considerably in their shapes, pitches, and materials.

Hay tarps are available in various designs, materials, and fabrics; thus, the quality of tarps can vary considerably. Good quality hay tarps made of materials that shed water and do not deteriorate rapidly should be used. Tie hay tarps securely so wind will not damage the tarp or lift the tarp and allow water to enter the stack. Tarps should overlap or fit together so water cannot enter between them.

Inexpensive hay tarps often tear easily and degrade within a short period of time due to ultraviolet light. Poor quality or poorly positioned tarps may allow water to be channeled into a section of the stack, causing considerable stack damage. Good quality hay tarps should not rip or tear, fit tight against the stack, and last for several years. Haystacks should be inspected regularly to make sure hay is adequately protected.

Fully enclosed buildings should be sufficiently ventilated or water can collect inside the building as bales continue to lose moisture. The type of storage facility that is best suited for a particular application is highly dependent on a grower's situation. The best storage facility for an individual grower depends on several factors, including the objectives of the hay management system, local environmental conditions, and cost of the facility.

Generally, most losses occur on the top and bottom layers of the stack, although interior damage can also occur. Interior damage often results because of a leaky covering that channels water from rain or snow melt across the top of the stack and down through an interior section of the stack.

Hay should be stored on surfaces and in locations where bottom bales remain dry and where water will not collect or flooding does not occur. Preferred surfaces for stacking hay are coarse rock or river rock. This type of material promotes good drainage and helps to keep water from ponding around bottom bales. Coarse surface material also minimizes rocks from "sticking" to bales when they are moved. Top bales should be arranged on the stack to form a peak so water and snow will be readily shed from the hay tarp.

Conclusion

The moisture content of growing alfalfa is between 75 and 80%. Plant respiration continues until the moisture content of plant tissue drops below 40%. Cut alfalfa must lose large quantities of water as rapidly as possible to promote good hay curing and result in high quality hay. To help ensure high yields and high quality, harvest management practices should be used that reduce the time from cutting to baling.

Performing operations in a timely manner is critical to good haymaking. Operations, done in a timely manner, do not generally increase production costs, but have a big impact on hay yields and product quality. Using good management and performing haymaking operations on a timely basis can increase profits.

New technology is continually being developed to improve haymaking. Information on the latest developments in haymaking should be sought from reputable sources. Sources of good information on haymaking include high quality trade magazines, grower meetings sponsored by respected companies and organizations, knowledgeable crop consultants and Extension personnel, and numerous internet web sites hosted by universities, government agencies, forage organizations, and companies.

Please Use This Space for Notes

Controlling input costs and maximizing hay yields and selling price are critical for profitable alfalfa hay production. Table 1 shows the relationship among production costs, yield, and selling price. Keeping production costs low, while maximizing yields and selling price will result in more profits than when yields and selling prices are low and production costs are high. This data table shows in a quantitative manner how these three factors work together to affect the net returns or profits of alfalfa hay.

Table 1. Net return per acre of irrigated alfalfa in western Colorado as affected by production costs, yield, and selling price. This data table was created by Rod Sharp, Extension Ag Economist, Tri-River Area, Colorado State University.

Yield ton/acre	Price per ton	Cost per acre -----					
		200	250	300	350	400	450
3.5	100	150	100	50	0	-50	-100
4.5		250	200	150	100	50	0
5.5		350	300	250	200	150	100
6.5		450	400	350	300	250	200
7.5		550	500	450	400	350	300
8.5		650	600	550	500	450	400
3.5	110	185	135	85	35	-15	-65
4.5		295	245	195	145	95	45
5.5		405	355	305	255	205	155
6.5		515	465	415	365	315	265
7.5		625	575	525	475	425	375

8.5		735	685	635	585	535	485
3.5		220	170	120	70	20	-30
4.5		340	290	240	190	140	90
5.5	120	460	410	360	310	260	210
6.5		580	530	480	430	380	330
7.5		700	650	600	550	500	450
8.5		820	770	720	670	620	570
3.5		255	205	155	105	55	5
4.5		385	335	285	235	185	135
5.5	130	515	465	415	365	315	265
6.5		645	595	545	495	445	395
7.5		775	725	675	625	575	525
8.5		905	855	805	755	705	655
3.5		290	240	190	140	90	40
4.5		430	380	330	280	230	180
5.5	140	570	520	470	420	370	320
6.5		710	660	610	560	510	460
7.5		850	800	750	700	650	600
8.5		990	940	890	840	790	740

2:10 pm Tuesday, Feb 10

Improving Soil Health and Productivity

Jessica Davis, CSU Research/Extension Soil Scientist
 (970)491-1913 or jessica.davis@colostate.edu

A Comparison of Manure and Compost Use for Crop Production

	Pros	Cons	Other Information
M A N U R E	<ul style="list-style-type: none"> •Excellent soil conditioner and source of plant nutrients •Can be used for organic certified crops for human consumption if applied 120 days before harvest (excellent for fall applications) 	<ul style="list-style-type: none"> •Potential contamination with plant and human pathogens •Potential contamination with weed seeds •Possible contamination with veterinary pharmaceuticals (antibiotics, hormones) 	<ul style="list-style-type: none"> •N availability is about 40% in the first year after application (assuming incorporation and irrigation). •Manure should be tilled in for optimum impact on soils and crops. •Be sure to get an analysis of the manure before you buy it or apply it.
	Pros	Cons	Other Information

C O M P O S T	<ul style="list-style-type: none"> •Excellent soil conditioner and source of plant nutrients •More uniform material that is easier to spread •The heating process kills most pathogens and weed seeds •Its finer texture improves usefulness in perennial crops •Can be used for organic certified crops for human consumption if applied in fall or spring (there's no prescribed waiting period) •Usually higher in P and K concentrations than the feedstocks 	<ul style="list-style-type: none"> •Usually higher in salts than the feedstocks (the waste materials that go into the compost mix) •Usually more expensive than manure •It's important to know what the feedstocks were (for example, avoid grass clippings treated with chlorpyrifos because it doesn't breakdown) 	<ul style="list-style-type: none"> •N availability is about 20% in the first year after application (assuming irrigation). •When topdressing perennials, it's best to apply in the fall, so freeze/thaw cycles and snowfall can incorporate it into the soil. •Be sure to get an analysis of the compost before you buy it or apply it.
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Soil Organic Matter

Increasing soil organic matter content is the single-most important thing you can do to improve soil health. Additions of manure or compost have been shown to:

- ü Increase the soil's water (and nutrient) holding capacity (especially important in sandy soils)
- ü Improve soil structure, aeration and drainage in heavy soils (can improve potential for remediation of salinity or sodicity)
- ü Improve infiltration and reduce runoff and erosion
- ü Reduce soil pH due to the release of organic acids as organic matter decomposes
- ü Increase faunal and microbial activity and biological diversity in soils

Interaction with other factors:

- Ø The more land is tilled, the faster organic matter will decompose, resulting in lower soil organic matter contents.
- Ø Higher soil organic matter contents often require higher herbicide application rates to achieve efficacy. Read the label!
- Ø The higher the salt content in a soil amendment, the deeper it is necessary to till in order to dilute the salts and avoid toxicity. For example, salt content (EC) less than 10 mmhos/cm can be topdressed or shallowly (4 inches) tilled in. Amendments with higher ECs should be tilled more deeply (6-8 inches) to avoid salt problems.

Please Use This Space for Notes

3:15 Tuesday, Feb 10

Green Manure and Cover Crops for a Purpose

Richard Sparks, *NRCS Irrigation Specialist / Agronomist*
richard.sparks@co.usda.gov

Cover crops in general are grown in rotation with cash crops primarily for their biomass and ground cover to reduce wind erosion and to incorporate organic matter. The cover crop may or may not be harvested by grazing or haying.

Green Manure Cover Crops are incorporated into the soil at an immature stage of growth primarily for soil improvement or pathogen suppression.

In the San Luis Valley, cover crops or green manure cover crops may also be grown in rotation **to reduce the consumptive use of our groundwater.**

Regardless of the primary purpose, cover crops should also be evaluated for all their various and complimentary or antagonistic effects which include:

1. Nitrogen production or nitrogen consumption
2. Nitrogen “catch crop” to reduce NO₃ leaching
3. Ability to recycle N, P, K, Ca, S, Zn, Fe and other nutrients
4. Reduction or increase in pathogen infestations associated with cash crops
5. Reduction of consumptive use or reduce groundwater pumping
6. Improve or deplete soil organic matter
7. Forage or hay production

Cover Crops adapted to the SLV can be categorized as follows:

1. **Winter Annuals:** (winter varieties of cereal rye, wheat, triticale)
2. **Cool Season Annuals:** (oats, peas, non dormant alfalfa)
3. **Warm Season Annual:** (Sorghum-sudan (Sordan), Pearl millet)

4. **Cool Season Biennial Legume:** (Sweet clover)
5. **Perennial Grasses: for long term set aside.**
 - a. **Cool Season introduced:** Crested wheatgrass or Russian wildrye
 - b. **Warm Season natives:** Blue grama or Switchgrass ?
6. **Perennial native forbs:** (Gaillardia or Indian blanket flower, black-eyed susan)

Each category of cover crop carries its inherent limitations in achieving complementary purposes. This presentation takes a look at various cover crops, their limitations, and the effectiveness at achieving the desired purposes.

Please Use This Space for Notes

Table 1: General Examples of Cover Crops and Benefits

<i>Cover Crop</i>	<i>Produces Nitrogen</i>	<i>Recycle Nutrients</i>	<i>Nematicidal</i>	<i>Forage</i>	<i>Erosion Control</i>	<i>Comments</i>
<i>Winter Annuals</i>						
<i>Winter rye</i>	No	E	G	F	E	Elbon WR is a nematicidal non host; Aroostook WR is a non host; common WR & WW is a host.
<i>Winter wheat</i>	No	G	N	G	E	
<i>Winter triticale</i>	No	G	?	E	E	
<i>Warm Season Annual</i>						
<i>Sorghum Sudan</i>	No	E	E	F	F	Suppresses root knot nematode; Increases stubby root nematode
<i>Sweet Clover</i>	120	E	F	G	F	Poor nematode host
<i>Annual peas</i>	60	P	P	E	P	Good nematode host
<i>Alfalfa (annual)</i>	100	P	?	E	F	After two harvests
<i>Blackeyed susan</i>	No	P	E	P	F	
<i>Gaillardia</i>	No	P	E	P	F	
<i>Crested Wheat</i>	No	F	?	F	G	
<i>Switch grass</i>	No	G	E	F	G	Questionable adaptation
<i>Blue grama</i>	No	G	?	G	G	

Winter Annuals: (For Erosion Control and Biomass Production)

Winter grains such as **cereal rye, wheat, triticale** will survive well if planted to a 1 ½” – 2” depth by October 1st. Winter rye will easily survive even planted as late as October 15,

provided it doesn't blow out, but will be much more beneficial as a green manure before potatoes if planted around Sept 20th. Winter annual cereal grains provide ground cover during the early spring months; consequently are very effective at reducing wind erosion.

Decomposing rye residue produces allelopathic compounds; delay in incorporating the rye until too close to the planting date of Sordan, grass, alfalfa, or canola may hinder stand establishment. It does not seem to affect potatoes. Incorporate rye into the soil while still 6 – 8 inches in height (early May). Pre-irrigate to leach allelopathic compounds prior to seeding Sordan early June.

Winter wheat or winter triticale are excellent forage producers. They should be used in lieu of rye when the cover crop is to be harvested by grazing or haying.

Winter varieties of **mustards, canola, fava beans, or Austrian peas** will winterkill.

Cool Season Annuals: (Erosion Control and Biomass Production)

Early planted spring oats make a good cover crop for grass, alfalfa, or canola seeding. Allow to grow to 6 inches of height. Kill with glyphosate and drill grass or alfalfa directly into the oat residue. This is an excellent way to suppress weeds, and prevent blowing out of small-seeded species on sandy soils.

When taking oats as a cover crop for hay, consider including **inoculated peas**. Seed early, and harvest at boot to soft dough stage. If hay can be removed by July 15, alfalfa can still be drilled into stubble before August 15.

Annual alfalfa deserves additional consideration as cover crops for one year hay production, and high levels of nitrogen production.

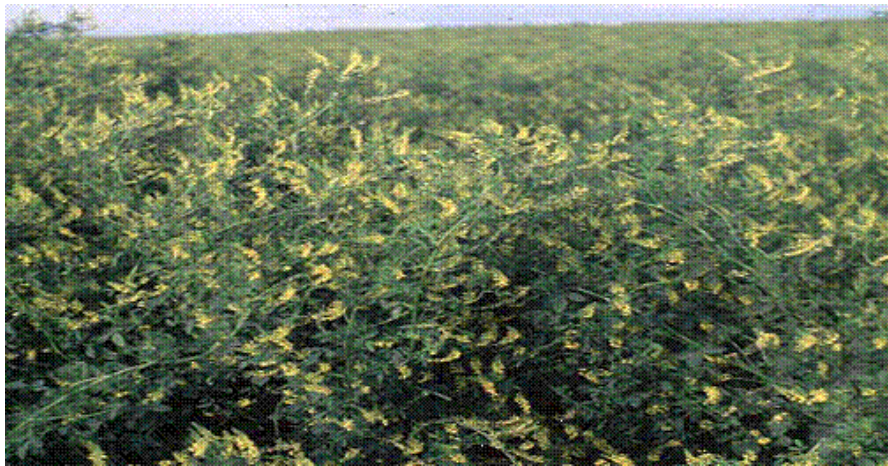
Warm Season Annuals: (Reduced Consumptive Use and Pathogen Suppression)

Sorghum / sudan hybrids (Sordan is used in this presentation as an abbreviation). Sordan 79 has shown superior nematode suppression compared to some other sorghum-sudan cultivars. Sordan is better for cover crops than either sorghum or sudan. Sordan has been successfully used in the SLV as a cover crop for pathogen suppression while at the same time significantly reducing consumptive use especially when deficit irrigated. Local growers using Sordan have indicated a significant improvement in yield and quality of potatoes when grown as a cover crop the year before potatoes. (Keith Holland, Doug Gunnels, Dennis Beiriger, Rockey Farms, Steve Tonso, Lynn Kopfman, David Radke, Danny Neufeld, and numerous others can share testimonials.) It also has shown significant nutrient recycling, especially in regards to Calcium, Iron and Zinc. (Delgado, 2007)

Sordan's suppression of specific nematodes, and other pathogens is complex. These are discussed separately in this presentation.

Cowpeas and soybeans are warm season annual legume crops that have been mentioned as possible cover crops in SLV. McCall is an early maturity soybean variety that has been tried that may almost mature in some years. Forage soybeans more commonly grown as cover crops failed to mature near Cheyenne, Wyoming due to cold nighttime temperatures. Buckwheat may do a little better, but biomass production would be low and it may not compete well with annual weeds.

Cool Season Biennial Legume: (Sweetclover)



Yellow sweetclover is a very drought resistant legume that deserves consideration in discussing cover crops grown in a fallow situation. Grown alone or in a mixture with oats or sordan; harvested for hay; and then green manuring the sweetclover re-growth for nitrogen holds a lot of promise. Nitrogen production would easily double that produced by peas and oats, if managed correctly.

Large acreages of sweetclover were grown in the San Luis Valley for finishing lambs and hogs during the early 1900's. Its use ended after WWII with the production of inexpensive nitrogen fertilizers, intensive agriculture, and an increase alfalfa production.

With the introduction of a fallow year in some rotations to reduce consumptive use, it warrants new consideration. Sweet clover is the most drought tolerant of the commercially available legumes (Ogle et al., 2008b), and does fairly well with 9 inches of precipitation.

Seeding sweetclover concerns some because of its weedy characteristic and the presence of hard seed that will remain viable in the soil for many years. This seems to be easily managed in a potato grain situation. Established plants will be killed through seedbed preparation and potato harvest prior to going to the next crop. Newly germinating seeds that occurs in potato or small grain remain low growing and do not produce seed. Herbicides applied in the grain crop will also kill or suppress the sweet clover.

Management & Miscellaneous Info on Cover Crops:

Sordan (sorghum X sudan) K. Dover, K.-H. Wang & R. McSorley 2004

Sordan is better than either parent in that it produces larger quantities of biomass. It has high seedling vigor, grows rapidly. Biomass will increase significantly with the rate of nitrogen applied (Iptas and Brohi, 2003). Little or no nitrogen may be needed following potato crop, but seeded following barley may need up to 50 lbs nitrogen for good biomass.

Decomposing sordan residue has allelopathic effects, which can suppress small seeded weeds. That is also a good motive for leaving large amounts of surface residue to protect potato acreage from wind erosion. (This may be an issue in its use as a cover crop prior to seeding grasses?)

Sordan roots 3 to 4 ft deep, and helps to aerate compacted sub-soils, and is used to reclaim sodic soils. If mowed when it is 2 - 3 ft., it will re-grow and root even deeper and produce much finer stems. It absorbs phosphorous, calcium, iron, and zinc from deeper depths, and recycles them into the potato root zone.



Its ability to recycle nutrients coupled with enhancement of mycorrhizae (a beneficial root-associated fungus) which enhance crop growth may explain the potato quality and yield bump of **(40% higher production for tubers greater than 8 ounces)** observed in “*A decade of advances in cover crops*” *Jorge A. Delgado, Merlin A. Dillon, Richard T. Sparks, and Samuel Y.C. Essah 2007.*

Sordan (sorghum X sudan)

Some sorghum-sudangrass varieties can be toxic to livestock if grazed before 24 inches in height (initial growth or regrowth). Severe drought stress or frost will produce prussic acid poisoning. Horses should never be allowed to graze on or eat hay made from sorghum-sudangrass as it may cause inflammation of the urinary tract (cystitis syndrome)(Chambliss, 2002; Sattell et al., 1998).

In an Oregon potato trial sorghum-sudangrass (hybrids 'Sordan 79' and 'SS-222') residues were incorporated into the soil and reduced populations of *Meloidogyne* spp. These sorghum sudan varieties are poor root-knot nematode hosts and chemicals present in the leaves were found to be nematicidal (Mojtahedi et al., 1993) (Inghamm 1990)

No sorghum sudan variety significantly reduced populations of *Paratrichodorus minor* (stubby root nematode), *Pratylenchus scribneri* (lesion nematode), or *Criconebella* spp. (ring nematode) (McSorley and Gallaher, 1991), or Sting nematode (*Belonolaimus* spp.) (McSorley et al., 1994b). See table 2.

For best nematode control Sordan must be chopped and incorporated immediately into the surface 3 or 4 inches while still green (Orfanedes, 1995). Also, deep chiseling will reduce nematodes due to mechanical effects and deeper winter freezing (McKeown and Potter).

Mowing and allowing frost killing (Sattell et al. 1998) will also allow the incorporated tissue to be only 1 or 2 months old, which has higher cyanide content and much more effective as a nematicidal green manure than older growth. (Viaene and Abawi, 1998)

Deficit Irrigated Sordan for Reduction of Consumptive Use

Sordan is very drought tolerant, producing more biomass per inch of water applied than other grain crops. Also, since it is a warm season crop, full irrigation would not require more than 10 inches of irrigation and provide 4T/Ac hay.

Deficit irrigated, Sordan does very well with less than 7 inches of irrigation in the shorter growing season. Soil moisture stress will enhance its ability to suppress CRK Nematode, and withdraw moisture and recycle nutrients from deeper depths. Mowing one time will reduce water requirement.

Delaying planting Sordan till soil temperatures exceed 60 degrees F, unfortunately, leaves soil exposed to serious organic decline and irreversible loss of fine soil particles to soil erosion.

A potato, barley, Sordan (3 year rotation) or a winter rye cover crop prior to Sordan, potatoes (2 year rotation) will minimize this soil loss, while still maintaining its cover crop benefits. Reduction of pathogens and improved long term potato yield will bring sustainability to SLV potato industry.

Table 2: Cover Crops and Pathogen Host / Non-host Reported Status

<i>Cover Crop</i>	<i>Columbia root knot M chipwoodi</i>	<i>Root lesion nematode P. penetrans</i>	<i>Stubby root nematode P. minor</i>	<i>Tobacco Rattle Virus</i>	<i>Verticillium</i>	<i>Powdery scab</i>	<i>Rhizoctonia</i>	<i>Pink rot P. erythroseptica</i>	
<i>Sordan varieties</i>	PH	PH	GH		NH				
<i>All varieties</i>									
<i>'Sordan 79'</i>	NH								
<i>SS-222'</i>	NH								
<i>Bravo II'</i>	NH								
<i>'P855F'</i>	GH								
<i>'P877F'</i>	GH								
<i>Pearl millet</i>		NH							
<i>Oil Seed</i>	NH	NH	NH		NH	NH		NH	Nematicidal Non-N
<i>Radish</i>	NH					NH?		NH	
<i>"mustards"</i>	NH?					NH		NH	
<i>Canola</i>									
<i>Alfalfa</i>	H NH	H	H	NH	NH		H	NH	Race 1
<i>Grasses</i>	NH H?	H							
<i>Sweet Clover</i>						H?			
<i>Barley</i>					NH		NH	GH	
<i>Wheat</i>		GH			NH		NH	GH	
<i>Oats</i>		GH			NH		H		
<i>Corn</i>					NH			NH	
<i>Peas</i>								H	

Winter rye (VNS)	PH					Poor host during cold temp
	NH		NH	NH		
Elbon, Aroostook Winter wheat		PH				

Table 2 Explanation: “NH” cover crops which are non-hosts (shown as “NH” in Table 2) will suppress the pathogen populations. Sordan varieties, mustard species, and Elbon winter-rye are nematocidal when incorporated as a green manure cover crop. Canola is less nematocidal than other mustards due to lower glucosinilate levels. “PH” cover crops are poor hosts, and would likely reduce the pathogen. “GH” cover crops will likely increase the pathogen.

Pathogen Suppression of Other Cover Crops

Brassica cover crops managed as a green manure, may reduce or suppress some pathogens, including *Verticillium* in potato; *Pythium*, *Fusarium* and *Rhizoctonia* rootrots in beans; *Pythium* in lettuce; pinkoot in onion; *Aphanomyces*, *Pythium*, *Rhizoctonia* and *Fusarium* root rot in peas; and cavity spot and *Fusarium* in carrot (Sanders, 2005).

Oilseed radish varieties incorporated as green manure cover crops can dramatically reduce stubby root nematode and root lesion nematode. (Nematodes: Alternative Controls by Martin Guerená 2006 NCAT)

Winter rye cover crop incorporated as a green manure suppresses disease and improves crop health. Consider using before or after mustard or oil seed radish to reduce erosion, and enhance pathogen suppression.

While both rye and wheat have been demonstrated to serve as hosts for *P. penetrans*, it has been suggested that *P. penetrans* egg hatch and population growth were substantially reduced at soil temperatures below 9°C. *P. penetrans* population increases were likely minimal on the winter cereal cover crops (Gaylon D. Morgan, Ann E. MacGuidwin, Jun Zhu and Larry K. Binning)

Grasses have been found to be a suitable host for root lesion nematodes

Pasture grasses kept weed-free for two consecutive years strongly suppress root knot nematodes (Adeniji and Chheda, 1971; Chellemi, 2002; Dickson and Hewlett, 1989; Rodriguez-Kabana et al., 1991)

PINK ROT: *Phytophthora erythroseptica*

Even one year out of potatoes will drastically reduce soil fungal populations, as the previous potato crop produces most pink rot inoculum. Identifying that wheat and barley were hosts of the pink rot organism has helped growers understand why pink rot has become such a devastating disease on potatoes due to the build up of inoculum in the soil

Pythium and *V. dahliae* populations within the conventional tilled potato treatment were greater than those in the reduced tillage treatment

SCAB: Use of rye winter cover as a green manure prior to planting potatoes has been effective in reducing scab.

Rhizoctonia: avoid planting potatoes following red clover, alfalfa, oats

Cultural controls: Rotate to other than crucifer or solanaceous crops for two to three years. *Rhizoctonia* is favored by heavy crop residue

Alfalfa, Managed as an Annual Cover Crop

1989 ARS researched and developed the use of “Nitro”, a non-dormant alfalfa variety, in Minnesota. That variety is no longer available; however, other non-dormant alfalfas can still be grown as an annual crop to produce nitrogen and an additional yield enhancement (25 to 50 cwt) from incorporation of organic material. Two to three tons of alfalfa can be harvested and sold, making it an economically competitive choice. Consumptive use of annual alfalfa would be much less than perennial alfalfa.

Alfalfa or (sweet clover?) may be infected by *S. sclerotiorum* and possibly act as a reservoir of the fungus during years when *Sclerotinia*-susceptible crops are not grown.

Problems may develop with potato, canola, and alfalfa rotations.

Alfalfa can serve as host for both root-knot and root lesion nematodes.

Weed-free alfalfa which hosts stubby root nematode, but not TRV, cleanses CRS from soil. Nightshade hosts the TRV and stubby root nematode and would prevent the TRV cleansing.

8:10 Wednesday, Feb 11

Screening Potato Germplasm for Powdery Scab Resistance

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Introduction:



Powdery scab is a potato disease that affects the roots and tubers of a potato plant. It is caused by the protist *Spongospora subterranea* f. sp. *subterranea* (S.s.s.) and has become an increasing problem in recent years. This disease can produce galls on the roots of a potato plant and “powdery” lesions on the tubers. Each root gall and tuber lesion can yield hundreds of sporeballs. Each sporeball contains hundreds of spores, and under the proper conditions, one spore can cause an infection which can then develop into another root gall or tuber lesion. The dynamics of this life cycle can exponentially increase the inoculum load in the soil and on susceptible tubers. Potato cultivars that produce russet potatoes tend to be resistant to tuber lesion development. However, a plant that produces russet potatoes is not necessarily resistant to root galling. In the San Luis Valley, variable field conditions exist from year to year. Also, the S.s.s. infection process is very environmentally sensitive in naturally infested fields. This has created difficulties in consistently evaluating potato germplasm for resistance to powdery scab. The purpose of this project was to develop a greenhouse assay for evaluating potato germplasm resistance which was consistent and compatible with San Luis

Valley field results.

Materials and Methods:



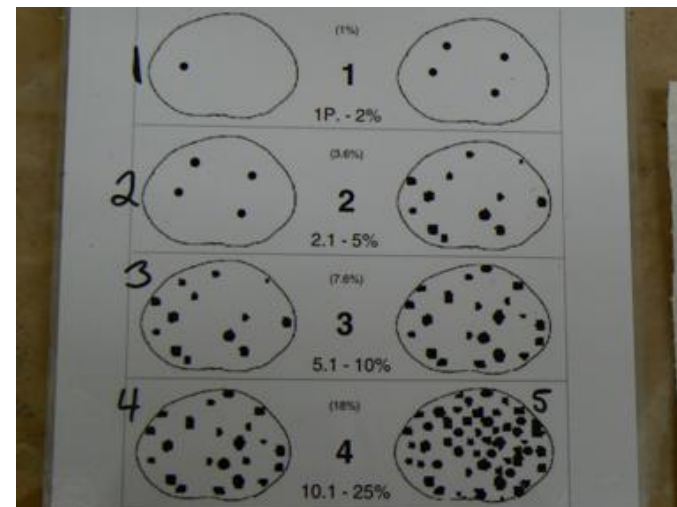
Two soil types, three inoculum levels, two inoculum sources and two soil moisture regimes were evaluated in a greenhouse for powdery scab severity using four potato cultivars. Soil temperature was maintained at an ideal range (11-18°C) for powdery scab development as reported in current

literature. Greenhouse results were then compared with three years of field data collected from field trials conducted in the San Luis Valley (SLV). Cultivars were evaluated for root galling, tuber lesion

incidence, and severity. Soil with 50% sand, an inoculum level of one sporeball per gram of soil, and relatively high soil moisture (0-10 cbars) had the most consistent symptom expression when compared with field results.

This combination of factors was then tested in a greenhouse using fourteen potato cultivars which varied in levels of powdery scab susceptibility. A relative ranking system was also developed to compare greenhouse results with known SLV field results. Results demonstrated that a greenhouse assay can be used successfully for screening advanced potato germplasm for susceptibility to powdery scab.

Results and Discussion:

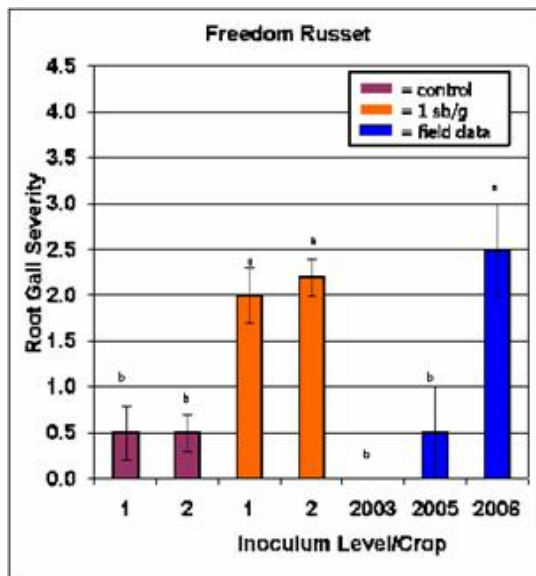


Seve

experiments were conducted in order to determine the most appropriate greenhouse environment for powdery scab development. It was discovered that powdery scab severity was reduced when the levels of irrigation was reduced during tuber set. The cultivars Rio Colorado and Rio Grande Russet both showed reductions in either root galling or tuber severity index under low soil moisture. This could be caused by reducing the level of exudates they release into the soil because of a perceived water stress. Current literature suggests that plant exudates may be triggering the release of *S.s.s.* zoospores from the sporeball and attracting them to the plant tissue for infection. With a potential reduction in exudates, the number of *S.s.s.* infections could be reduced in these cultivars. A perceived water stress may also trigger a resistance response in the potato cultivars with lower powdery scab severity under the half irrigation regime. This resistance response could account for lower severity levels.

There has been documentation showing that a decrease in potato plant health can result from powdery scab symptom expression in roots and tubers if disease levels are high. A decrease in fresh root weight, tuber number and size was observed when evaluating a high and low soil moisture irrigation regime. For a potato producer, the limiting of irrigation water during tuber set may result in a decrease in powdery scab symptoms in susceptible potato cultivars based on results found in this trial and in current literature. A downside to this management practice is a possible decrease in tuber yield resulting from limiting the water supply to the potato plant during tuber set, which was observed in this trial for the cultivar Rio Colorado. For this reason, limiting the total amount of water during tuber set is not recommended in all situations as a control measure for powdery scab.





Relative Ranking of Field and Greenhouse:

Once the On most appropriate environment was determined for powdery scab symptom expression, 14 different potato cultivars were evaluated in the greenhouse and compared with field trial results. Powdery scab symptom expression tended to be higher in the greenhouse than in the field for nearly every cultivar evaluated. Also, disease expression was more consistent in the greenhouse than in the field (Fig 1). Due to the unpredictable environment in the San Luis Valley, it makes sense to use this greenhouse assay rather than field trials to evaluate potato cultivars for powdery scab resistance. However, most potato cultivar evaluations on powdery scab resistance have been conducted using field trials. For researchers to use the results from this greenhouse assay and compare them with known field results, a relative ranking of cultivar susceptibility needed to be established to obtain an accurate comparison of greenhouse and field results.

To simplify this relative ranking, three levels of powdery scab susceptibility were established (low, medium, and high – see Table 1). This relative ranking has been developed for root gall severity and tuber severity index. Due to the high levels of disease in the greenhouse, a scale was developed to appropriately recognize relative ranking of field results and place them at the appropriate level in the greenhouse. For example, Rio Grande Russet was among the lowest ranking for root gall severity in the field over three years. To compensate for the higher greenhouse results, the scale was adjusted from 0 to 1.5 for the field up to 0 to 2.5 for the greenhouse. This adjustment still keeps Rio Grande Russet in the low root gall severity category while acknowledging the relatively high root gall severity obtained in the greenhouse.

When examining root gall severity, the relative ranking of the greenhouse to the field tends to give rankings which are mostly consistent for the low, medium, and high levels. For example, the five cultivars which have low root galling in the field also have low root gall readings in the greenhouse. However, there are a few differences when comparing field and greenhouse results. The cultivars of Russet Burbank and DT6063-1R were ranked as low in the greenhouse but were ranked as medium (Russet Burbank) and high (DT6063-1R) in the field. Also, the cultivars of Purple Majesty and Atlantic were ranked high in the greenhouse but were ranked low in the field for rootgall severity (Table 2).

Relative Disease level	Relative Ranking for Root Gall Severity (maximum rating = 4)		Relative Ranking for Tuber Severity (maximum rating = 500)	
	Field	Greenhouse	Field	Greenhouse
Low (L)	0 - 1.5	0 - 2.5	0 - 20	0 - 50
Medium (M)	1.6 - 2.5	2.6 - 3.0	21 - 75	51 - 175
High (H)	2.6 - 4.0	3.1 - 4.0	76 - 500	176 - 500

Severity index rankings between field and greenhouse were very similar for all the cultivars evaluated (see Table 2). All six of the cultivars with russet skin were ranked low in the greenhouse and low in the field. Also, four of the five cultivars that had a high ranking in the field also had a high ranking in greenhouse. Only the cultivars of Purple Majesty, VC1002-3W/Y, and Superior had rankings that differed between the field and greenhouse for severity index. When examining the fourteen cultivars for root gall severity and severity index, in general the relative rankings remained similar between the field and greenhouse. At most, a cultivar only differed by one ranking level with the exception of root gall severity in the cultivar DT6063-1R. A relative ranking of low

was present in the greenhouse but was high in the field for this cultivar. Root mass in DT6063-

Potato Cultivar	Root Gall Severity		Tuber Lesion Severity	
	Field	Greenhouse	Field	Greenhouse
1. VC0967-2R/Y	3.8 (1)	3.8 (1)	112.9 (3)	220.8 (5)
2. DT6063-1R	2.8 (4)	2.3 (10)	100.8 (4)	275.0 (3)
3. Mountain Rose	2.3 (8)	3.0 (6)	199.0 (1)	284.0 (2)
4. Rio Colorado	2.5 (5)	2.6 (7)	193.7 (2)	303.0 (1)
5. Purple Majesty	2.3 (7)	3.4 (4)	79.1 (5)	157.0 (7)
6. VC1002-3W/Y	3.7 (2)	3.7 (2)	54.7 (7)	200.0 (6)
7. Superior	2.8 (3)	3.7 (3)	67.6 (6)	250.0 (4)
8. Atlantic	2.4 (6)	3.1 (5)	24.1 (8)	133.5 (8)
9. Russet Burbank	2.3 (9)	1.3 (13)	0.0 (12)	0.0 (12)
10. Ranger Russet	1.4 (11)	2.0 (12)	3.7 (9)	13.2 (10)
11. Canela Russet	1.4 (10)	2.5 (8)	0.0 (11)	1.5 (11)
12. Rio Grande Russet	1.2 (12)	2.4 (9)	0.0 (13)	0.0 (13)
13. Freedom Russet	0.9 (13)	2.1 (11)	2.5 (10)	16.0 (9)
14. CO94035-15RU	0.7 (14)	1.2 (14)	0.0 (14)	0.0 (14)

1R was relatively low when compared with the other cultivars in the greenhouse when roots were evaluated for root gall severity. This has not been observed in the field and may have been a factor of seed quality or other differences in this cultivar when grown in the greenhouse. A relative ranking of low in the greenhouse may have been a result of low root mass, which would have resulted in a fewer number of root galls, rather than a low susceptibility to powdery scab root galling.

The goal of conducting cultivar evaluation trials is primarily to discover potato germplasm that is resistant to powdery scab development. Based on the relative ranking system, all cultivars which were relatively low in the field were also low in the greenhouse for root gall severity and severity index. Using this relative ranking system is necessary for comparing field to greenhouse results when evaluating potato cultivars for resistance to powdery scab.

Conclusions:

This project was divided into two phases. The first phase evaluated different greenhouse environmental parameters in order to determine which combination of factors resulted in powdery scab disease expression that most closely matched field trial data. Phase 2 of this project then took the most appropriate greenhouse conditions determined in Phase 1 and tested those conditions using fourteen potato cultivars with varying susceptibility to powdery scab. The results collected from the greenhouse were then compared with known powdery scab results from SLV field trials over several years. For the cultivars evaluated, results from two greenhouse crops resulted in more consistent powdery scab levels than field trial disease levels. Also, powdery scab levels from the greenhouse typically equaled disease levels from the field trial year that had the highest severity when evaluating field trials from three different years. The disease potential for each potato cultivar evaluated in Phase 2 was obtained in the greenhouse. Since field trials often result in lower disease levels than the disease potential for each cultivar, the greenhouse is an important tool for determining the highest level of powdery scab a potato cultivar could develop when grown under favorable conditions.

In order to compare known powdery scab levels from the field with powdery scab levels from the greenhouse, a relative ranking needed to be developed since disease levels in the greenhouse were typically higher than field levels. A relative ranking for powdery scab susceptibility of low, medium, or high was assigned to each cultivar for root gall severity and tuber severity index. Overall, the

relative ranking assignments given to each cultivar matched field and greenhouse disease levels with only a few exceptions. Results from Phase 2 indicate that under the appropriate conditions and using an appropriate ranking system, a greenhouse can be used to accurately determine potato germplasm which are resistant to powdery scab development.

References available upon request (email: ahouser@lamar.colostate.edu).

9:25 Wednesday, Feb 11

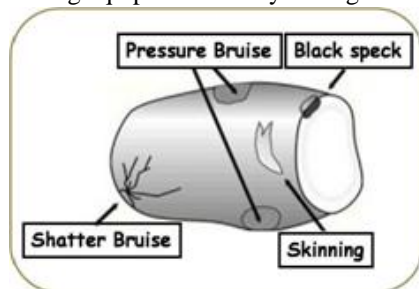
Preventing Physiological Disorders in Potato Storage

Sastry Jayanty, CSU Research/Extension Postharvest Specialist

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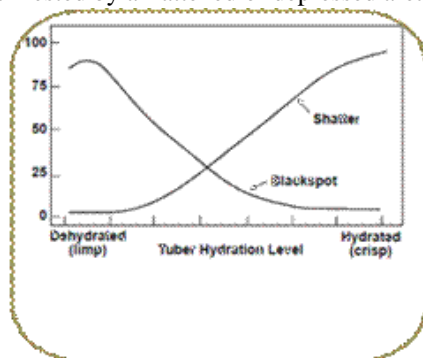
Sustainable potato production involves good management practices during the harvest and in the storage. Physiological disorders in potato tubers are mainly due to bad management practices during harvesting and storage. In this write up I discuss important biological and physical factors that contribute these management guidelines. Potato bruises and cuts cause storage problems. Damaged tubers alone are undesirable to consumers. Injuries also accelerate water loss and open the tuber to disease infection. Harvest and handling equipment usually damage some potatoes.

Types of physiological disorders.



There are four types of physiological disorders commonly reported. 1. Immature potatoes skin scuffed off and rubbed off during handling which is called skinning. 2. Black spot is due to impact, cells damaged beneath the skin. Tissue turns dark or black can be seen only after peeling the skin. 3. Due to impact potatoes tend to cracks and splits which is called shatter bruise. 4. Pressure bruise or pressure flattening is manifested by a flattened or depressed area on a potato tuber.

Fig. 1.



Bruise increases the potential for disease. May not be acceptable for the fresh market and high level of bruise can lead to rejection of shipment. Bruises results in physiological aging leads to increased stem numbers and reduced yield.

Bruise damage occurrence:

Harvesting operations : 50%
 Sorting and transport : 30%
 Seed cutting : 20%

Harvesting conditions

Soil moisture at vine kill and harvest affects tuber hydration level. Dehydrated tubers are more susceptible to blackspot. Hydrated tubers are usually more susceptible to shatter bruise. Potatoes harvested at low temperatures bruise less when the tuber hydration level is between dehydrated and hydrated (fig. 2). When tuber temperature changes, the tuber hydration level resulting in the lowest bruise changes dramatically. Rapid changes in tuber hydration can occur when there is an absence of rainfall, or irrigation is discontinued while plants are growing prior to harvest. Optimum tuber temperature for harvesting is indicated based on air temperature that is between noon to late evening. Harvest potatoes only when

Fig. 11

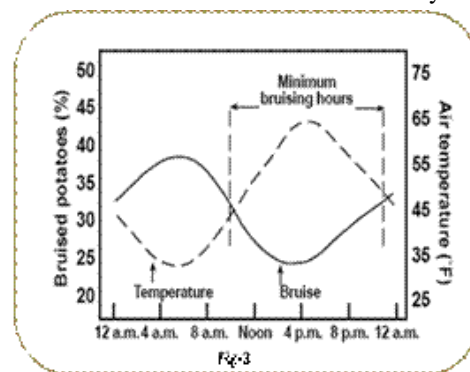
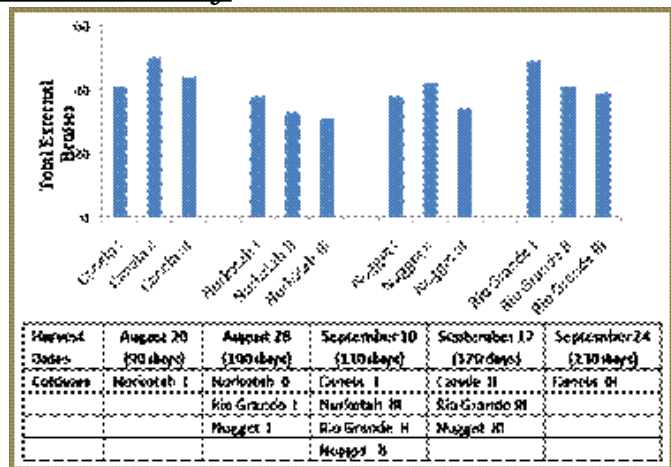


Fig-3

tuber pulp temperatures are 45°F to 65°F with 50 to 60°F being optimal

Tuber Maturity



Three different harvest dates were selected to study the effect of tuber maturity on pressure bruising. Tubers were left in the field for approximately 21 days after vine kill to allow for proper skin set. Tuber samples were examined carefully for external and internal signs of pressure flattening and bruise and percent dry matter was determined.

Fig 4. Tubers showed signs of pressure bruising externally and a few internal bruises were observed. The maturity of the tuber seemed to have some effect on bruise susceptibility as the most mature tubers showed less bruise symptoms in all cultivars except Canela Russet (fig-4).

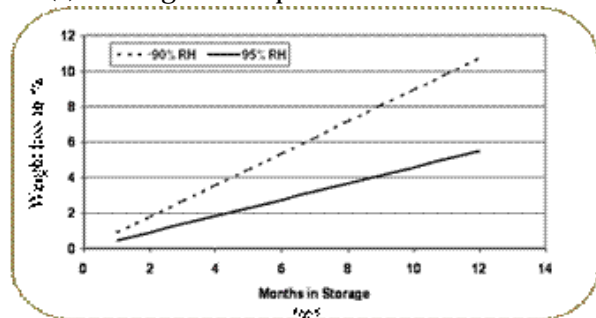
Storage conditions

Temperature, humidity and ventilation are important storage management tools for the storage operator in maintaining the quality of the tubers in storage.

Temperature

Several factors can influence temperature management for stored potatoes. These include: whether the potatoes are to be marketed for processing, as fresh table stock, or as seed; the temperature of the tubers at the time they are placed in storage; the length of time the tubers are to be stored; the extent of tuber damage at harvest; and the presence of disease organisms. High temperatures accelerate biological deterioration. Low temperatures during handling can worsen bruising damage and cause internal discoloration. Variable temperatures can cause sprouting. For long-term storage, temperature control consists of three phases: (1) removing field heat and respiration heat, (2) wound healing, then (3) holding at a temperature best suited for use of the crop.

Humidity

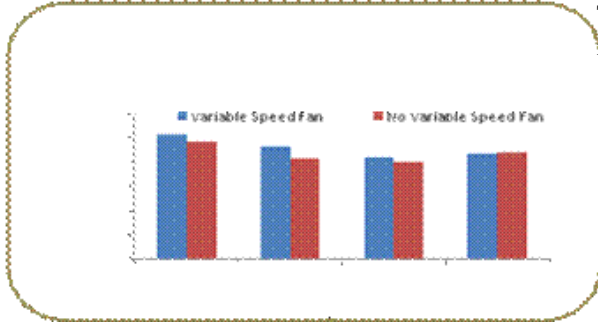


Potato tuber constitutes 75 to 80 percent water and is prone to shrinkage and shriveling. Relative humidity in potato storage should be held at 95 to 100 percent. Potatoes if stored at high humidity will lose 7 - 10 % of their weight over a three month period. If stored at lower humidities potato tubers will lose more of their weight - up to 20 % at times. Humidifiers should vaporize water without allowing droplets to contact potatoes. Excessive water causes disease problems. Humid air should be circulated through ventilation systems designed to maintain uniform temperature and humidity. The circulating air also removes carbon dioxide and provides oxygen for respiration. High humidity is essential for optimum wound healing during the curing period. It is also essential during the entire storage period to minimize tuber weight loss; weight loss rapidly increases at relative humidity levels below 90 percent.

Ventilation

Air movement may not be necessary during the curing period because the heat and moisture generated by the potatoes may provide an environment that is favorable for wound healing. Do not allow free moisture (condensation) to form during storage. If that does occur, air circulation may be necessary. Thereafter, air movement may be required to maintain the desired temperature and humidity throughout the storage pile. This may also require passing humidified air and/or heated or refrigerated air through the pile.

The primary function of air movement is to maintain a uniform temperature and humidity. Therefore, continuous air movement is not necessary since intermittent air movement can accomplish this goal.



Dirt and clods are a problem that can seriously affect air movement through the storage pile. They tend to form a solid barrier that slows down air movement and prevents air from reaching some areas of the pile. Variable speed fan storages produced tubers with higher dry matter in all cultivars except Rio Grande Russet (fig-6). Losing less percentage of dry matter in commercial bins equipped with variable speed fans may be the result of less moisture loss from tubers and low respiration levels. These were first year results and more study is needed to verify findings and expand on the initial conclusions. One problem we encountered during the course of our study was that tubers were put in storage and taken out at different times and this may have affected some of our results.

Wound Healing and Curing

Tubers are often bruised and cut during harvesting and pre-storage handling. Regardless of how the stored potatoes are to be marketed, wound healing is essential to minimize the entry areas for ever present disease organisms. Healing proceeds most rapidly at temperatures of 60° to 65° F. At this temperature and with a high humidity, a suberin layer (similar to a scab on animals) develops in 3 to 5 days. Cell regeneration, or complete wound healing, can take place beneath this suberin within 10 to 20 days, depending on the condition of the potatoes. When potatoes are placed in storage, rapid cooling can result in more rot forming organisms in the tuber because the entry points remain unhealed. Rapid cooling, particularly in the absence of adequate air, can also result in black spot and other potato damage.

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1:30 Wednesday, Feb 11

ALTERNATIVE POTATO CROP MANAGEMENT FOR SUSTAINABLE TUBER YIELD AND

QUALITY

Samuel Essah, CSU Potato Research/Extension Specialist, SLV Research Center

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Introduction

Early blight of potato is a disease influenced by soil fertility and plant nutrition. High nitrogen (N) application rates have been shown to suppress early blight (Davis 1985). However, N rates are typically higher for early blight control compared to the optimum requirements for maximum yield (Barclay et al. 1973). Excessive N application can suppress potato yield, and also reduce tuber specific gravity. More economical control of early blight has been achieved by managing fertility for optimal yield and using protectant fungicides to manage the disease (Mackenzie 1981).

Compost tea is the water extract of composted manure and/or plant materials. The resulting tea is rich in a diverse population of bacteria, fungi, protozoa, and soluble plant nutrients. When compost tea is sprayed on a plant, the leaf surface is occupied by beneficial organisms, forming a physical barrier against the pathogenic species and providing a competitive environment in which the pathogenic species lose out (ACRES_{USA} 2001). Additionally, as a foliar nutritional source, compost tea stimulates healthy plant growth, helping the plant to further resist attack.

Potato growers have always sought for alternative methods in suppressing potato foliar disease and to improve potato tuber yield and quality. The objective of this study was to evaluate the interactive effect of compost tea, fungicide program and nitrogen management on potato tuber yield, tuber size distribution and quality.

Experimental Procedure

Experimental Setup: Plots were established in 2007 and 2008 at the San Luis Valley Research Center at Center, CO. The previous crop in 2007 was barley and in 2008 was sudan grass. The experiment was established as a factorial arrangement of the treatments in a randomized complete block design. Each treatment was replicated four times. Treatments included compost tea applied at a rate of 8 gal/ac. The fungicide program used was the application of Bravo at 1.5 pt/ac, Quadris at 6.1 fl oz/ac, and Dithane at the rate of 2.0 lb/ac. The two N fertilizer rates used were, 120 and 160 lb N/ac. The six treatments in this study were, 120 lb N/ac (control); 160 lb N/ac (control); 120 lb N/ac + compost tea (120 N-CT); 160 lb N/ac + compost tea (160 N-CT); 120 lb N/ac + Fungicide (120N-F); and 160 lb N/ac + Fungicide (160N-F).

Two potato cultivars Russet Norkotah and Russet Nugget were used as test crops.

Cultural Management: Seed pieces were machine planted on May 11 in 2007 and May 6 in 2008 with a 12 in. within-row spacing in rows spaced 34 in. Individual plots were four rows wide and 25 ft. long. Throughout the growing season, plot care and cultural management practices followed the recommendation by CSU, San Luis Valley Research Center. On September 4, 2007 and August 29, 2008, potato vines were killed using a mechanical vine beater. Tubers from plots were machine harvested from the middle two rows on September 25, 2007 and September 25, 2008.

Data Collection: Tubers harvested from each plot were weighed to record total field yield. Tubers from each plot were graded for external and internal defects (Growth cracks, knobs, misshapes, hollow heart and brown center). Tubers were sorted into various size distribution groups based on weight (4-16 oz, 4-10 oz, 4-12 oz, 6-12oz, and 6-16 oz). Ten large (10-16 oz) tubers were taken for hollow heart and brown center evaluation. Tuber specific gravity was measured using the weight-in-air/weight-in-water method.

Results and Discussion

Russet Norkotah

Total Yield and Tuber Size Distribution

Application of fungicide at N rate of 160 lb/ac (160N-F) produced the highest total yield of 381 cwt/ac in 2007. Total yields for all other treatments were lower than for the 160N-F treatment, but similar to each other (fig. 1a). The 160N-F treatment also produced the highest marketable tuber (4-16 oz) yield but this was not significantly different from the 160N-CT treatment (fig. 1b). No difference was observed in yield for all other size distribution groups (fig. 1 c, d, e) in 2007.

In 2008, total yield was reduced by 13% when compost tea was applied at a lower N rate (120 lb N/ac) compared to all other treatments. No significant difference was observed among all other treatments for total yield (fig. 2 a). Marketable tuber yield, 4-12 oz tuber yield, and 6-16 oz tuber yield were significantly reduced by 16, 14, and 20%, respectively, when compost tea was applied in the lower N rate plots when compared to all other treatments (fig. 2 c, d, e). No other significant difference was observed among the treatments for these size distribution groups.

Tuber Quality

External defects were generally low in 2007, ranging from 1.2 to 2.7%. Treatment 160N (control) showed the least external defects and treatment 120N-CT produced the highest (Table 1). Similarly, percent internal defects were generally low, ranging from 0 to 2.8%. The treatment 120N-CT showed the highest percentage of hollow heart. Tuber specific gravity ranged

from 1.080 to 1.085. Treatment 120N-F, 160N-F, and 120N-CT showed the highest gravities (Table 1).

In 2008, 120N showed 5% external defects but all other treatments showed less than 4% external defects (Table 2). 120N-CT showed only 1.6% internal defects, but all other treatments either showed no internal defects or less than 1% internal defects. Fungicide application with 120 lb N per acre produced high tuber specific gravity.

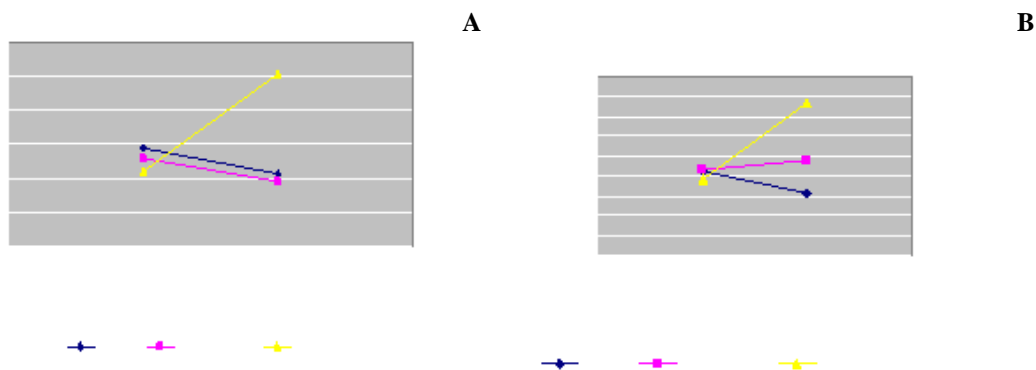
Table 1. Interactive effect of compost tea, fungicide program and nitrogen management on tuber external and internal defects, and specific gravity of Russet Norkotah (sel. 8), 2007

Treatment	% External Defects ²	% Internal Defects ³	Specific Gravity
120N ¹	2.4	0	1.080
160N	1.2	1.9	1.080
120N-CT	2.7	2.8	1.083
160N-CT	1.9	0	1.080
120N-F	1.8	0.6	1.085
160N-F	2.5	1.8	1.083

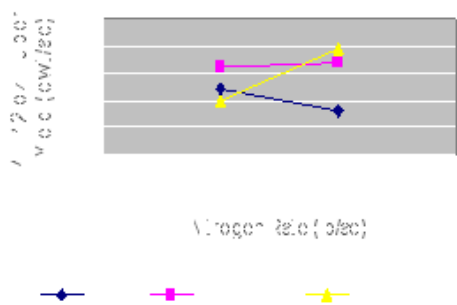
¹ N = nitrogen rate; CT = compost tea applied; F = fungicide applied

² Includes growth cracks, knobs and misshapes

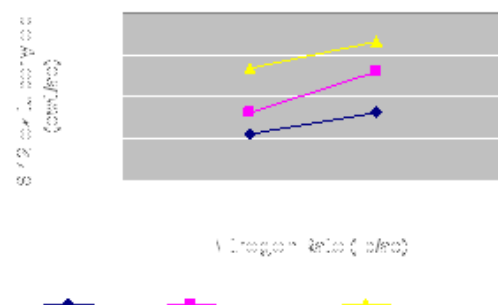
³ Includes hollow heart and brown center



C



D



E

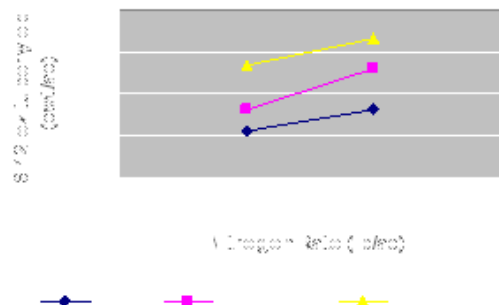
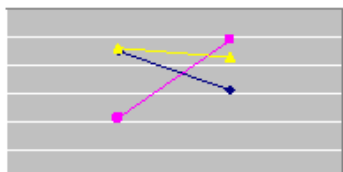
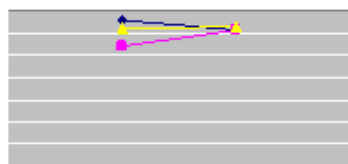


Figure 1 (2007). Interactive effect of compost tea, fungicide program and nitrogen management on total yield and tuber size distribution of Russet Norkotah.

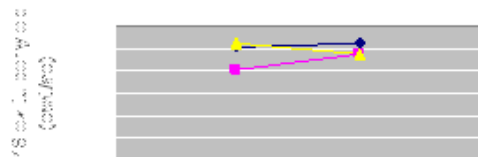
C



D



E



Yield (t/ha)



Figure 2 (2008). Interactive effect of compost tea, fungicide program and nitrogen management on total yield and tuber size distribution of Russet Norkotah.

Table 2. Interactive effect of compost tea, fungicide program and nitrogen management on tuber external and internal defects, and specific gravity of Russet Norkotah (sel. 8), 2008

Treatment	% External Defects ²	% Internal Defects ³	Specific Gravity
120N ¹	5.0	0	1.076
160N	2.6	0	1.074

120N-CT	3.6	1.6	1.074
160N-CT	2.3	0.8	1.074
120N-F	0.8	0	1.077
160N-F	2.2	0.6	1.075

¹ N = nitrogen rate; CT = compost tea applied; F = fungicide applied

² Includes growth cracks, knobs and misshapes

³ Includes hollow heart and brown center

RUSSET NUGGET

Total Yield and Tuber Size Distribution

In 2007, the application of fungicide in the 160 lb N/ac treatment produced the highest total tuber yield, but this yield was not different from that produced from 120N-F and 120N-CT (fig. 3a). The 160N-F treatment produced more marketable tubers but the yield was similar to other treatments with fungicide or compost tea applications, depending on the size distribution group being considered (fig. 3 b – e).

In 2008, with the exception of the 6-16 oz size distribution group, the compost tea treatments produced more total tuber yield and more tuber yield in all the other size distribution groups, but these yields were not significantly different from those of the 160N-F treatment (fig. 4 a – e).

Tuber Quality

In general, a low percentage of external defects were observed in 2007 and 2008. Less than 1% external defects were observed on tubers from the 160N-F, 120N-CT, and 160N (control) treatments in 2007. No internal defects were observed in any of the tubers in both years of the study (Table 3 and 4). Tuber specific gravity ranged from 1.087 to 1.092. The treatment 160N-CT produced the lease specific gravity in 2007 (Table 3). In 2008, 120N-CT and 120N-F produced tubers with high specific gravities (1.102 and 1.103, respectively). No significant difference was observed in tuber external defects in 2008.

Table 3. Interactive effect of compost tea, fungicide program and nitrogen management on tuber external and internal defects, and specific gravity of Russet Nugget, 2007

Treatment	% External Defects ²	% Internal Defects ³	Specific Gravity
120N ¹	2.4	0	1.089
160N	0.6	0	1.089
120N-CT	0.3	0	1.089
160N-CT	2.7	0	1.087
120N-F	1.2	0	1.092
160N-F	0.8	0	1.090

¹ N = nitrogen rate; CT = compost tea applied; F = fungicide applied

² Includes growth cracks, knobs and misshapes

³ Includes hollow heart and brown center

E

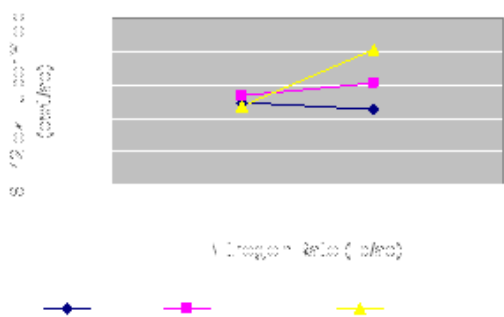
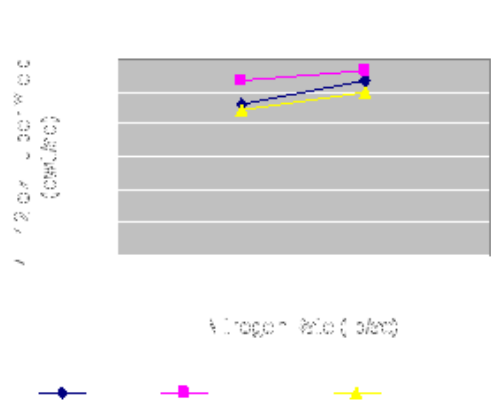
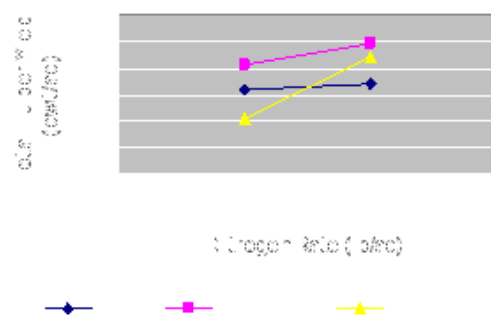
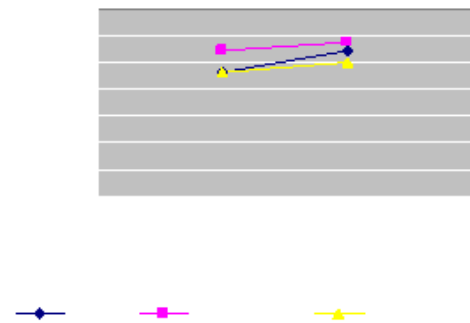


Figure 3. (2007). Interactive effect of compost tea, fungicide program and nitrogen management on total yield and tuber size distribution of Russet Nugget.

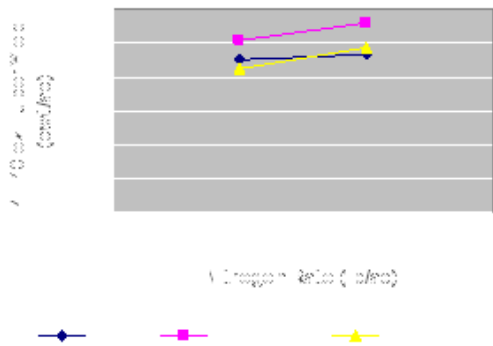
A

B



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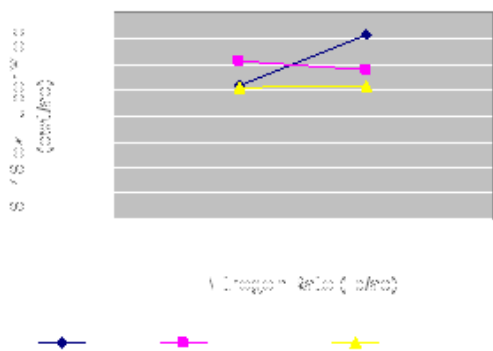


Figure 4. (2008). Interactive effect of compost tea, fungicide program and nitrogen management on total yield and tuber size distribution of Russet Nugget.

NOTES

Table 4. Interactive effect of compost tea, fungicide program and nitrogen management on tuber external and internal defects, and specific gravity of Russet Nugget, 2008

Treatment	% External Defects ²	% Internal Defects ³	Specific Gravity
120N ¹	0.7	0	1.097
160N	1.0	0	1.096
120N-CT	1.5	0	1.102
160N-CT	1.0	0	1.098
120N-F	2.0	0	1.103
160N-F	1.0	0	1.097

¹ N = nitrogen rate; CT = compost tea applied; F = fungicide applied

² Includes growth cracks, knobs and misshapes

³ Includes hollow heart and brown center

SUMMARY AND CONCLUSION

The main purpose of this study was to evaluate the interactive effect of compost tea, fungicide program, and nitrogen management on tuber performance of Russet Norkotah and Russet Nugget, and to determine whether compost tea could be used as an alternative to fungicide application. Data from this study indicate that compost tea can be applied as an alternative to fungicide application to produce optimum potato tuber yields. To achieve optimum yields, fungicide or compost tea should be applied to the potato plants with nitrogen application rate of 160 lb N/ac. Compost tea, when applied at low N rates, results in reduced tuber yield.

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NOTES

3:20 PM, Wednesday, Feb 12

New Directions in Potato Certification

Kent Sather, Manager, Colorado Potato Certification Service

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The potato industry is alive and well. It changes and adjusts and reforms as new challenges and opportunities arise.

Being a certified seed potato grower is voluntary. Growers who make the decision to participate are subject to Rules and Regulations of Colorado Potato Certification Service/Colorado State University as delegated by the State Board of Agriculture. Seed potato rules and regulations are the result of two primary concepts:

1. Limiting new diseases from being introduced into a growing area.
2. Dealing with problems that have already been introduced to a growing area.

National quarantines administered by USDA-APHIS are in effect for international shipments. Colorado benefits from and complies with these rules and regulations. One recent example of a quarantine pest problem is the Potato Cyst Nematode (PCN) confirmation in Idaho and in Alberta. Regulations in place hopefully will limit any further spread of the pest.

Colorado Potato Certification Service (PCS) maintains an official document containing rules and regulations for certified seed growers. These rules and regulations are developed by scientifically sound principles as well as utilizing national standards already established. Just as industry and problems change, rules and regulations are adjusted. Final approval of rule changes rests with Colorado State University (CSU).

Each February, PCS and Colorado Certified Potato Growers' Association (CCPGA) are reviewing possible changes to Certification Rules and Regulations.

Mandatory Shipping Point Inspection

One current but often misinterpreted rule relates to shipping point inspection requirements for seed shipped within the valley:

From Colorado Rules and Regulations for Certification of Seed Potatoes, May 2008

Page 1

Definitions

10. Waiver of Grade Inspection - A statement which may be part of a sales contract or on a separate form wherein the buyer agrees to accept grade without official inspection.

and Page 6

13. Grades and Grade Inspection

a. All Certified Seed Potatoes must be graded to conform with the Colorado standard grades and sizes for seed potatoes unless a signed waiver of grade inspection has been obtained from the purchaser as outlined in Section 13-d-e-h.

e. Each lot sold within the Marketing Order Area shall be inspected by a Federal/State Inspector or a waiver of grade inspection must be secured from the purchaser at the time of delivery or acceptance.

Based on this, a shipping point inspection for seed sold within the Marketing Order currently is required. However, this present rule allows for an exception – a “waiver of inspection”. This gives the receiver (buyer) a choice. The load gets an inspection, or the receiver requests a waiver from the certified seed grower. That Waiver of Inspection document is available through the PCS office. This should be made available to the receiver by the seed grower and signed by both at the time of delivery or acceptance. Over the years, this waiver option has mistakenly become the expected protocol.

CCPGA has proposed a change to this rule. The Waiver option and definition would be removed. This would make an inspection on all shipments mandatory. Proponents believe this will

reduce size complaints. It should also reduce incidence of other grade issues such as tobacco rattle virus, root knot nematode, and late blight.

Discussion on this rule will have taken place at the annual CCPGA meeting on February 9, 2009. If passed by CCPGA members, CSU will accept the change. Even so, the change would not go into effect until shipment of the 2009 crop. Shipment of the current 2008 crop will be a transition year. CCPGA is encouraging all certified seed growers to plan for shipping point inspection for the 2008 crop. Commercial growers are encouraged, also this year, to request a shipping point inspection and not opt for a waiver.

Grower Entry Tier II – Qualified Seed

The Grower Entry Program, Tier II concept was added to the Rules and Regulations two years ago. This bears some discussion given the current direction of this industry. (Tier I is included here for comparison)

From Colorado Rules and Regulations for Certification of Seed Potatoes, May 2008

Page 16

Grower Entry program: *The grower entry program is designed for growers who wish to enter the certification program, but are unable to fulfill all of the requirements during the first year of production, or for growers who wish to meet official disease control standards within their farming operation. In order to be certified or qualified, seed in this program must meet the disease tolerances and all pertinent rules and regulations for the generation grown. There are two tiers to this program.*

Grower Entry Tier I - This tier is for growers intent on becoming full certified seed growers. It should be valuable for an inexperienced seed grower who would get the benefit of PCS inspections and training before assuming full responsibility for selling certified seed. A prospective grower must contact the PCS office prior to May 1st and outline how he expects to eventually meet all requirements for certification. A review of progress will be made at the end of each growing season to determine the feasibility of continuing in the grower entry program or proceeding to full participation as a certified producer the next season. Normal fees will be assessed for certified acreage entered into the grower entry program. In addition, a \$6.00/acre fee will be assessed on all acreage within the farming operation not entered as certified in the grower entry program for a one time bacterial ring rot inspection. Seed produced under this tier is not eligible for sale as seed, either certified or common, no tags or bulk certificates will be issued, nor will seed lots be included in the Seed Directory until the grower has qualified for full certification as per the rules and regulations.

Grower Entry Tier II “qualified seed potatoes”- This tier is for grower’s intent on meeting official disease control standards within their operation. A prospective grower must contact the PCS office prior to May 1st and outline how he plans to use the seed inspected to meet disease control standards within his operation. A review of progress will be made at the end of each growing season to determine the feasibility of continuing in the grower entry program. Normal fees will be assessed for acreage entered into the grower entry program. Seed produced under this tier is not “certified seed” and may not be sold to any other grower. It may be used only within the grower’s operation and is intended only to meet disease control standards within that operation.

and Page 1, Definitions

3. Qualified Seed means potatoes derived from certified potatoes which have been inspected by Colorado Potato Certification Service which meet all applicable rules and regulations for certification and are eligible for planting to meet official disease control standards but are ineligible for seed sales.

Page 8

15. POST HARVEST TESTING. All Colorado certified or qualified seed potatoes must be subjected to a post harvest test and meet prescribed standards to be eligible for re-certification (certified or qualified) or sale (certified only).

Page 13

B. Storage Isolation - Grower entry of qualified seed for official control status.

1. *Qualified seed lots should be isolated and if possible stored separately from non-certified stocks.*

This level of seed production/inspection provides avenues and possible advantages for a commercial grower that may want to meet official disease control standards on certain seed lots planted within his/her farming operation. Commercial potatoes shipped to Mexico must be from officially inspected seed sources. The upcoming seed law requires a certified or qualified seed source at some level. A grower may simply wish to have a seed lot inspected. The Tier II program would allow a grower options in these scenarios.

Here is an example. A commercial grower wants to sell potatoes from his 2009 crop to Mexico. He also wants to keep seed back to plant a second year (2010 crop) that will qualify for the

Mexico shipments. He visits with PCS officials to qualify for the Tier II program in 2009. He finds seed that is eligible for recertification and submits all paperwork and inspection fees to PCS by the due dates. PCS conducts regular inspections according to protocol.

If that particular seed lot passes all summer and post harvest test inspections, the grower can:

1. Sell the 2009 crop to Mexico – it is from a certified seed source.
2. Sell the 2009 crop locally as a table product.
3. Replant that seed for a 2010 crop and ship it to Mexico – the progeny will be from a qualified source. This does not need to be entered for inspection.

If that particular seed lot fails a summer or post harvest test inspection, the grower can:

1. Sell the 2009 crop to Mexico – it is from a certified seed source.
2. Sell the 2009 crop locally as a table product.
3. Replant that seed for a non-qualified 2010 crop – this crop, however, would not be eligible for shipment to Mexico.

Note that a grower CANNOT sell a qualified lot to another grower for replant. PCS limits replant potential to be within the growers own operation in both Grower Entry levels!

These two rule changes, mandatory shipping inspections and Grower Entry Tier II, are current examples of how a program can, within scientific and logical bounds, adjust existing rules and regulations according to local and national issues.

A complete electronic version of Colorado Rules and Regulations for Certification of Seed Potatoes, along with other Colorado Potato Certification Service information, can be found on-line at www.colostate.edu/Depts/PCS/.

Thursday, 1:30 PM

Crop Insurance Changes for 2009

Craig Dresher, Rain and Hail Insurance Co.



United States Department of Agriculture

October 21, 2008

BACKGROUND:

Section 12011 of the Food, Conservation, and Energy Act of 2008 amended section 508(e) of the Federal Crop Insurance Act (7 U.S.C. 1508(e)), by adding at the end the following:

(5) ENTERPRISE AND WHOLE FARM UNITS.—

(A) IN GENERAL.—The Corporation may carry out a pilot program under which the Corporation pays a portion of the premiums for plans or policies of insurance for which the insurable unit is defined on a whole farm or enterprise unit basis that is higher than would otherwise be paid in accordance with paragraph (2).

(B) AMOUNT.—The percentage of the premium paid by the Corporation to a policyholder for a policy with an enterprise or whole farm unit under this paragraph shall, to the maximum extent practicable, provide the same dollar amount of premium subsidy per acre that would otherwise have been paid by the Corporation under paragraph (2) if the policyholder had purchased a basic or optional unit for the crop for the crop year.

(C) LIMITATION.—The amount of the premium paid by the Corporation under this paragraph may not exceed 80 percent of the total premium for the enterprise or whole farm unit policy.

TO: All Approved Insurance Providers
All Other Interested Parties
All Risk Management Agency Field Offices
FROM: Tim B. Witt /s/Tim B. Witt

Deputy Administrator

SUBJECT: Enterprise and Whole Farm Unit Subsidy Changes

ACTION:

Effective for 2009 crop year crops with November 30, 2008 and subsequent contract change dates, subsidy factors for enterprise and whole farm units are presented in the following table and posted on applicable actuarial documents. These subsidy factors apply to crops with Revenue Assurance, Crop Revenue Coverage, and select crop/counties for Actual Production History where enterprise units are available.



The Risk Management Agency Administers And Oversees All
Programs Authorized Under The Federal Crop Insurance
Corporation
An Equal Opportunity Employer

INFORMATIONAL MEMORANDUM: PM-08-057

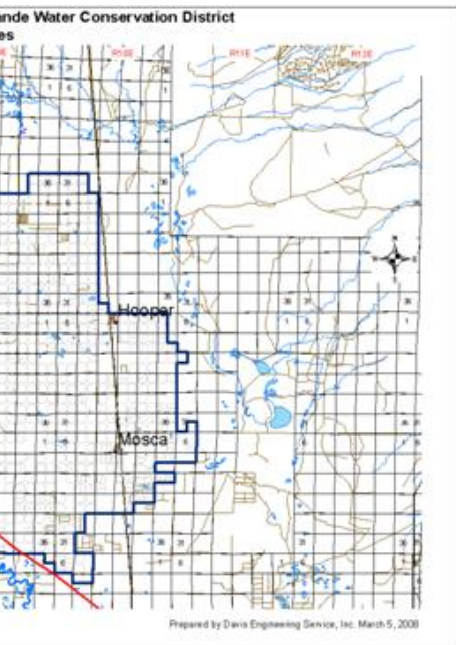
*Only for those crops and counties where whole farm and enterprise units are available

DISPOSAL DATE:

This Informational Memorandum is for the purpose of transmitting information and the expiration date is December 31, 2008.

Please Use This Space for Notes

Crop/Enterprise	08/08	09/08	10/08	11/08	12/08	01/09	02/09*	03/09*
Wheat Enterprise All Co. Enterprises*	00.0000	00.0000	00.0000	00.0000	00.0000	00.0000	00.0000	00.0000
Wheat Enterprise All Co. Enterprises*	00.0000	00.0000	00.0000	00.0000	00.0000	00.0000	00.0000	00.0000



d availability on MPC1). *Will be indicated by "EU" on the 5030 form.*
ble acreage of the insured crop in which the producer has a share in the county. The

Enterprise Unit must also qualify:

(a) For two or more Basic Units of the same insured crop that are located in two or more separate sections, section equivalents, or FSA farm serial numbers; **OR**

(b) For two or more Optional Units of the same insured crop established by separate sections, section equivalents, or FSA farm serial numbers.

3. The qualifying Basic or Optional Units must each have insurable acreage of the same crop in the crop year insured. If there are only two units, both must have planted acres.

4. The producer must comply with all reporting requirements and regulations for the Basic Units and/or Optional Units comprising the Enterprise Unit. More specifically, the producer may maintain and submit the same records as in the past. Those records must show that the producer qualifies for at least two Basic or Optional Units of the same insured crop as outlined above.

5. The producer must select the Enterprise Unit structure in writing by the sales closing date. Producers may do this in the "options" section of the CRC application in the initial crop year or on a policy change form each subsequent crop year. Once selected, the producer's Enterprise Unit structure will remain in effect unless the insurance company is notified, in writing by the sales closing date, that the producer wishes to change unit structure.

6. If the producer does not qualify for Enterprise Units when the acreage is reported, the Basic Unit structure will be assigned.

7. If a producer selects and qualifies for an Enterprise Unit, the producer will qualify for a premium discount based on the insured crop and number of acres in the Enterprise Unit. The Actuarial Document, FCI-35 Coverage and Rates provides the applicable

enterprise unit discount factor by number of acres. ***These factors must be used in conjunction with a BU (Basic Unit Discount) option factor to calculate the correct enterprise unit premium.***

Level.....75% Base
 Price.....\$3.56 Harvest
 Price.....\$3.05

CRC Enterprise Unit and Loss Examples

If a producer selects the Enterprise Unit structure, the Basic or Optional Units comprising the Enterprise Unit will retain separate Final Guarantees. Each acre within the Enterprise Unit will have the same Final Guarantee as it would have had under the Basic or Optional Unit structure. However, CRC pays losses at the Enterprise Unit level. For example, an Optional Unit within the Enterprise Unit may have a Calculated Revenue that is less than its Final Guarantee. CRC would pay this loss under the Optional Unit structure. However, under the Enterprise Unit structure, Calculated Revenue surpluses from the other Optional or Basic Units within the Enterprise Unit may offset this loss.

Insurance Coverage							Claim Information			
Unit No.	Acres	Share	App Yield	Yield Quot	Total Bu. Quot	Total Rev. Quot	Bushels to Count	Rev. to Count	Gross Loss	Net Loss

Level.....75% Base
 Price.....\$3.56 Harvest
 Price.....\$4.05

Insurance Coverage							Claim Information			
Unit No.	Acres	Share	App. Yield	Yield Quor.	Total Bu. Quor.	Total Row. Quor.	Bushes to Count	Row. to Count	Gross Loss	Net Loss

RA Enterprise Units

1. Must contain planted acres in at least 2 sections, section equivalents, FSA farm serial numbers, or units established by written agreement.
2. To qualify, an enterprise unit must contain all of the insurable planted acreage of the same insured crop in:
 - (a) One or more basic units that are located in two or more separate sections, section equivalents, or FSA farm serial numbers, with at least some planted acreage in two or more separate sections, section equivalents, or FSA farm serial numbers; or
 - (b) Two or more optional units established by separate sections, section equivalents, or FSA farm serial numbers, with at least two optional units containing some planted acreage.
3. The producer must comply with all reporting requirements of the basic or optional units.
4. The Enterprise Unit option must be selected by the applicable Sales Closing Date.
5. If the producer does not qualify for Enterprise Units when the acreage is reported, optional units or basic units will be assigned depending on how the production was reported.
6. There will be a premium discount for enterprise units. The discount for enterprise units depends on the number of different sections in which the RA crop is planted. The discount increases up to a maximum of 10 sections.

RA Enterprise Unit and Loss Example

Enterprise Units on an RA policy use a weighted average of expected per-acre revenues for each of the optional or basic units in a county.

The weighted average depends on the number of acres in each basic or optional unit, adjusted for share. See the example below.

Level.....75% Projected Harvest Base
 Price.....\$3.56 Fall Harvest
 Price.....\$3.05

*The Total Revenue Guarantee = the Acres x the Weighted Average Weighted Average = \$141.40

(Total Liability divided by total share acres.)

In the following examples, everything stays the same, EXCEPT the Harvest Price goes up.

Fall Harvest Price.....\$4.05

Insurance Coverage								Claim Information			
Unit No.	Acres	Share	Share Acres	Year Yield	Yield Acre	Liability	Total R/Warrant	Share to Count	Revenue to Count	Gross Loss	Net Loss

Insurance Coverage								Claim Information			
Unit No.	Acres	Share	Share Acres	Year Yield	Yield Acre	Liability	Total R/Warrant	Share to Count	Revenue to Count	Gross Loss	Net Loss

The Fall Harvest Price Option is selected:

*The Total Revenue Guarantee = the Acres x the Weighted Average

Weighted Average= \$160.82 (Total Liability divided by total share acres.)

About Whole-Farm Units

Available only under RA. Will be indicated by "WU" on the 5030 form.

A Whole-Farm Unit includes all insurable acres of all RA crops in a county. The insurable acreage must qualify for at least two enterprise units and each crop must account for at least 10% of the total liability for all crops combined that are produced on the farm. Winter Wheat cannot be included in a Whole Farm unit. However, Winter Wheat can be included under an optional, basic, or enterprise unit.

If the insured elects whole-farm unit coverage, no other unit structure can be selected (exception is Winter Wheat). If the insured does not qualify for whole-farm units when the acreage is reported, optional units or basic units will be assigned depending on how the production was reported.

There will be a premium discount for a whole-farm unit. The adjustment the producer receives is in addition to the enterprise unit discount. The additional discount for the whole-farm unit depends upon 1) the ratio of insured acres of the crops listed on the acreage report for the unit, 2) coverage level, 3) APH yields, and 4) projected harvest prices. The insured per-acre premium decreases as the number of legally defined sections on which the producers insured acreage increases up to a maximum of 10 sections. The per-acre premium also depends on the proportion of insured crop acres on the unit. For example, if the unit contains corn, soybeans, and barley, the per-acre premium will depend on the ratio of corn to soybean insured acres, the ratio of corn to barley insured acres, and the ratio of soybean to barley insured acres.

2:15 PM, Thursday, February 12, 2009

FSA New Farm Bill Update

FSA County Executive Directors, Russell Valdez, Kevin Reeves & Don Greenstreet

INTRODUCTIONS – Don Greenstreet

ELIGIBILITY REQUIREMENTS – Don Greenstreet

1. Adjusted Gross Income Certification
2. Payment Limitations

NON-INSURED CROP DISASTER ASSISTANCE PROGRAM (NAP) – Don Greenstreet

SUPPLEMENTAL DISASTER ASSISTANCE PROGRAMS – Russ Valdez

1. Supplemental Revenue Assistance Payments (SURE)
2. Livestock Forage Disaster Program (LFP)
3. Livestock Indemnity Program (LIP)
4. Emergency Assistance for Livestock, Honey Bees, and Farm Raised Fish (ELAP)
5. Tree Assistance Program (TAP)

DIRECT AND COUNTER-CYCLICAL PAYMENT PROGRAM – Kevin Reeves

AVERAGE CROP REVENUE ELECTION PROGRAM (ACRE) – Kevin Reeves

Average Adjusted Gross Income

Three qualifying levels beginning in 2009:

\$500,000 Avg. Adjusted Gross Non-farm Income	Exceed this - ineligible for any commodity program benefits
\$750,000 Avg. Adjusted Gross Farm Income	Exceed this - ineligible for DCP Direct Payments.
\$1,000,000 Avg. Adjusted Gross Non-farm Income	Exceed this - ineligible for Conservation programs, unless 66.66% or more of AGI is average adjusted gross farm income.



February 12, 2009
San Luis Valley, Colorado

Farm Service Agency

USDA-Farm Service Agency

Average Crop Revenue Election (ACRE) Program Beginning in 2009

TWO TRIGGERS MUST BE MET BEFORE PAYMENTS CAN BE ISSUED

1. STATE TRIGGER

+/-10% from preceding year	State ACRE Guarantee	must exceed	Actual State Revenue
	90% times Benchmark State Yield (5-year olympic average planted yield) times ACRE Program Guarantee Price (2-year national average market price)		100% times Actual State Planted Yield times higher of: National Average Market Price or 70% of National Loan Rate

AND

2. FARM TRIGGER

+/-10% from preceding year	Farm ACRE Benchmark Revenue	must exceed	Actual Farm Revenue
	100% times Farm's Expected Yield (5-year olympic average planted yield) times ACRE Program Guarantee Price (2-year national average market price) plus Per Acre Producer-Paid Crop Insurance Premium		100% times Actual Farm Yield times higher of: National Average Market Price or 70% of National Loan Rate

CALCULATION OF A FARM'S PAYMENT

FARM PAYMENT = 83.3% of a farm's planted/considered planted acres for 2009-11; 85% in 2012 ^{1/} times (farm's expected yield divided by State benchmark yield) times



- In exchange for participating in ACRE, a producer's direct payment is reduced by 20% and loan rate is reduced by 30 percent.
- Separate payments are established for irrigated and nonirrig. yields in States that have more than 25% irrigated and more than 25% nonirrig.
- If all producers on farm to do not elect to participate in ACRE, then farm can not participate.
- ACRE payments are issued October 1 after the crop is harvested (no advance payments).

1/ The total number of planted acres for which a producer may receive ACRE payments may not exceed the total base acres for the farm.
 If the total number of planted acres exceeds the total base acres on the farm the producers may elect which planted acres to enroll in ACRE

NOTES

8:50 AM Friday, Feb 13

Rio Grande Conservation Reserve Enhanced Program

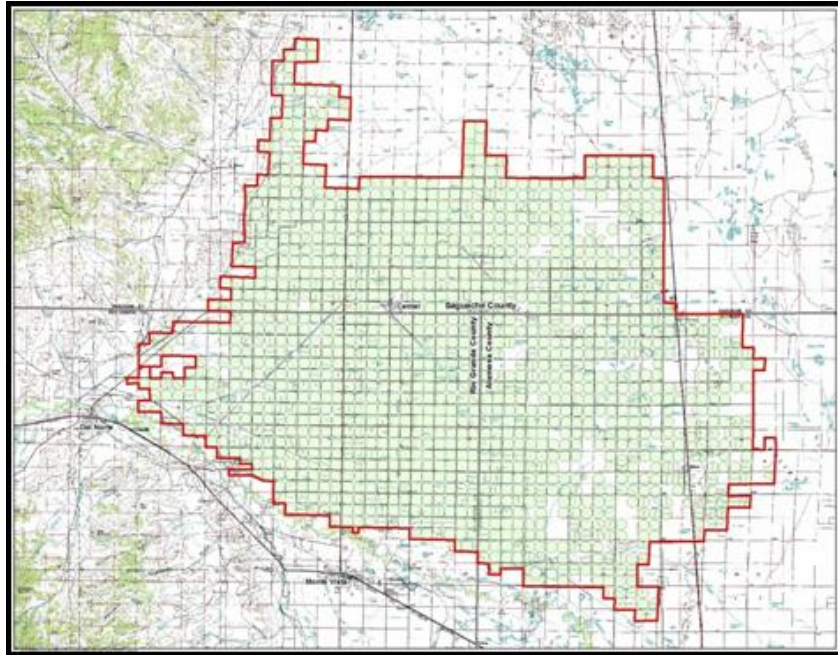
(Draft Proposal)

Tim Davis, Ag Conservation Consultant, Sterling, CO.

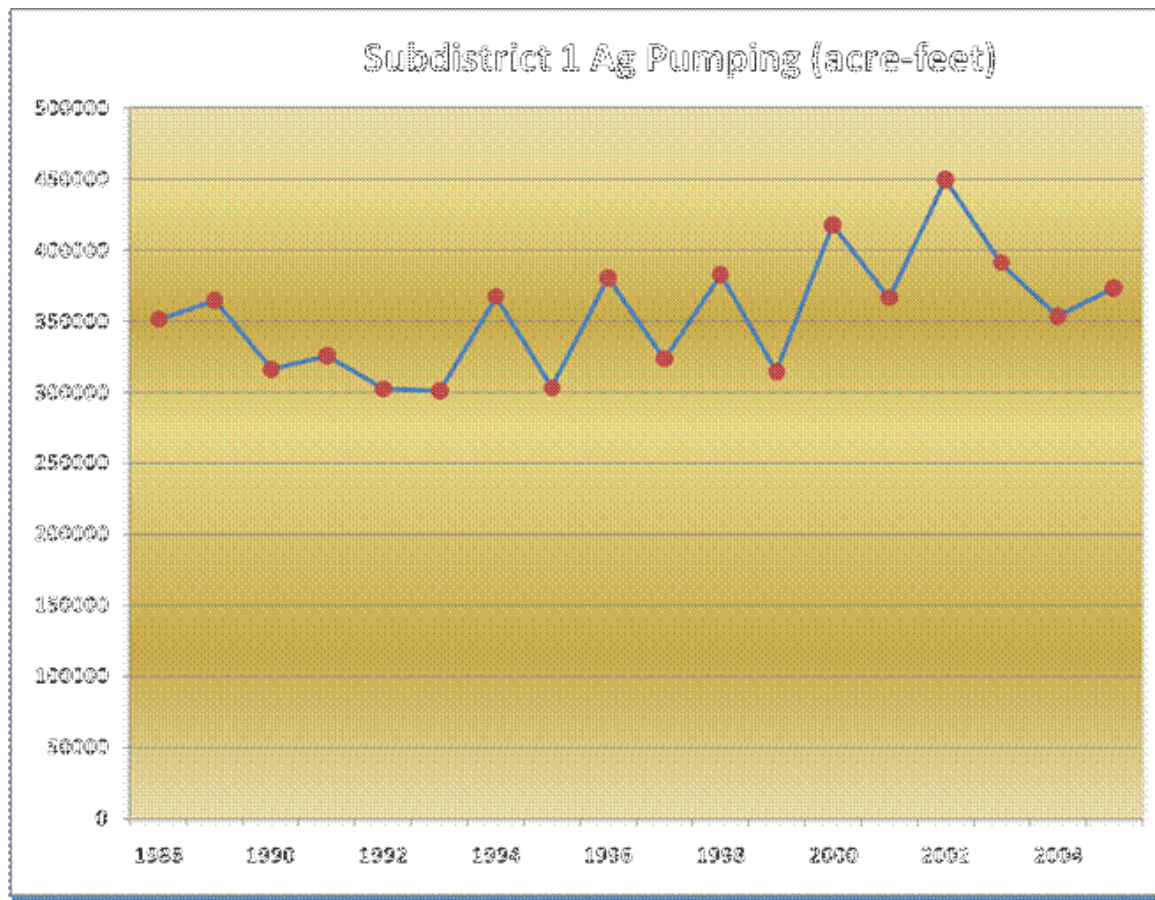
The State of Colorado (State) and Special Improvement District #1 of the Rio Grande Water Conservation District (Subdistrict #1) seek to obtain federal funds through the United States Department of Agriculture (USDA) for the purpose of encouraging farmers within Subdistrict #1 of the Rio Grande Basin (Basin) to enroll in a voluntary Conservation Reserve Enhancement Program (CREP). This program will provide funding incentives and cost-sharing from both the USDA and local interests to participants who voluntarily enter their land into eligible conservation practices such as native vegetation establishment or wildlife conservation for a period of 14 or 15 years. The State and Subdistrict #1 will seek to enroll approximately 40,000 acres of irrigated cropland in portions of Alamosa, Rio Grande, and Saguache Counties. Of the approximately 200,000 acres of cropland irrigated by surface or ground water within Subdistrict #1, the Rio Grande Subdistrict #1 CREP (Rio Grande CREP) seeks to retire approximately 20 percent of those acres and the water associated with irrigating those acres.

The project area lies within the boundaries of Subdistrict #1 in the San Luis Valley (Valley) of south-central Colorado. The Valley is considered a high alpine desert and is bounded on the east by the Sangre de Cristo Mountains and on the west by the San Juan Mountains. The entire valley varies from 40 to 65 miles wide east to west and is about 100 miles from north to south. The Valley has been farmed for over 150 years, where the primary irrigated crops include potatoes, small grains, alfalfa, and high market value vegetables such as spinach, lettuce, and carrots. There are minimal dryland crops in the Valley due to insufficient precipitation. The water levels of the aquifer system within the Valley are currently declining, which is negatively affecting surface flows and increasing operating and pumping costs for producers.

The project area lies north of the Rio Grande and east of a line extending north of the City of Alamosa (see Exhibit M). The project area encompasses approximately 385 square miles which is five percent of the total land area in the Valley. Irrigation in the project area approximates 33 percent of all irrigated land in the Valley.



The confined and unconfined aquifers are over-appropriated, with current rates of withdrawal exceeding their ability to recharge, resulting in a ground water overdraft or mining of the aquifers. Additionally, surface streams may have been impacted by this unsustainable use of the aquifers. The confined aquifer and its unique artesian pressure characteristics play an important hydrological role to the stream systems in the Valley. There is a scientifically proven hydraulic connection between the aquifers and streams in the Valley. Thus, withdrawals from the confined aquifer may impact stream flows, as well as the unconfined aquifer. Further, the confined aquifer provides hydraulic support for surface streams; if the water level declines considerably and/or the historical pattern becomes skewed to the point that the artesian pressure is permanently lowered, the surface streams may be significantly impacted. This would cause reduced streamflow, water level decline in the unconfined aquifer, and a dry up of wetlands created by the shallow unconfined aquifer.



Conservation practices applied within Subdistrict #1 through the Rio Grande CREP would include:

- CP-2 Establishment of Permanent Native Grasses
- CP-4D Permanent Wildlife Habitat, Non-easement
- CP-9 Shallow Water Areas for Wildlife
- CP-23 Wetland Restoration
- CP-23A Playa Lake Restoration

The project would accept a total of approximately 40,000 acres of irrigated cropland. Landowners participating in the Rio Grande CREP would receive the irrigated rental rates for any qualified irrigated acreage they enroll. Surface irrigated cropland (pivot corners) adjacent to eligible ground water pivot irrigated cropland will be eligible for surface irrigated rental rates if all other CREP enrollment criteria are met. Dryland pivot corners do not exist within the project area and therefore are not included as eligible in this proposal. The 15 year cost of enrolling 40,000 irrigated acres is estimated at \$125 million, to be funded approximately 80 percent by federal and 20 percent by non-federal locally driven sources.

Under 14 or 15-year contracts, the Rio Grande CREP will enable eligible producers to enroll in the program, convert enrolled acres to permanent habitat, forego irrigation on those acres, and receive financial and technical assistance from USDA and Subdistrict #1. No other program exists that can provide the financial and technical resources through collaborative federal-state-local partnerships necessary to address water management and other resource issues so critical to Subdistrict #1, the Valley, and the State.

The primary objectives of the Rio Grande CREP are:

- 1) Reduce soil erosion from approximately 681,252 tons to approximately 149,487 tons per year on all acres enrolled in CREP, a savings of approximately 531,765 tons per year.
- 2) Establish a minimum of 40,000 acres of habitat for numerous wildlife species, including several aquatic and wetland dependant species that are declining due to habitat degradation.
- 3) Reduce fertilizer and pesticide application by approximately 20 percent over the total project area and eliminate the need for herbicides and fertilizer on all enrolled acres (see Exhibit F for specific amounts).
- 4) Establish a minimum of 40,000 acres of native vegetation throughout the project area.
- 5) Restore and enhance a minimum of 750 acres of degraded and inefficient wetlands.
- 6) Reduce agricultural use of the confined and unconfined aquifer in the Basin by approximately 60,060 acre-feet of ground water per year equaling approximately a 12 percent water savings within the project area and approximately five percent within the entire Basin in Colorado.
- 7) Increase streamflows in streams associated within the project area.
- 8) Reduce energy consumption from an average of 144,704 kilo-watt per hour (kW-hr) to less than 5,000 k-W per pivot for the first year or two on all pivots enrolled in the CREP. Subsequent year's energy consumption will be reduced to zero for all pivots enrolled in the CREP. Total energy savings for the term of the CREP contracts will approach six million k-W hr.
- 9) Reduce the percentage of ground water test wells containing nitrogen (NO₃) levels above EPA standards.

Total Estimated Project Costs

Source	Costs	Percent of Total
Federal Funds	\$ 94,495,000	75%
Non-federal incentives and cost-share	\$ 27,345,565	22%
Non-federal in-kind contributions	\$4,000,000	3%
Total Project Costs	\$ 125,840,565	100%

Subdistrict #1 of the Rio Grande Water Conservation District Estimated Payments for 15 Year Water Retirements

	RGWCD Subdistrict #1 Annual Rental Payments	RGWCD Subdistrict #1 One-time Target Area bonus pymt/acre	RGWCD Subdistrict #1 One-time seeding bonus pymt/acre	RGWCD Subdistrict #1 Annual Water Retirement (per acre)
Non-target area	\$0.00	\$0.00		\$22
Target Area	\$10.00	\$100.00	\$100.00	\$33
Totals				

Subdistrict #1 of the Rio Grande Water Conservation District Estimated Payments for Permanent Water Retirements

	RGWCD Subdistrict #1 Annual Rental Payments	RGWCD Subdistrict #1 One-time Target Area bonus pymt/acre	RGWCD Subdistrict #1 One-time seeding bonus pymt/acre	RGWCD Subdistrict #1 Annual Water Retirement	RGWCD Subdistrict #1 Perp. Water Retirement- One-time Bonus-per ac.
Non-target area	\$0.0			\$44	\$200.00
Target area*	\$10.00	\$100.00	\$100.00	\$66	\$200.00

Totals					
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The Rio Grande CREP upon approval by USDA-FSA will be announced and promoted through local newspapers within the Valley. CSU Cooperative Extension will also provide information at its local offices. State staff, FSA, and Subdistrict #1 representatives will conduct meetings in each county to inform producers of the program and answer any questions. The subdistrict office in Alamosa will be available during business hours to assist producers and will work with NRCS and FSA field offices in the region.