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**ATRAZINE: WATER QUALITY IMPACTS AND MANAGEMENT ALTERNATIVES**

The Colorado Department of Health recently completed a water quality scan of approximately 100 rural domestic wells in the South Platte alluvial aquifer. All wells sampled were less than 150 feet deep and the depth to water ranged from 2 to 25 feet. Nitrate was the most commonly detected contaminant, exceeding EPA drinking water standards in approximately 33% of the wells. Atrazine was detected in 27% of the wells sampled, although none were above the EPA Maximum Contaminant Level (MCL) of 3 ppb. Other pesticides that were detected included: Alachlor, Benefin, DCPA, EPTC, and Hexazinone. Only one well

in the survey was found to contain any pesticide at levels above EPA established health standards (see Figure 1).

Atrazine has been the most commonly detected pesticide in water in the corn growing regions across the U.S. However, most of these detections have been well below the MCL. Atrazine is the most widely used herbicide in U.S. corn and sorghum production. In Colorado, over one million pounds of active atrazine ingredient are used annually, making it second only to use of 2,4-D. Atrazine, the common name of a

***Based upon the atrazine problems in Midwestern states, crop advisors in Colorado need to begin considering replacements and/or Best Management Practices for atrazine.***

triazine herbicide, was first marketed in 1959. It has been sold under the trade names of Atrazine, Aatrex, Atratol, Gesaprim, and Zeaphos. It is also a component of the herbicides Bicep, Bullet, Extrazine, Lariat, Marksman, Prozine, and Sutazine. Atrazine is used primarily to control annual broadleaf weeds and certain grasses in corn and sorghum.

Atrazine has come under increased scrutiny in recent years, due to frequent detection in ground and surface water, and its classification as a potential human carcinogen. In a 1991 U.S.G.S. study of surface water in the Mississippi River basin, it was detected in each of 146 water samples. Atrazine concentration exceeded the MCL in over 25% of these samples, and both the Missouri and Mississippi rivers continuously ran above standard for several weeks. As a result, EPA may restrict or ban the use of atrazine in certain areas.

Environmental concerns about atrazine have resulted in several Midwestern states placing restrictions on its use before any further EPA action. USDA recently conducted an economic analysis of the impact of restricting or banning atrazine and concluded that the economic loss to producers in the Midwest could range anywhere from \$80 million to \$1.2 billion annually. In light of these developments, crop advisors in Colorado need to consider replacements and/or Best Management Practices for atrazine. Although there are other pre-emergence products available for broadleaf control in corn, none are as versatile or provide as broad a spectrum of weed control. Atrazine is also widely used on fallow ground in Colorado, but good residue management can help minimize off-target effects in these situations.

Ciba-Geigy, the principal manufacturer of atrazine, has recently withdrawn its use for industrial weed control and has made label changes that reduce application rates, eliminate fall application, and designate it as a restricted-use pesticide. Additional label changes to deal with surface water concerns have been accepted by EPA and will become effective for the 1993 planting season. However, EPA has indicated that there is a strong possibility of further regulatory action. Ciba-Geigy contends that the use of appropriate BMPs by farmers will keep atrazine levels in drinking water low enough to meet standards.

#### **Alternative Management Practices**

A number of alternative chemicals and weed control methods are currently available that should be considered, especially if there is significant risk of contaminating water supplies with atrazine.

**Pre-plant or pre-emergent herbicide options for weed control in corn include:**

Banvel (dicamba)  
Bladex (cyanazine)  
Cycle (metalochlor + cyanazine)  
Dual (metalochlor)  
Frontier (dimenthenamid)  
Lasso (alachlor)  
Modown (bifenox)  
Roundup (glyphosate)

**Post-emergent herbicide options include:**

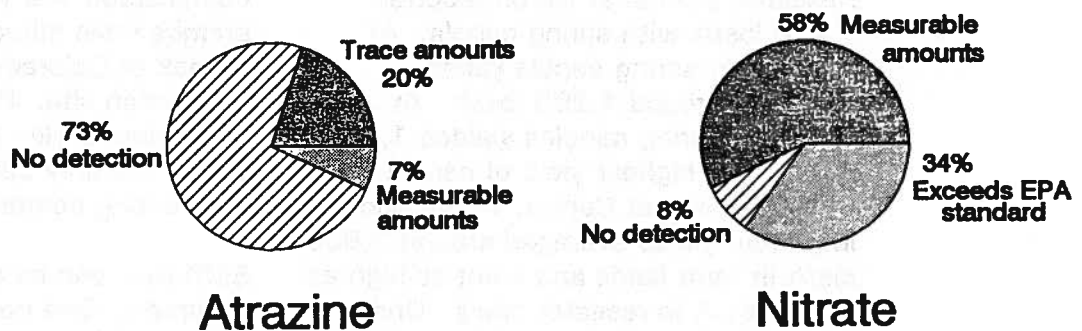
Accent (nicosulfuron)  
2,4-D  
Banvel  
Basagran (bentazone)  
Beacon (primisulfuron)  
Bladex  
Buctril (bromoxynil)  
Pursuit (imazethapyr) - use only with tolerant corn hybrids

**BMPs recommended by CIBA-Geigy to protect water from atrazine include:**

1. Apply the lowest effective labelled rate.
2. Combine band application with tillage.
3. Calibrate sprayer precisely to ensure uniform application, avoiding drift.
4. Incorporate strip cropping into planting strategy.
5. Utilize filter strips and set-backs around surface water.
6. Practice crop rotation.
7. Avoid application immediately prior to any rainfall or irrigation.
8. Reduce tillage to increase surface residues

Although currently there are no known serious water quality problems from atrazine in Colorado, the experience of the Midwestern states indicates the need for special care with this product. Farmers who use atrazine on coarse soils, erosive soils, or near surface water need to take the appropriate precautions and consider using alternative weed control measures. Waskom

## South Platte Groundwater Survey Rural Domestic Wells



Colorado Dept. of Health, 1992

Figure 1

## ALTERNATIVE CROPS - OILSEEDS

The predominant oilseed crops of Colorado are sunflower followed by safflower, canola, and crambe and acreage is increasing. Sunflower is well established and should be considered an important substitute for small grains in Colorado. There is renewed interest with safflower because of its oil quality and consumer awareness concerning saturated and unsaturated fats. Safflower oil contains a high percentage of polyunsaturated fats. Canola and crambe are the newcomers and have had the most dramatic impact on Colorado in 1992.

*There was a conference held in Billings, MT on February 18-19 on safflower. For information on the conference or on safflower in general, call Chuck Crowell, 406/482-2456.*

Canola is a form of rapeseed and both are considered mustard. There are differences that you must be aware of. Colorado has established districts within the state which limit production to either canola or rapeseed but not both. They are highly cross compatible and mixing will result in a crop which does not meet the edible standards of canola or the industrial standards of rapeseed. Rapeseed, used for industrial oils, has a high percent of erucic acid, toxic to animals; while canola has essentially no erucic acid and is used for cooking oil. In 1992, trials at the Great Plains Research Station at Akron reported 1,400 lbs/A with spring canola. At Burlington, spring canola yields averaged around 1,200 lbs/A. At Brighton, spring canolas yielded 1,200 lbs/A. The highest yield of canola, however, was at Center, where under irrigation, yields averaged around 2,800 lbs/A in farm fields and went as high as 5,100 lbs/A in research trials. Under dryland conditions with current prices at \$10/cwt, it is estimated that yields of 1,000 lbs/A would be comparable to wheat or millet so 1,200 lb yields will return about \$20/A to the grower. This may or may not be sufficient to interest producers. Currently the problem may

be in transportation costs. Intermountain Canola (Idaho Falls, Idaho) has been contracting in Colorado but at this time, probably all of their contracts are filled. National Sun Industries (Goodland, Kansas) has expressed interest in canola but currently has no plans of canola. They are contracting sunflower, however. Canola planting coincides with the planting of spring grains such as wheat and barley.

In 1992, we also tested crambe, another member of the mustard family. Crambe produces an oil similar to rapeseed but the oil composition has a higher percentage content of erucic acid - the ingredient the industry wants. Last year, trials at Burlington and Brighton were not commercially viable. Crambe is very heat sensitive and yields ranged from 700 to 850 lbs/A. National Sun has been considering a \$10/cwt contract so dryland production may be limited to areas of northeastern Colorado. Climatically, the Julesburg area appears conducive to crambe. Trials have not been successful in the San Luis Valley. Yields of 4,800 lbs/A compared favorably with our previous trial results of 2,400 lbs/A. Oil composition and yields of Colorado crambe have influenced National Sun to look at Colorado as a crambe production site. Planting will coincide with some barley production. National Sun is the only current crambe contracting company.

Safflower can be contracted in eastern Colorado. One company that has expressed interest is SVO Specialty Products, Another is Oilseed International Limited (Chuck Crowell, Sidney, Montana). □Johnson

## SPRING FERTILIZATION OF WINTER WHEAT

It is time to consider the need to topdress your winter wheat crop now. Winter wheat has a high demand for nitrogen after it breaks dormancy, especially after grazing and if nitrate levels are expected to be low and soil moisture is high, addition N would be beneficial. Colorado State University scientists have conducted fall and winter fertilization experiments on dryland winter wheat at several locations and results have indicated that nitrogen fertilizer can be applied in the fall, in the spring, or a combination of both successfully.

Some spring application may offer advantages to applying all the fertilizer in the fall as total rates can be adjusted by applying some in the spring. Farmers have the opportunity to examine their crop for yield potential, price of wheat, protein premiums, soil moisture, and cost of fertilizer before making decisions.

Fertilizer nitrogen applied to wheat should be based on a residual nitrate soil test taken to at least a depth of 2 feet. Soil sampling in the fall is preferred but if not accomplished, early spring sampling is acceptable. Nitrogen should generally be applied to wheat prior to April 15. Because of warmer temperatures, it may be advisable to have nitrogen applied between April 1-10.

There are many options when fertilizing wheat in the spring. Urea ammonium nitrate solution can be dribbled, surface banded, or spray broadcast, and is available and competitively priced. Ammonium nitrate is an excellent source although it is harder to obtain. Anhydrous ammonia can even be used for a spring application.

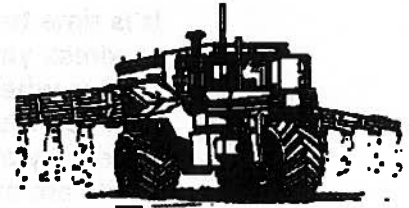
The use of ammonia is not necessarily limited to preplant fall applications. Ammonia can be spring-applied but the applicators need to be equipped with back swept ammonia knives, or narrow knives and coulters. Shank spacings of 15 to 18 inches and an application depth of 3 to 4 inches should produce good results. Few farmers may use this method but it can be done.

Because of improved formulation in recent years, ammonium nitrate is not preferred because of price. Over the years, however, with early spring top-dressing there seems to be little difference between the various nitrogen sources. Nitrogen in urea and nitrogen solution can be lost by volatilization, but conditions in the spring usually do not favor this loss. There is usually sufficient soil moisture and precipitation to move the fertilizer into the soil. The lower evaporation potential and cooler temperatures reduce potential loss of nitrogen by volatilization.

Nitrogen solution (28-0-0) and (32-0-0) work equally well as nitrogen sources for top dressing winter wheat. Nitrogen solution is often used as a herbicide carrier and broadcast sprayed. This method works well although the potential for volatilization of nitrogen from this method of application is greater than if the fertilizer were dribbled or surface banded. Generally we expect little difference between methods, although in some instances, dribbled may be better if there is higher potential for nitrogen losses.

*Consider crop's yield potential, price of wheat, protein premiums, soil moisture, and cost of fertilizer before making decisions for spring application of fertilizer.*

With the excellent soil moisture across the state, top-dressing nitrogen this spring should be desirable. Farmers should base the nitrogen application on a residual soil nitrate test. All of the nitrogen sources available will do a good job; however, farmers need to be comparison shoppers and look for the best bargain. Be certain that application equipment is working properly and is applying the fertilizer uniformly. □Follett



### **NEW CSU PINTO VARIETY - ARAPAHO**

Arapaho, a new pinto bean variety, has been released by the Colorado State University Experiment Station. Arapaho was released to provide bean growers with a pinto variety which has upright plant architecture, improved field tolerance to white mold, and good seed quality. Arapaho's upright growth habit is considered to be a factor which contributes to field tolerance of white mold, and also provides for a more porous canopy which enhances penetration of agrichemicals and application of irrigation water late in the growing season. Seed yield of Arapaho in the presence of severe white mold pressure is higher than Bill Z and many other widely grown pinto varieties in the western U.S. (Table 1). Arapaho had both higher seed yield and lower white mold incidence than Bill Z, UI-114, or UI-126 in eastern Colorado when white mold severely reduced seed yield during 1990. In the absence of white mold disease pressure, yield of Arapaho was similar to UI-114, but lower than Bill Z or UI-126 (Table 1). Arapaho is susceptible to the prevalent strains of rust in Colorado and the High Plains region. Arapaho is similar to Bill Z and UI-126 for reaction to both common

and halo blight. Seed size is similar to UI-114 and plant maturity was similar to Bill Z in Colorado (95-97 day).

Arapaho, as well as most upright pinto varieties, may lodge because of stem breakage near the soil surface. This situation is accentuated when plant populations are low. Therefore, growers should maintain plant populations above 72,000 plants/acre (60 lbs seed/acre). Hence, management practices for Arapaho are more sensitive than for other pinto varieties, especially in regions which have a history of white mold infection.

Foundation seed is available from the Colorado State University Foundation Seed Project, Fruita, CO. Limited Registered and Certified seed is available from Colorado seed producers in western Colorado. Plant variety protection will be sought under Title V of the Plant Variety Protection Act. Contact the Colorado Seed Growers Association for suppliers 303/491-6202. □Brick

***Arapaho, a new pinto bean variety, has been released that has upright plant architecture, improved field tolerance to white mold, and good seed quality.***

***Contact the Colorado Seed Growers Association (303/491-6202) for suppliers.***

Table 1. Mean seed yield and disease reaction of Arapaho and other commercial pinto bean varieties.

Variety	Eastern CO, 1990 (3)*		Scottsbluff, NE 1992			Coop Dry Bean Nursery	
	Yield lb/A	White Mold %	Yield	Halo %	Common %	1985(18)*	1991(26)*
Arapaho	2140	46	1963	7	10	2908	2497
Bill Z	1920	70	2448	1	23	3100	---
Othello	1893	56	1841	8	34	---	---
UI-114	1521	77	1632	7	43	2792	2387
UI-126	1703	76	2164	3	27	---	---

\* Number in parenthesis indicates the number of locations tested in that year.

### FERTIGATION - IS IT FOR ME?

Fertigation is defined as applying fertilizer with irrigation water for crop use. There are many methods of fertigation; some are desirable and others are wasteful and environmentally incorrect.

Those which are desirable would include all enclosed pressure systems such as sprinkler or other systems adapted to gated pipe such as surge. Using these techniques, fertilizer can be accurately metered on growing crops without excessive leaching or runoff.

#### Advantages of fertigation:

- Nitrogen leaching controlled
- Improved fertilizer application accuracy
- Fertilizer applied at optimum stages improving uptake efficiency.
- Reduces soil compaction
- Reduces mechanical plant damage

Water provides accurate nutrient placement in the root zone. This is easier on single set systems such as the center pivot because fertilizer injection is continuous for the entire field. Surge system injection must have a short injection period during one or more cycles for each set.

Fertilizer injected with water can be applied closer to the time the crop requires it as compared to fertilizing in the fall or spring. By applying fertilizer during peak uptake periods, one can get by with less nitrogen. Corn, for example, takes up most of its nitrogen between the 6 inch stage and tasseling.

Fertilizer application can be injected during bad weather if necessary as opposed to traveling through the field with heavy equipment.

**Desirable methods of fertigation include:**

**center pivot  
tow line sprinkler  
surge**

Liquid nitrogen (UAN) and/or ammonium polyphosphates (APP) are the most common types of fertilizer used with fertigation. Of course, soil and water tests are necessary to determine the exact amounts of nutrients needed to be applied per acre and to know the compatibility of fertilizer with the quality of your water to prevent problems with aluminum pipe.

How does a person know how much to apply over how long a time period? Calibration of your system is simple. Each step is explained:

1. Desired application rate (lbs/acre) equates to the amount of nutrient desired per acre. *In this example, use 40 lbs of nitrogen per acre.*
2. Total irrigated acres in set (acres) is the set size being irrigated with fertilizer-treated water. If surge is used, then calculate acres by knowing row number, row width, and length of the field. A set having 46 rows (30" wide) running for 410 feet distance equals a 2 acre set. One acre contains 43,560 square feet. For a center pivot, the set size would be the entire circle. *Use 2 acres in this example.*
3. Length of time for set (hours) is time required to inject fertilizer during the set. If a center pivot was used, time would equal that time required to complete the circle. *Use 3 hours for this example.*
4. Concentration of fertilizer (lbs/gal) is the pounds of nutrient in one gallon of fertilizer. To determine this, you need to know the weight of one gallon of fertilizer. Then multiply the % nutrient. *For this example, 28% x 11 lbs/gal for UAN. This equals 3.08 lbs of nitrogen for one gallon.*

The following formula is used to calculate the rate of injection in fertilizer gallons per hour.

$$Gal/hr = \frac{(lbs/acre) \times acres}{time \times (lbs/gal)}$$

By substituting the values described above, it is determined that we would need to inject 13.3 gallons of 28-0-0 per hour to apply 40 lbs of nitrogen per acre using a 3 hour application time.

$$Gal/hr = \frac{40 \times 2}{3 \times 2} = 13.3$$

□Croissant

#### THE COST OF CERTIFIED SEED

Even though wheat seed costs normally average 5 - 6% of crop inputs, many growers refuse to spend a few extra cents per acre to plant certified seed. Many farmers believe they can produce seed cheaper and as good as certified seed. In many cases, growers can use the same parent seed and apply the same seed production techniques that certified seed producers use, but a real cost comparison will show that cost differentials are not that great and seed quality will still be lower. The comparison in Table 2 involves costs involved in 3 examples: 1) purchase of certified seed, 2) purchase of quality uncertified seed, 3) quality uncertified seed produced on your own farm for your own purpose. Columns 1 and 2 are planted with registered seed. Column 3 is planted with foundation seed; all cleaned seed retained and planted within 3 planting seasons. We assume that each lot is



sown on an 80 acre dryland field, produces 35 bushels per acre of raw product, and receives the same amounts of fertilizer, weed, and insect control. Seeding rate is assumed to be 50 lbs. per acre on each field. Seed is conditioned over an air/screen cleaner and a length grader with a 20% cleanout for certified, 12% for uncertified. Basis is figured from expected time of sale. Figures listed are based on costs obtained from an actual seed company. Those examples are realistic, but you may want to substitute your own cost in the table. In addition to cost considerations, Table 3 contains some further comparison involving quality considerations between certified and the uncertified seed.

Table 2. (Footnotes are explained on the next page)

END PRODUCT:	CERTIFIED (1)	PURCHASED (2)	HOMEGROWN (3)
<b>A. EXTRA COST OF SEED<sup>1</sup></b>	.149	.149	.488
<b>B. CERTIFICATION FEES</b>			
1. Membership	.01	---	---
2. Field Inspection <sup>2</sup>	.10	---	---
3. Seed Analysis	.01	.01	---
<b>C. SANITARY PRACTICES</b>			
1. Labor for Equip. clean up <sup>3</sup>	.10	.05	.02
2. Field Roguing <sup>4</sup>	.03	.01	.01
<b>D. SEED CONDITIONING</b>			
1. Conditioning fee	.50	.35	.35
2. Clean out loss <sup>5</sup>	.25	.15	.15
<b>E. OVERHEAD<sup>6</sup></b>			
1. Advertising	.25	.10	---
2. Utilities	.08	.08	.08
3. Office	.20	.10	---
4. Load out	.10	.10	.10
5. Carry over <sup>7</sup>	.05	.05	.40
6. Bad debt <sup>8</sup>	.09	.09	---
7. Grower premium	.50	.50	---
<b>F. BASIS<sup>9</sup></b>	2.90	2.90	3.40
<b>COST OF PRODUCTION</b>	<b>\$5.32</b>	<b>\$4.64</b>	<b>\$5.00</b>
<b>SALE PRICE</b>	<b>\$5.50</b>	<b>\$3.90</b>	<b>\$5.00</b>

## FOOTNOTES

1. Bin run seed cost is assumed to be \$4.60 per bushel. Seed rate of 50# per acre results in a cost per acre of \$3.83. Column 3 cost for Foundation seed of \$17.50 per 50#. Column 1 and Column 2 price is based on \$8 per 50 lbs. for Registered seed.
2. Assumes an ASCS proven yield of 32 bu./Acre multiplied by 60 lbs. divided by 100 multiplied by 15 cents, or \$2.88 per acre, multiplied by 80 acres and divided by final cleaned product bushels of 2240. (.103)
3. Assumes \$30 labor to clean drill, \$60 to clean combine, \$35 to clean grain bin, \$70 to clean down cleaners, \$15 each to clean augers and trucks. Total of \$225 divided by final product bushels of 2240 to arrive at figure used for certified production and 1/2 of that time for Column 2 production and 1/4 for Column 3.
4. Assumes 10 hours @ \$7 per hour for certified and 3 hours for Columns 2 and 3.
5. Assumes 2% outright loss (non-usable cleanout dockage), and a 20% dockage on remaining cleanouts. Raw product is 2800 bushels multiplied by 2% is 56 bushels lost. 504 bushels of cleanout product remains after a cleanout of 20%. Of that 504 bushels, 20% of ordinary market value is lost. 20% of \$3.50 (ordinary wheat price) is .70 cents per bushel multiplied by 504 bushels equals \$352.80. Add \$352.80 with \$196 loss on un-usable cleanouts, for a total cleanout loss of \$548.80. Divide by final product bushels of 2240 to arrive at figure used for certified seed. Less precision cleaning for uncertified seed means less cleanout loss.
6. Reflects some expenses of a typical seed company. Additional consideration should be given to other problems and expenses such as: Insurance cost (general liability, errors and omissions, workman's compensation, unemployment, etc.), Weighing expenses (cost of scales or scale rent), professional membership fees (ASTA, CFGA, CSA, WBF, NFIB, etc.), extra storage expenses incurred by the nature of the seed business (seamless bins, added cost for several small bins instead of one large bin in order to accommodate varietal separation), specialized equipment costs (vacuum cleaners, compressors, special conveyors, etc.). In addition, compliance with OSHA and EPA regulations can be added expense.
7. Assumes 5% carryover. Storage is assumed to be .40 cents per bushel per year. Lost interest on carryover is figured at \$4.58 per bushel multiplied by 12%. Homegrown seed in Column 3 is figured on 1/3 being stored one year and a second 1/3 stored two years.
8. Assumes 1.5% bad debt at a value of \$6 per bushel.
9. Market for seed wheat is in August and September and the price for Columns 1 and 2 reflect the commercial price at that time. The alternative for homegrown wheat is for sale when markets are higher, therefore the higher basis price in Column 3.

**Table 3. Comparison of Seed Sources**

	CERTIFIED (1)	PURCHASED (2)	HOMEGROWN (3)
A. Quality Seed Production Practices	✓	✓	✓
B. Independent Field Inspection	✓	NO	NO
C. Quality Conditioned	✓	?	?
D. Seed Analyzed	✓	✓	NO
E. Varietal Purity Assured	✓	?	✓?
F. Legal PVP Varieties	✓	NO	✓
G. Guaranteed Free of Noxious Weeds	✓	NO	NO
H. Independent Quality Control	✓	NO	NO

**WHAT ABOUT TOMORROW?**

***The seed is the most basic and fundamental component of agriculture.***

A new video has been released which questions whether new seed varieties will be available to producers in the future. "What About Tomorrow?" is a 10 minute video that discusses concerns such as the cancellations of some major breeding programs and U.S. research dollars and products finding their way into foreign markets. The number of wheat breeders in the U.S. has plummeted by 50% in less than 10 years. Funding for public research programs continues to decline.

Yet, research for new seed varieties is critical to keep U.S. producers competitive in international markets. Over 60% of yield improvements come through genetic advances. Biotechnology will bring new and improved varieties to farmers in other parts of the world, and U.S. research must keep pace.

The video explains how farmers and seed companies benefit when plant breeders' rights are protected through

Plant Variety Protection, indirectly providing necessary funding for continued research and development of new varieties. Through the national Plant Variety Protection Act (PVPA), new varieties are "protected as the intellectual property of the plant breeders, allowing them to maintain a reasonable return on their investment and research dollars. If Plant Variety Protection is violated, future seed varieties are jeopardized.

"The benefits of Plant Variety Protection go first to the American farmer," according to Tom Lutgen, Chairman of the "What About Tomorrow?" Committee which developed the video. PVPA protects the farmer by assuring that the variety he plants is legal seed and has all the enhancements that were intended by the breeder. More importantly, it helps to ensure him of seed for future crops. The seed is the most basic and fundamental component of agriculture. The farmers' earliest decisions hinge on seed selection, quality, and

expectations. The seed industry and the farmer share a unique partnership, each relying on the other and each contributing to America's economic health."

"What About Tomorrow" is available for loan through the Colorado Seed Growers Association office. This 10 minute video would be an excellent addition to any Extension program involving individuals involved in production agriculture. Contact me at 303/491-6202 to arrange to use "What About Tomorrow".

Stanelle

**Where trade names are used, no discrimination is intended, and no endorsement by the Cooperative Extension Service is implied.**

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