

AGRICULTURE

Golden Plains Area Newsletter

JUNE 2018

Low-Interest Loans Available for Agricultural Producers in Colorado Impacted by Natural Disasters

(Denver, CO) May 17, 2018 – Agricultural producers in Colorado who lost property in two recent natural disasters are eligible for physical loss loans from the U.S. Department of Agriculture (USDA). USDA's Farm Service Agency (FSA) offers these loans for losses caused by fire, blizzard and high winds.

FSA is offering these low-interest emergency loans to producers with a qualifying loss in the counties named below. Approval is limited to applicants who suffered severe physical losses only, including the loss of buildings and livestock. The deadline for producers in designated and contiguous counties to apply for loans for physical losses in Jan. 9, 2019

Fire and High Winds:

An Administrator's Physical Loss Notification was issued for the primary damaged area of Baca, Chaffee, El Paso, Las Animas, Prowers, Pueblo and Washington counties in **Colorado**, due to excessive fire and high winds that occurred February 13 Through April 19, 2018.

Additionally, producers in 23 contiguous **Colorado** counties may be eligible for programs based on this designation. The contiguous counties are: Adams, Arapahoe, Bent, Costilla, Carson, Lake, Lincoln, Logan, Morgan, Otero, Park, Pitkin, Saguache, Teller and Yuma.

Producers in the contiguous counties of Greeley, Hamilton, Morton and Stanton in **Kansas**, along with Colfax and Union in **New Mexico** and Cimarron in **Oklahoma**, may be eligible for emergency loans.

Blizzard and High Winds:

An Administrator's Physical Loss Notification was issued for the primary damaged area of Kit Carson, Logan, Phillips, Sedgwick, Washington and Yuma counties in **Colorado**, due to a blizzard and high winds that occurred April 13 through April 14, 2018.

<http://goldenplains.colostate.edu>
<http://www.ext.colostate.edu>

Dennis Kaan, Area Director
Area Community Development Agent
Washington County Office
(970) 345-2287

Ron Meyer
Area Agronomy Agent
Kit Carson County Office
(719) 346-5571

John Spring
Agronomy, Weed Management
Sedgwick County Office
(970) 474-3479

Linda Langelo
Area Horticulture Program Associate
Sedgwick County Office
(970) 474-3479

McKensie Harris
Area Livestock Agent
Yuma County Office
(970) 332-4151

Joel Schneekloth
Regional Water Resource Specialist
Central Great Plains Research Station, Akron
(970) 345-0508

Dr. Brent Young
Regional Agriculture and Business
Management Specialist
Regional Engagement Center, Sterling
(970) 522-7207

Dr. Assefa Gebre-Amlak
Regional Crop Protection,
Pest Management Specialist, Fort Collins
(970) 491-2666



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Colorado State University, U.S. Department of Agriculture and Kit Carson, Phillips, Sedgwick, Washington, and Yuma Counties cooperating.

Extension programs are available to all without discrimination.

Additionally, producers in six contiguous **Colorado** counties may be eligible for programs based on this designation. The contiguous counties are: Adams, Arapahoe, Cheyenne, Lincoln, Morgan and Weld.

Producers in the contiguous counties of Cheyenne, Sherman and Wallace in **Kansas**, along with Chase, Cheyenne, Deuel, Dundy, Kimball and Perkins in **Nebraska**, may be eligible for emergency loans.

About Physical Loss Loans

Physical loss loans can help producers repair or replace damaged or destroyed physical property

essential to the success of the agricultural operation, including livestock losses. Examples of property commonly affected include essential farm buildings, fixtures to real estate, equipment, livestock, perennial crops, fruit and nut bearing trees, and harvested or stored crops and hay.

Please contact FSA for more information on loan eligibility and the application process. FSA office information is available at <http://offices.usda.gov>. Additional FSA disaster assistance program information is available at <http://disaster.fsa.usda.gov>

AGRONOMY

PestSweep!

R.F. Meyer, Golden Plains Area Agronomy



Colorado State University Extension conducted a pesticide recovery and disposal program in an effort to target unwanted and un-labeled pesticides. This program contracts with a hazardous waste company to transport and dispose of pesticides recovered. Collected wastes totaled approximately 2209 pounds. Pesticides included Furadan and Endrin,

pesticides that have been off label for quite some time. This project has completed its third year and has collected a total of approximately 7000 pounds of unwanted pesticides. Pictured are Golden Plains Area Extension Agents Dennis Kaan and John Spring.

Corn Planting

Ron F. Meyer
Area Extension Agent
(Agronomy)

Since soil temperature, stand establishment and uniform emergence are all key considerations when attempting to determine an optimum corn planting window, early plantings are generally discouraged when significant acreages are involved along with cold soil temperatures. Agronomy professionals agree that the optimum corn planting window will be related directly to a consistent soil temperature of around 50 to 55° F at the two-inch soil depth.

Traditionally, these consistent soil temperatures occur between late-April through early-May. Cool soils often result in a lengthy germination period, corn emergence can often times take over three weeks from the time of planting to full stand establishment when soils are not able to warm in the spring. Table 1 outlines the approximate days to seedling emergence based on various, consistent, soil temperature ranges:

Table 1: Days to emergence based on soil temperature.	
Soil Temperature	Approximate Days to Corn Emergence
50° F.....	25 – 20 Days
55 - 60° F.....	14 – 10 Days
65 - 70° F.....	8 – 5 Days
75 - 80° F.....	4 Days

Under cold weather conditions or fluctuating soil temperatures, the coleoptile (shoot) still emerges from the seed, but rather than growing upward towards the soil surface, it twists or curls around the seed. The unusual growth pattern of the coleoptile is in response to cold soil conditions; this type of growth alone is usually not cause for alarm. Once soil temperatures improve, the coleoptile will “right” itself and grow towards the surface, where it splits open when exposed to sunlight, allowing the first leaves to emerge.

Corn may leaf out underground for a number of reasons. A cloddy seedbed or improper closure of the seed furrow may allow light to penetrate below the soil surface. If light reaches the emerging coleoptile (spike) underneath the soil surface, it may rupture, causing the leaves to unfurl. Cold soils and compacted and/or crusted soils can also lead to

leafing out underground. Some herbicides can occasionally magnify the corkscrew problem with the soil conditions mentioned above.

Once corn is emerged other issues can express themselves due to cold weather. Purple Corn Syndrome shows up in a handful of cornfields nearly every year. This purple leaf color results from the expression of genes for anthocyanin pigment formation. Most corn hybrids contain 5 of the necessary 8 genes required to produce this purple color, while the other 3 genes are present in only certain hybrids suggesting this attribute is a “genetically inherited” trait more prominent in certain hybrids over others.

Since several of these genes are cold sensitive, overnight temperatures in the 40s with daytime highs in the 60s are often sufficient to trigger a purpling effect on corn leaves. These temperature

sensitive genes are only expressed in seedlings prior to the six-leaf stage of growth, and the early corn developmental stage often coincides with the same period most likely to have lower temperatures. Corn usually outgrows the “purple” condition by the time it is 12 inches tall. Green color recovery occurs quickly if weather remains conducive for rapid growth or slows if conditions remain cool enough to retard root and shoot growth. Technically speaking, the cold soil condition ties up phosphorus and restricts the corn plant from this

nutrient’s uptake. Some corn hybrids do not respond well when this occurs.

Realizing that cool temperatures, not the purple pigment itself, results in slow plant growth is important. Extensive research has been conducted on purple corn with no negative yield implications observed. When the weather warms, corn plants turn green and begin to outgrow this issue.

Source: Pioneer Hi-Bred Intl’.

CSU’S AgDRIP

Ron F. Meyer
Area Extension Agent
(Agronomy)

R.F. Meyer, Golden Plains Area Agronomy

Groundwater use and availability are a key issue for the vitality of our region. In an effort to gather information about how groundwater is used over the course of the growing season, researchers at Colorado State University are initiating a new program titled the Agricultural Data Reporting and Incentives Program (AgDRIP). This voluntary program will attempt to collect monthly groundwater use information from individual irrigation wells operated by Plains Groundwater District agricultural producers. The water use information collected will be used to compare crop yields which will contribute to the understanding of how differences in seasonal water use influence crop production. High capacity wells in the Plains Groundwater Management District are eligible to

enroll in the reporting program, which will provide financial incentives to producers that choose to participate. The program is supported by the US Department of Agriculture and will run from March through December of 2018. No well-specific groundwater information from the project will be shared with state or federal agencies. Invitations with additional details about the program have been sent to eligible irrigated landowners. **This Colorado State University research project is voluntary.**

For more information about the project, please visit the project’s website (www.AgDrip.org) or contact CSU Extension Agent Ron Meyer (RF.Meyer@colostate.edu) or Professor Jordan Suter in CSU’s Department of Agriculture and Resource Economics (Jordan.Suter@colostate.edu).

Wheat Production And Protein

RF Meyer

Can we influence protein contents with wheat production management strategies? Last season the wheat market needed protein content and was

willing to pay premiums for it. However, many of our wheat fields tested low for protein and consequently, price discounts were assessed to

wheat loads delivered to elevators. Those fields that had acceptable protein levels were paid a premium and as a result, some growers are interested in managing wheat fields for better protein levels.

First, research has found that there is an inverse relationship between yield and protein levels. As wheat yields increase, protein levels tend to decrease. A simplified explanation for this phenomena is that high yields are the result of extra starch accumulation within wheat kernels. This extra starch essentially “dilutes” protein content. Wheat yield is directly correlated with starch content of wheat kernels. As the starch content increases during grain fill, kernels get heavier, which increases test weight and leads to more yield (produced pounds per acre increases). Wheat kernels contain approximately 65% starch and this starch content is extremely sensitive to the growing season’s environment at the end of the season.

Wheat kernels contain approximately 8 – 15% protein. Protein levels are a direct function of the amount of nitrogen within the plant during later stages of production. In fact, protein tests made on wheat kernels measure the nitrogen content to determine protein levels. Protein begins accumulating within kernels during grain fill.

Research has found that 10 days after flowering protein begins to accumulate in kernels and by 20 days after flowering 50% of protein has been placed into developing kernels. During this time, starch is also being deposited into kernels. Growing conditions and adequate nitrogen amounts after wheat plants flower determine protein levels in grain. Excessive heat and drought during this grain filling time period lowers the amount of starch deposited into kernels which increases protein percentages. Better than average moisture conditions during grain fill will consequently lower protein percentages.

Can protein levels coming off a wheat field tell us if nitrogen was yield limiting? Colorado State University researchers found a direct correlation that suggest protein levels in wheat are tied to nitrogen management. As a result, the rule of thumb for nitrogen management is as follows: wheat fields testing less than 11.1% protein had yield limiting low levels of nitrogen fertilization. Wheat fields that have grain protein levels above 12% may not have been yield limited by nitrogen fertilization.

Table 1: Guidelines for interpreting winter wheat grain protein-nitrogen nutrition levels in Colorado.

Protein level	Interpretation
< 11.1%	Yields may be significantly limited by nitrogen deficiency. More nitrogen fertilizer would probably increase yields and protein content.
11.1-12.0%	Yields may have been limited by nitrogen deficiency. Applying more nitrogen fertilizer may increase yield but will increase protein content.
> 12.0%	Yields were probably not limited by nitrogen deficiency. Application of more nitrogen probably will not increase yield but will increase protein content.

Source: RJ Goos, et. al. , Colorado State University

Can we fertilize to influence protein in wheat? 80% of a wheat plant’s nitrogen accumulation is taken up prior to flowering. However, that leaves 20% of a plant’s nitrogen needs taken up after flowering and during grain fill. Researchers at Oklahoma State University have found that late applications of nitrogen can increase protein levels in wheat. These researchers applied nitrogen to wheat test plots as late as the flag leaf stage (right before heading) and found that later nitrogen applications increased

protein contents. These later applications increased wheat yields only slightly, but increased protein contents more. The application method was liquid nitrogen streamed onto fields. Nitrogen fertilizer type did not matter, but actual nitrogen amounts applied did matter. Better protein boosts were noted with rainfall received right after nitrogen applications. Protein levels were increased by 0.05% protein content per pound of nitrogen

applied. Therefore, it took 20 pounds per acre actual nitrogen to raise protein levels 1%.

Similar protein results could be achieved with adequate nitrogen fertilization earlier in the growing season. Many wheat fields are fertilized early in the spring with herbicide applications. Adequate nitrogen applications at this time of the growing season would affect protein levels also.

Soil and plant tissue tests will determine nitrogen amounts needed. Setting realistic yield goals and knowing current nutrient test levels will keep applications near economic levels.

Keep in mind that yield should drive crop input decisions for each field. Planting varieties that are proven to be adapted to our area and protein. Protein levels are a direct function of the amount of nitrogen within the plant during later stages of managing other inputs such as weed and disease issues need to have production priorities first. Protein premiums are not consistent but there are nitrogen management decisions that can affect protein contents when protein production is profitable.

Source: Brian Arnall, Oklahoma State University

Replanting Options after Hail

R.F. Meyer, Golden Plains Area Agronomy

Summer hail storms can cause considerable damage to area crops. Management decisions for severely hail-damaged fields can include the following; abandon cropping for this summer and fallow, or, replant with a crop that will mature before the first fall frost. Available soil moisture, previous herbicides applied, and crop insurance can all influence replanting decisions.

For dryland crop production, soil moisture is a critical factor when deciding to replant. A general rule of thumb (though not scientific) is: 2 feet of available soil moisture is the minimum needed to begin a crop, with moisture to 4 feet being ideal. But, even with a 2 foot soil profile near saturation, adequate rainfall is essential for the remainder of the growing season to provide acceptable yields. Soil samples from 4-foot profiles throughout fields in question will determine whether adequate soil moisture exists for replanting success.

Previously applied herbicides also are important to consider. Fields with some sulfonylurea herbicides such as Ally have strict crop rotation restrictions. These restrictions are printed on the label and must be followed.

When hail damage occurs after June 1, recrop options become somewhat limited due to a limited

growing season, however, there are a few acceptable crops that will mature. Irrigated fields can be re-planted with dry-beans, sunflower, millet, early season corn or a feed crop. If corn is the crop desired for replanting then a general deadline is June 15 and consider varieties of 85 days or less in maturity. Corn should not be an option later than mid-June. Fields that are replanted after mid-June consider millet, sunflower, or a feed crop. Millet has been grown in the High Plains for quite some time and its short maturity makes the crop a viable option. Sunflower has also shown promise in University testing. Colorado State University Extension studies suggest sunflower planted as late as July 6 has matured satisfactory (Meyer, Pilcher and Peairs). Although somewhat lower in yield and quality, late planted sunflowers can still produce quite well, offering a salvage crop to a farm with weather-destroyed crops. If a feed crop is the choice, have markets in place or be able to use the production in your own operation. Late planting options exist, however, keep in mind that late season rainfall is needed to bring this cropping strategy to harvest.

Palmer Amaranth Biology

Palmer amaranth (*Amaranthus palmeri*, also called Palmer pigweed) is one of the most concerning and rapidly spreading weeds in the United States today. It has been a problematic weed in parts of the southern Plains for decades, but is probably best known recently for severe disruption to cotton and soy production in the Southeast. In the last few years it has been rapidly expanding into the Midwest. It has also been present in northern Colorado for some time, but has remained a relatively minor weed so far. Nonetheless, given its history of rapid adaptation and aggressive interference elsewhere, it should be watched closely.

Originally native to the deserts of the US southwest and northern Mexico, Palmer amaranth is well adapted to hot, dry growing conditions. Germination of Palmer amaranth doesn't usually begin until average soil temperatures exceed 60 F, typically in late May or early June in the Golden Plains. Once it begins however, individual seeds germinate rapidly and grow quickly. To give an idea of its relative abilities, a study done at Kansas State University found that Palmer amaranth seeds germinated in about 1/6th the time it takes redroot pigweed. Once emerged, Palmer amaranth seedlings grew twice as fast as redroot pigweed under typical summer temperatures. This rapid emergence and early growth gives not only a major competitive advantage, but also shortens the window of opportunity for effective chemical control of smaller plants.

Underlying this rapid growth is Palmer amaranth's ability for extremely efficient photosynthesis under hot, dry conditions. It can continue full rate photosynthesis long after high temperatures and drought stress shut down most other plants. Palmer amaranth has several uncommon biological adaptations to further maximize photosynthetic ability. It is *diaheliotropic*, meaning that its leaves move to track the sun over the course of the day in order to maximize the amount of sunlight gathered. Its leaves are also arranged symmetrically around the stem to maximize light gathering, and minimize the amount of shade that upper leaves cast onto lower leaves. Very few other plants (including the other

pigweeds) have either adaptation, making Palmer amaranth more efficient than even closely related species.

Another trait that makes Palmer amaranth particularly difficult to control is an extended period of emergence – from the time soil temperatures first warm in late May continuing until early September. Weeds that emerge before planting or early in the growing season can usually be controlled with appropriate inputs, but late-emerging weeds are often able to avoid control measures entirely. By the time they come up, crops are too large for any further herbicide application or cultivation, and the activity of soil residual herbicides applied at planting or early crop stages has declined. While the competitive ability of late emerging weeds with the crop is generally reduced, Palmer plants emerging as late as mid-August can still produce substantial amounts of seed before the first frost.

The most troublesome aspect of Palmer amaranth biology, however, is probably its tremendous ability to quickly evolve in ways that allow it to expand into new regions and new crops, and to evolve ways to resist or avoid our efforts to control it. Palmer amaranth has high levels of genetic diversity as a species. It also has separate male and female individuals, meaning that it has to cross-pollinate in order to produce seed. As a result, its high genetic diversity is constantly reshuffled into new and unique combinations in each generation, allowing rapid adaptation to new environments or new control efforts. A reasonable analogy for this might be trying to 'crack' a combination lock – if enough combinations are tested, eventually the right one will be found and the lock opened. Palmer amaranth can try 'combinations' much faster than most other weeds due to its reproductive biology, making it particularly good at adapting.

The most obvious case of this rapid adaptation is the evolution of herbicide resistance. Across the US, Palmer amaranth has been found with resistance to 6 herbicide modes-of-action. Even more troublesome, cross pollination has created multiple resistant populations (resistant to two or more herbicide modes of action). Palmer amaranth populations resistant to both glyphosate and ALS-

inhibiting herbicides are widespread across the country, although the resistance status of populations in Colorado is currently unknown.

Although herbicide resistance is the best known example, Palmer amaranth has adapted in other ways too. An interesting example of this can be found in a comparison of growing season length requirements of Palmer amaranth populations from Nebraska and Arkansas. Nebraska plants flowered and produced seed more quickly than plants from Arkansas. When grown over the whole summer (a long growing season) Arkansas plants grew larger and produced more seed. However, when plants emerged later in the summer (a short growing season), the plants from Arkansas produced very little seed, while the Nebraska plants were still able to make a fair amount of seed with the short season. This situation is similar to matching the proper crop maturity class to a specific growing environment. As Palmer amaranth moved from South (with long growing seasons) to North (shorter growing seasons) it appears that it was able to evolve short-season 'varieties' better adapted to its new environment. As previously mentioned, weeds that emerge late in the growing season are often able to avoid control, making this trait doubly advantageous.

Over the last 50 years, Palmer amaranth has become one of the most problematic and worrisome weeds across the Southern US, and it continues to expand northward aggressively. High competitive ability under hot, dry conditions is part of its success, as is herbicide resistance. Perhaps more importantly, however, is its remarkable ability to quickly adapt to new regions and new environments. Even though it has not yet become a major weed in the Golden Plains, it is one that should be watched and managed carefully. The threat of herbicide resistance is reason enough to keep a close eye on it, but the fact that the Palmer amaranth we have in 5 or 10 years will be different (and probably worse) than what we have now is even more so.

Pigweed Identification

There are 5 species of pigweed likely to be found as weeds of cropland in northeast Colorado. Pigweeds are all members of the genus *Amaranthus*, consequently they may be also be referred to as 'amaranths'. They are also all fairly closely related and can often be difficult to distinguish, particularly

as seedlings. It is important to be able to do so, however, as there can be important differences in how they are managed according to which species are present. A brief list of identifying characteristics follows.

- Redroot pigweed (*Amaranthus retroflexus*)
Stems and leaves are covered in fine hairs, giving them a rough-ish texture. None of the other common pigweed species have hairs.

- Tumble pigweed (*Amaranthus albus*) and prostrate pigweed (*Amaranthus blitoides*).
Both species have much smaller leaves than other pigweeds. Leaves are usually egg-shaped, and commonly have a waxy appearance, and 'wavy' or 'crinkled' edges. Neither species has a distinct flower head, instead small, inconspicuous flowers are held at the base of leaves throughout the plant. Prostrate pigweed grows low to the ground in a spreading manner, while tumble pigweed usually grows in a rounded or ball-like shape (similar to Russian-thistle).

-Palmer amaranth (*Amaranthus palmeri*), and common waterhemp (*Amaranthus rudis*).
These species look very similar and are often confused. Neither has hairs on the stems or leaves, leaving them smooth to the touch, and relatively easy to distinguish from redroot pigweed (which is hairy, and feels rough). Leaves are much larger than prostrate or tumble pigweeds. The most reliable way to distinguish Palmer amaranth from waterhemp is the length of the petiole (the leaf stem). On true leaves of Palmer amaranth, the petiole is longer than the leaf blade. On those of waterhemp, the petiole is shorter than the leaf blade. Of the two, Palmer amaranth is typically much more aggressive. It is also more likely to be found in dryland or otherwise dry conditions. Both species are commonly resistant to both glyphosate and ALS-inhibitor (Group 2) herbicides in the rest of the country. Until shown otherwise, it would be prudent to assume they are probably resistant to these herbicides in Colorado too.

Redroot, tumble, and prostrate pigweed are long-established weeds in our area, and good control options are generally available. Palmer amaranth and waterhemp, on the other hand, are relatively new to the area, and much more problematic in other regions. For these reasons, they should be managed aggressively. Since both of these species likely have some herbicide resistance wherever they

are found, and are known for rapidly developing new resistance, they should be treated carefully in this regard. Don't rely on a single mode of action to control them, especially glyphosate. Tank mixing is highly recommended.

Pigweed seed is small, and has no special dispersal mechanisms. It is spread from field to field mostly on vehicles and equipment, especially combines. If Palmer amaranth or waterhemp is present in a field, make an effort to clean equipment before it goes from the infested field to a clean one. If possible, harvest clean fields first and weedy ones last to minimize the number of cleanings. Control of plants on field edges and roadsides is another important sanitation measure to prevent long distance spread. Lastly, good information is key to

making good decisions – so scout carefully and follow up when needed!

Looking for perennial grass weeds in chemical fallow.

I would like to establish some field trials investigating improved herbicide options for control of native perennial grass weeds in no-till fields. Prairie three-awn, windmill-grass, and prairie dropseed are the species of primary interest. If you have issues with these (or other) perennial grasses I would greatly appreciate the chance to talk with you about it. If you are interested in the project, please contact me: John Spring, john.spring@colostate.edu, (970)474-3479. Thank you!

HORTICULTURE

Lawns

Linda Langelo, CSU Horticulture Program Associate

It is almost that time of year when we start to mow our lawns. I find it to be great exercise rather than a chore to cross off the weekly list. There is nothing like the smell of a freshly mowed lawn. Here are some suggestions about how to keep the lawn healthy while enjoying a freshly mowed lawn. Healthy lawns have fewer disease, pest and insect problems. Healthy lawns are high maintenance. Like life, timing is everything with keeping the lawn healthy.

One easy reminder before starting to mow for the season, is to be sure to only mow off 1/3 of the blade of grass each and every time you mow. Why? The grass becomes stressed. Removing more than 1/3 of the blade each time encourages the grass roots to dry out and to have fewer cells to use for photosynthesis. Even though we fertilize the lawn, grass still transforms sunlight or radiant energy into sugars and starches for food.

Keeping the mower at a consistent height can help you with the removal of 1/3 of the blade only if, you consistently mow at regular intervals. If you decide to skip mowing for a week, the grass keeps growing taller blades. Then you are long past

removing a 1/3 of the blade. If this happens, you could always mow and cut off some of the blade. Then return in a couple of days with the mower at three to three and a half inches and mow again. I am assuming you have not allowed your grass to grow several inches tall such as eight or nine inches or more. If the grass is about four and a half or even five inches, that is one thing. Any taller and it might as well be pasture.

Why is the number three or three and a half inches the proper height for grass in the summer? A three inch grass blade has the ability to shade the crown of each grass plant. This height will also allow the grass to hold more moisture. The greatest benefit on a very hot summer's day is at three inches the grass can stay cooler. Benefiting from shade and coolness allows the soil moisture to go further. This is money in your pocket. Instead of watering frequently every day for 20 or 30 minutes, you can water maybe two or three times a week. In some cases, with clay soil, watering can be extended to maybe once or twice a week. Clay soils retain moisture longer, due to their structure.

Find out what type of soil structure you have. You can do this by getting a soil test done which is recommended every few years. Healthy grass needs the proper amount of water. Too much or too little causes issues. Again, improper watering causes stress on the grass. The best watering practice is to water deeply and less frequently. Understanding the soil's structure gives you an indication of your soil's water holding capacity. Sand drains quickly while loamy soils have good drainage while not draining too quickly. Loamy soils have more nutrients and moisture over sandy soils. Clay soils are high in nutrients but are dense and compact. Naturally, they will drain very slowly. So in terms of speed, sandy soil drains the quickest, then loam, then clay.

What is the best grass to grow in sandy soil? Fescue is the best grass for sandy soil. Kentucky Blue grass prefers a clay-loam mixture. Buffalo grass will grow in most any soil with the exception of very coarse sandy soils.

The grass will have a more developed and deeper root system in the soil when the grass is watered deeply and fertilized properly. The best time to fertilize your lawn is in September and October/November. This allows the roots to store the food in their root systems during the winter. This follows the natural cycle of how all plants

behave in the fall. They send sugars and starches into the root system to store until conditions are right in the spring. Then these sugars and starches are used to grow vegetative growth in the spring. Adding more food/fertilizer on your turf in the spring increases the growth, adds to the mowing frequency, and does little to support a healthy root system. So late spring and early summer or summer fertilizations are not necessary. They stress the grass. This causes diseases such as dollar spot, leaf-spot and melting out diseases which are mostly spring diseases.

Here is how these diseases happen. You apply nitrogen to your turf in April or May when you start to see the grass growing. New grass blades begin to grow. New grass is vulnerable and more susceptible to disease. These diseases lie dormant in the soil until there is a change in weather or temperature. Applying more nitrogen to the grass encourages more new grass blades to grow. Then you have more grass that is susceptible to disease. This adds up to creating the environment to keep the disease cycle going. The grass is not actively growing in the fall as it is in the spring. This means there is less grass susceptible to disease. The grass behavior in the fall is to store food in the root system.

Soil, Water and Healthy Plants

Linda Langelo, CSU Horticulture Program Associate

The quality of soil leads to the success of any gardening. In the case of vegetable gardening, periodically test the soil every 3 or 4 years and understand the soil structure. Plant roots count on having the right nutrition and being in the right soil structure. It is no different than our bodies are counting on that we will eat the right foods to keep us healthy.

Understanding both soil and plant nutrition does not have to be complicated. Soil tilth is important and is determined by drainage, soil aeration, soil structure and moisture content. The key to improving soil tilth for any soil type is organic matter. By organic matter, I mean finished compost that does not smell or have big chunks of

undecomposed debris in it. Organic matter helps with moisture retention. However, it takes a long time for organic matter to build up 5% nitrogen in the soil. Five-percent is the optimal amount of nitrogen for healthy plants.

How does organic matter differ in quality to manure? Manure is animal feces which is still organic matter. Animal manures are high in salts and if added every season to the garden can raise the pH that causes chlorosis and other more severe problems in plant growth. Add animal manures sparingly.

Once you know your soil structure you have a better understanding of how to address any problems in growing healthy vegetables. You will

know what will do well in the vegetable garden. On key issue that will be easily solved is how to water the garden by understanding the soil structure. Watering still involves more in-depth knowledge of how to water individual vegetable crops. Each has their own timing for the best production.

Raising healthy plants increases yields. It also produces good seed for harvesting to save and continue on that favorite variety that is not commercially produced. Seed saving and harvesting have their own techniques and differ from crop to crop. Large fruits such as cucumbers go through a fermentation period. For other crops such as broccoli, eggplant or spinach there is a hot water treatment.

There is much to learn about seed harvesting long before the seeds are mature. Understanding when you have healthy plants in a particular crop.

Understanding when you have a rogue plant in a crop. Asking a professional or asking an experienced gardener can help you spot unhealthy or rogue plants in a crop. Weekly observation to inspect for insects or abnormal growth while in the garden to water or weed will be helpful.

To increase your understanding of all these topics, Colorado State University Extension and the Burlington Library invites you to attend a workshop at the Burlington Library on June 16th from 10:00 am to noon. Bring gloves and come ready to go out in the garden for some practice and observation. Please contact Lisa Brewer at (719)346-8109 at Burlington Public Library to sign-up for this workshop. The Burlington Library is open from 8am to 6pm, Monday through Friday and 8am to noon on Saturday.

LIVESTOCK

Be Proactive in Understanding and Preventing Heat Stress in Cattle

After what seemed like a long, drawn-out winter, the spring temperatures were very welcome. Now that June is here, summer is just knocking at the door waiting to provide sunshine, hot weather, and long days. While it may be great for kids in the swimming pool and families sitting on the back porch sipping lemonade, summer weather brings forth additional considerations for livestock producers.

The National Weather Service Climate Prediction Center is forecasting a 33 - 40% chance for summer temperatures in June, July and August to go above normal in Northeastern Colorado. This said, cattle managers must prepare for the possibility of heat stress in their cowherds and feedlot animals. Heat stress can be defined as the physiological stress incurred when trying to deal with elevated temperatures and humidity. Reduction

in feed intake, growth performance, milk production, efficiency and reproduction can occur when an animal is under stress to moderate the impact of high heat days.

The Livestock Weather Services Index (LWSI) provides a common tool used to monitor the potential of heat stress in livestock (Figure 1). The LWSI outlines the relationship of temperature and humidity in a single numerical value called the Temperature Humidity Index (THI). At certain THIs, livestock are more prone to fall victim to heat stress consequences. A THI value of 74 or less indicates the external environment is normal, and little concern should be had for livestock becoming heat stressed. When the THI value exceeds 74, livestock producers should be alert to possible heat stress incidences in their herds.

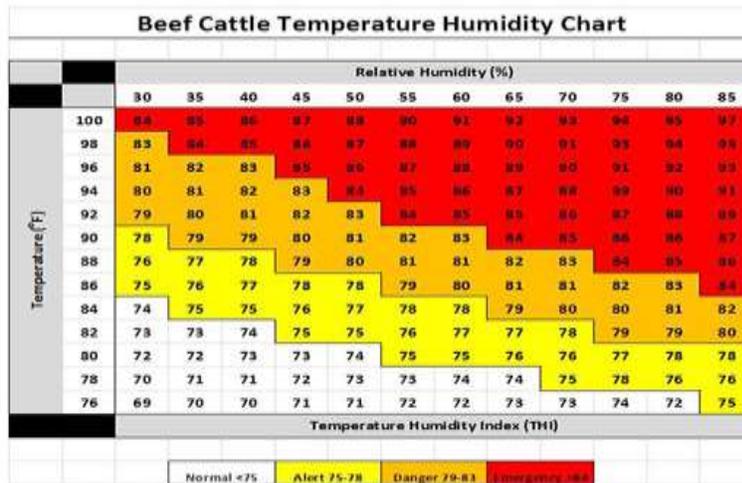


Figure 1: Cattle Temperature Humidity Index Chart

While temperature and relative humidity are the parameters used to determine the THI, they are not the only factors that affect heat stress conditions in cattle. In a study focused on identifying factors that influence heat stress in feedlot cattle, wind speed and solar radiation were identified as two additional variables that influence heat balance¹. Wind speed allows for evaporative cooling to take place, a process by which air movement replaces warm body air with cool air. This process may only occur if the ambient temperature is cooler than body temperature and the relative humidity is low. Solar radiation, or the heat energy from the sun, effects dark-hided cattle more intensely. This is why black-hided cattle are more prone to heat stress than cattle with lighter colored hides.

There are ways to mitigate the effects of hot summer days on cattle. First, it is important to remember core body temperature peaks about two hours after ambient temperature peaks, and it takes four to six hours for animals to dissipate the heat to achieve normal body temperatures again. Therefore, handling cattle before the temperatures get too hot and trying to avoid handling in the evening are ways to alleviate heat stress. Because body heat is radiated, it is important for stockmen to work cattle in smaller groups to avoid crowding and excessive holding times. Sprinkling cattle and/or the ground

has been shown to help reduce the risk of heat stress, especially if started in the morning before cattle get hot. Wetting the ground may be the more effective choice because ground cooling can provide more opportunity for cattle to dissipate heat. Finally, shade has been shown to have a positive effect on cattle performance during hot summer weather. If you are considering implementing shade resources for your cattle, know that shade stands should be oriented north-south to allow for wet areas to dry and should appropriately accommodate cattle to prevent overcrowding (approx. 20 to 40 ft²/animal).

No matter if you are a manager of feedlot animals or cows out on pasture, you should be cognizant of how temperature, humidity, wind, and weather can impact your animals this summer. Take measures now to ensure you are prepared to provide appropriate management for your cattle during extreme summer weather to alleviate heat stress.

References

- ¹ T. L. Mader, M. S. Davis, T. Brown-Brandl; Environmental factors influencing heat stress in feedlot cattle; *Journal of Animal Science*, Volume 84, Issue 3, 1 April 2006, Pages 712–719, <https://doi.org/10.2527/2006.843712x>

Introducing the New CSU Extension Livestock Agent for the Golden Plains Area

Howdy! It is very exciting to be welcomed as the new livestock agent into communities that are so enriched in production agriculture. I look forward to immersing myself in the day-to-day of your communities, learning from those who have made this place home, and contributing as a resource to the people and livestock producers in this area.

I was born and raised in Laramie, Wyoming. I spent the majority of my youth cultivating my passion for livestock and horses through the 4-H and FFA programs showing lambs, hogs, horses and cattle. Each of these activities was integral in helping me establish a sense of work ethic and ambition that I continually strive to build upon today. In 2011, I began my undergraduate career at the University of Wyoming studying animal science. There, I participated on the meat judging team, meat animal evaluation team, and beef leadership team, and was heavily involved with the Block and Bridle and Food Science student organizations. After graduating in 2015, I began a graduate degree at Texas A&M University. While there, I was involved with numerous research projects, educational outreach programs, and undergraduate teaching efforts, all of which focused on animal and red meat production. My primary role at Texas A&M was to coach the meat judging team. It is extremely humbling to have been given the opportunity to develop immense leadership skills while experiencing the beef, pork and lamb industry in such an applied way. Having just recently graduated, I am eager to begin my career with Colorado State University Extension.

My role as a livestock extension agent is to provide a helpful service to livestock producers in the area. I have the flexibility to be available to producers and affiliates in many different

capacities, making my job so exciting. Here is a brief list of what I have to offer livestock producers and the community:

- Provide resources and answer questions for producers who have questions about livestock production and management
- Deliver educational programs on a diverse array of topics that satisfy the needs of those who raise and manage livestock in this area
- Act as a liaison between Colorado State University and livestock producers in this area; create awareness about what CSU's researchers and affiliates are doing that may help producers increase profitability and improve animal management practices
- Collaborate with groups and associations (ex: Colorado Livestock Association, NRCS, etc.) to create an inclusive network for commodities and resources imperative to livestock production

I look forward to getting to know the community in the coming months. If you are near the Yuma County Extension office, please consider stopping by to say hello - an introduction and conversation are always welcome as I work to acquaint myself with community members and producers! I will be out and about at various activities, and will be sure to connect with as many people as possible.

Contact:

Location: Yuma County Courthouse, Suite B;
Wray, CO

Email: mckensie.harris@colostate.edu

Phone: (970) 332-4151

Colorado State University Animal Science Department Update

The beef researchers and extension specialists at Colorado State University (CSU) are making great strides in determining ways to best satisfy the research and educational needs of beef producers throughout the state. In March of 2018, the Colorado Beef Producer Needs Assessment results were released in the *Priorities Report* (available through the CSU Animal Science department or the Yuma County Extension office). This report outlined the most frequent producer responses that answer many questions related to producer's educational and research needs, effective format and delivery of information by extension personnel and other industry groups, and strategies for information gathering and utilization. The survey delineated the responses of beef producers into various regions of the state, which helps campus faculty, extension personnel, and other agencies and organizations focus their outreach efforts.

Responses of beef producers in the Peaks and Plains region (the Golden Plains Area is encompassed in this region) outlined three top areas needing additional education: marketing strategies, grazing and weeds, and nutrition and supplementation. Other needs such as herd health, reproductive technologies and management, as well as genetic technologies and tools were identified to be areas where more education is needed, too. When asked what the most effective method of information delivery was, producers in the Peaks and Plains region were most apt to answer their preferred formats for obtaining information were field days and ranch demonstrations, followed by full day seminars and workshops. The hands-on, in-person approach to educational programs was determined to be most effective in engaging producers who felt it important for CSU and other agencies to communicate their research efforts and report important enhancements for production agriculture.

The animal science department at CSU has also reinvigorated their *The State of Beef* publication. The aim with this resource is to keep Colorado agriculturists, industry stakeholders, and communities engaged with the happenings of the animal science department on campus. The first volume released earlier this year includes great

insight on departmental organizations, current research trials, and collaborative efforts with industry stakeholders like the Colorado Cattlemen's Association and the National Cattlemen's Beef Association. The animal science department looks forward to continuing to use this publication to reach agriculturists looking to understand and utilize the critical research that is currently underway.

One such project that really takes an innovative approach for answering the call of livestock producers looking to develop and implement production strategies, and evaluate profitability and enterprise growth, involves the primary use of heifers as offspring-producing and meat-producing entities in an operation. The *All Heifer, No Cow* innovative beef production system has been investigated for the past several years as a potential to produce beef without mature cows¹. This system capitalizes on the growth of these females to not only produce a heifer (who is early weaned) to replace herself, but to utilize nutrients provided in a finishing phase to produce young beef. Because about half of all feed in a beef operation is used to maintain cows, it seems likely that the out-of-the-box thinking of Dr. George Seidel, Dr. Jack Whittier (CSU faculty), and colleagues to eliminate mature cows in the operation has potential to improve the efficiency of producing beef. In fact, this study has shown that beef could be produced with 30 percent less feed and methane emission than the conventional cow/calf operation. There have been flaws identified with the *All Heifer, No Cow* concept, including difficulty in getting more than 70% of the heifers to replace themselves. However, what once was one of the concerns in the system's logic, carcass discounts due to physiological age determined to be over 30 months should no longer be a worry with the December 2017 update to the Agriculture Marketing Service's U.S. Beef Grading Standards. These standards now allow for age determination via dentition assessment or documentation of actual age. The future of the viability of this innovative beef production system remains promising, particularly as upcoming CSU research involves the development of simulation models to analyze

further the efficiency and profitability of eliminating mature cows in the production scheme.

The many additional research efforts of those in the animal science department at CSU may be found in the 30-page *Colorado Beef Research Report*. Furthermore, more details regarding the Colorado Beef Producer Needs Assessment results may be found in the *Priorities Report*. If you are interested in getting a copy of these publications,

call the Yuma County Extension office at (970) 332-4151.

References

¹ G. E. Seidel, J. C. Whittier; BEEF SPECIES SYMPOSIUM: Beef production without mature cows, *Journal of Animal Science*, Volume 93, Issue 9, 1 September 2015, Pages 4244–4251, <https://doi.org/10.2527/jas.2014-8526>

U.S. Roundtable for Sustainable Beef Releases Sustainability Framework

The U.S. Roundtable for Sustainable Beef (USRSB), established in 2015, has been diligently working on progress towards providing the beef value chain with an outline for improving the sustainability of beef production in the United States. In early May, the Sustainability Framework was released to the public for a 60-day comment period. The Sustainability Framework outlines the USRSB recommendations for working towards greater industry sustainability in the cow/calf operations, auction markets, feedyards, packers and processors, and retail and foodservice sectors. What is sustainability, though? It certainly is a buzzword in today's world and has been defined differently by many organizations. The USRSB defines sustainable beef as that which is environmentally friendly, socially responsible and economically viable. It is the USRSB's vision to move the U.S. beef industry towards becoming the global leader in sustainable beef. Their priorities involve educating and engaging the beef value chain, developing resources to enhance the sustainability of beef as a food source, and assessing the progress as strategies are set into place. In doing these things, the organization is hopeful the beef industry will become extremely transparent to its consumer-base and lead the world's effort of taking action to ensure opportunity for future generations. The USRSB is comprised of over 100 beef industry stakeholders from all segments of the industry. The 2018-2019 elected board members include individuals representing McDonald's Corporation, Arby's Restaurant Group Inc., Elanco Animal

Health, Noble Research Institute, Merck Animal Health, The Nature Conservancy, Golden State Foods, and the Colorado Cattlemen's Association.

Currently in a public comment period, the Sustainability Framework set forth by the USRSB identifies six areas as high priority sustainability indicators - *animal health and well-being, efficiency and yield, water resources, land resources, air and greenhouse gas emissions, and employee safety and well-being*. If beef producers in the United States are conscious of each of these six indicators and enhance or implement the programs outlined in the sustainability assessment guidelines, their operations will become more sustainable. Most beef cattle producers are already following some of the recommendations set forth in the USRSB's framework. For example, the metric recommended for improving efficiency and yield in the cow/calf framework asks the question, "Is there a strategy implemented to optimize animal productivity through improved nutrition, reproduction, genetics, technologies and practices?" If you are maintaining records for your cow herd and are able to determine productivity measures such as pounds of calf weaned per cow exposed and you are taking steps to improve this metric with each breeding season, then you are already contributing to the sustainability of U.S. beef. Fortunately, today's livestock operators have numerous resources and tools at their fingertips that can help improve the efficiency of animal production. Capitalizing on any number of these is certainly a way for producers to contribute to the industry's efforts of becoming more

sustainable, but also for increasing their operation's profitability. It should be known that while the Framework currently outlines specific strategies that satisfy identified metrics, the resource is a living document capable of changing as industry stakeholders see fit.

Because it is the intention of the USRSB board and membership to engage stakeholders in the development of the Framework, public comments regarding the feasibility of the outlined recommendations are being accepted until July 1, 2018. You may consider reviewing the Sustainability Framework for the particular industry sector you represent to provide practical comments to enhance its viability. Comments from the public (only viewable by the submitter and the USRSB administrator) will be utilized to adapt the recommendations to more appropriately reflect

feasible efforts for ensuring the U.S. is the global leader in sustainable beef production. You may view the Framework online at www.usrsbframework.org. To comment, you will need to register an account with USRSB.

The *Ranching Towards the Future* program, hosted by the JE Canyon Ranch of Branson, CO, is an upcoming program (June 27 -28) dedicated to educating Coloradans about the USRSB Sustainability Framework. This program will engage attendees in discussion regarding the implementation of tools from the USRSB and keying in on success for the U.S. beef supply chain. Learn more about this unique opportunity by visiting holisticmanagement.org.

PEST MANAGEMENT

2018 Grasshopper Populations and Infestations in Colorado

Assefa Gebre-Amlak and Frank Peairs, Colorado State University Extension

The 2018 grasshopper hazard map based on the 2017 survey of adult grasshopper activity conducted by USDA-APHIS-PPQ, shows that there will be low grasshopper populations in Colorado in general with the exception of localized moderate and spots of high populations of grasshoppers in southeastern counties

(https://www.aphis.usda.gov/plant_health/plant_pest_info/grasshopper/downloads/hazard.pdf).

The 2018 grasshopper hazards map shows that there will be low populations of grasshoppers in the Front Range (except the central Weld County), northeaster, west and southwestern Colorado counties. Please check the prediction map to see predicted grasshopper populations in your areas/counties or contact USDA APHIS Colorado office at: 303-371-3355.

Weather conditions will determine how much of the damage potential will be realized in those areas with moderate populations of grasshoppers too. For example, cool wet conditions after egg hatch can result in enough mortality in immature grasshoppers

to prevent outbreak. In addition, if adequate moisture is available, forage regrowth will offset much of the grasshopper damage. Most grasshopper outbreaks occur when drought conditions are prevalent.

Grasshoppers hatch, primarily during late May and June. Early scouting is important because treatments are most effective when grasshoppers are small. The goal of scouting is to get an estimate of grasshoppers per square yard, as well as their stage of development.

Economic threshold for grasshoppers on rangeland: The simple economic threshold for grasshoppers in rangeland is 15-20 grasshopper nymphs per square yard. This number is equivalent eight to ten adult grasshoppers per square yard. However, the economic importance of an infestation is affected by such factors as range condition, cattle prices, and treatment costs. CARMA is a computer program that allows the landowners to include these factors in their treatment decisions. CARMA is available at the

same website as the hazard map mentioned earlier. Treatment options for grasshopper management are based on the Reduced Agent and Area Treatment (RAAT) strategy, which results in untreated swaths and swaths treated with reduced chemical rates. Using lower rates and leaving untreated areas reduces treatment costs by as much as 50% and preserves biological control. Grasshoppers move constantly, insuring that they will enter a treated swath and that levels of control will be similar to complete coverage applications. Large infestations can be treated aerially with malathion, carbaryl or diflubenzuron (Dimilin). Smaller infestations can be controlled with RAAT treatments applied aerially or with all-terrain vehicles appropriately equipped to apply carbaryl or diflubenzuron. These insecticides do not have grazing restrictions when used in the rangeland.

All-terrain vehicles also can be used for spot treatments of egg-laying sites such as pastures,

ditches, and untilled field margins. Grasshopper nymphs tend to remain concentrated in their hatching areas for some time after they emerge, where the application of an approved insecticide can provide effective and economical control of localized infestations. There are baits of different products that are available for grasshopper management.

Dimilin (diflubenzuron) treatment for grasshoppers should be applied in 2nd to 3rd instar stage because growth regulator will not control adults. This product has no grazing restrictions.

Strategies for managing grasshoppers in crops as well as rangelands and recommendations for specific conditions can be found in the High Plains Integrated Pest Management (IPM) Guide, (<https://wiki.bugwood.org/HPIPm>).

It Is Time For Monitoring Alfalfa Weevil in Colorado

Assefa Gebre-Amlak, Pest Management Specialist, Colorado State University Extension

It is time to scout alfalfa fields for alfalfa weevil in Colorado. Weevil larvae are about 1/20 inch long when they first hatch. They range in color from cream, to pale green, and are curved with shiny black heads. A white stripe running down the middle of the back may be visible and becomes more distinctive as the larva matures. At this stage a 10X hand lens is necessary to identify the weevil larvae. The coloration and shape is characteristic throughout the four larval stages, referred to as "instars." Fully-grown larvae are up to 3/8 inch long and are wider in the midsection than at either end of the body.

Alfalfa weevil larvae feeding in the folded leaves can heavily damage stem terminals, but initial damage is not always clearly visible. The closed, overlapping foliage of the stem terminals should be unfolded to detect feeding damage. Third and fourth larval instars cause most of the economic damage, so initiating sampling at the peak occurrence of second instars should provide adequate sampling prior to economic weevil populations.

Field damage can be recognized on heavily infested stands as a grayish or frostlike appearance due to the dried defoliated leaves. At high weevil densities, foliage can be stripped; leaving only skeletonized and ragged leaf fragments and stems. Yield losses of 30 to 40 percent of the standing hay crop are possible under extreme population levels. Damage also may reduce hay quality due to loss of leaf tissue, leaving only the lower quality stems.

Damage to regrowth buds may occur when the plants break dormancy and after first cutting. Larval feeding on the regrowth after first cutting may be concentrated in strips coinciding with windrow locations, especially if the first cutting was taken early due to heavy weevil infestation and larvae survived under the windrows. Damage to regrowth may retard plant growth and result in yield reduction and encourage weed establishment.

Estimation of the weevil instars present in the field can be calculated using degree-days. Alfalfa weevil development increases at a nearly constant rate as the temperature rises above 48°F (9°C.). The amount of warm weather required for weevil larvae

to complete development is measured in units of degree-days. For the alfalfa weevil, degree-days are accumulated after 1 March for each 24-hour period in which temperatures exceed 48°F (10°C).

- **Monitoring techniques:** Sweep sampling using a standard sized 38 cm diameter net is the most efficient method for estimating larval populations. Sampling should begin when 148 degree days have been accumulated, when the larvae are expected to be primarily second instars and when alfalfa hay has reached at least 10 inches in height.

Ten, 180 degree sweeps are taken while the sampler is walking through the field. Count the number of larvae per sweep and repeat this sampling procedure, taking a minimum of three samples for fields up to 20 A, four samples for fields up to 30 A and five samples for larger fields. Survey for alfalfa weevil larvae in a predefined pattern based on field acreage. Weevil infestation may be patchy or uniform depending on terrain, weather and soil. Inspection for weevils in every distinctive section of the field will aid in determining the pattern of the infestation.

Bucket method or stem count method may also be used to determine the number of weevil larvae per stem. Take three six-stem samples in fields one to 19 acres, four samples in fields 20 to 29 acres, and five samples in fields 30 acres and bigger. The tools and supplies needed for this method includes a three or five gallon light-colored bucket, a white cloth, a hand lens, paper and pencil. Use the following steps to survey and estimate alfalfa weevil densities (larvae per stem).

The simple *economic threshold* for a sweep sample is 20 larvae per sweep. The simple economic threshold for the stem sampling method is 1.5 - 2 larvae per stem. For calculating detailed economic threshold,

check the High Plains IPM guide at (<https://wiki.bugwood.org/HPIPm>).

- **Management of the weevil:** Insecticide applications and early harvesting are the most common growing season management strategies.
- **Cultural control:** A non-insecticide control measure for alfalfa weevils is an early first harvest if an economic infestation is not detected until late in the growth of the first cutting. Harvesting alfalfa in an immature stage provides good control of larvae for the first crop. Rapid removal of hay will accelerate larval mortality due to desiccation by direct sunlight. An early first cutting tends to cure more rapidly because lighter windrows dry quickly, and forage quality is enhanced by higher crude protein and lower fiber content. Additional steps should be taken to ensure that surviving larvae do not cause economic damage to the regrowth. If larval survival under the windrows is high and baling is delayed (e.g., due to rainfall), damage to regrowth may be exacerbated. Regrowth should be inspected at a height of one to two inches to determine larval density.
- **Chemical control:** If damage becomes unacceptable as harvest approaches, an early harvest or "rescue" insecticide treatment may be necessary. Use care in applying insecticide when alfalfa is approaching bloom: refer to the Pollinator Protection section for guidelines on minimizing insecticide contact of pollinators. Also, consider the waiting period before harvest for different insecticides. Generally, harvest or insecticide applications should happen before bloom if weevils are a problem. For effective products check the High Plains IPM Guide at: (<https://wiki.bugwood.org/HPIPm>).

Miller Moth

‘Miller moth’ is the term given to any type of moth that is abundant in and around homes. In Colorado

and much of the Rocky Mountain west, the common ‘miller’ is the adult stage of the army

cutworm, *Euxoa auxiliaris*. In some years it becomes a serious nuisance pest, particularly during its annual migration from the plains to the mountains in late spring.



Figure 2. Army cutworm with damaged seedling.



Figure 3. Army cutworm pupa. (Photo by W. Cranshaw.)



Figure 4. Army cutworm moths showing variable patterning. (Photo by W. Cranshaw.)

Army cutworm moths have a wing span of 1.5 to 2 inches. It is generally gray or light brown with wavy dark and light markings on the wings. The wing patterns of the moths are variable in color and markings, but all have a distinctive kidney-shaped marking on the forewing.

Severe nuisance problems with “millers” seem to be limited to eastern Colorado. However, army cutworms also occur in western Colorado and may

be an important crop pests in late winter and spring. Adults similarly migrate to the mountains to spend the summer but less frequently occur as serious nuisance pests along the West Slope.

Life History and Habits

The army cutworm has an unusual life history. Eggs are laid by the moths in late summer and early fall. Most eggs are laid in weedy areas of wheat fields, alfalfa fields, or other areas where vegetation is thick—including turfgrass. Eggs hatch within a few weeks and the young caterpillars begin to feed. Army cutworm has a wide range of plants on which it feeds. It prefers broadleaf plants but will also feed on grasses.

Army cutworms spend the winter as a partially grown caterpillar, feeding as temperatures allow. In early spring the cutworms may damage crops, particularly alfalfa and winter wheat. They may also damage garden plants and are common in lawns. When high populations occur that consume all plants they may take on the “armyworm” habit of banding together crawling across fields or highways. Army cutworms become full grown by mid-spring, burrow into the soil, and pupate. Pupation can occur as early as March or may extend into early May, depending on temperatures.

Between three to six weeks later, the adult “miller” stage of the insect emerges. Next, they migrate and ultimately settle at higher elevations where they spend a few months, feeding on nectar and resting in sheltered areas. During this time they are in reproductive *diapause*, a physiological state during which they do not produce nor lay eggs. In early fall or late summer, they return to lower elevations, come out of diapause, and begin to lay eggs, repeating the annual, single generation life cycle.

Miller Moth Migrations

Miller moths are the migrating adult stage of the army cutworm. In eastern Colorado, spring flights move westward, originating from moths that developed across eastern Colorado and border areas of Wyoming, Nebraska, Kansas, and Oklahoma where army cutworm also occurs.

A likely explanation for the migration is that it allows the moths a reliable source of summer flowers. Flowers provide nectar which the moths use for food. In addition, the cooler temperatures of the higher elevations may be less stressful to the moths, allowing them to conserve energy and live longer.

During outbreak years, miller moth flights typically last five to six weeks, generally starting between mid-May and early June. However, they tend to cause most nuisance problems for only two to three weeks.

Exactly when the flights occur and for how long varies. During the 1991 outbreak high populations were present from early May through mid-June. However, in 1990, a year that also was above average for miller flights, heavy flights were not noted until early June and lasted about a month. In the warm, dry 2002 season, nuisance numbers of miller moths along the Front Range occurred over a very extended period—from late April through early July—and were concentrated around irrigated areas due to the drought.

Miller moths avoid daylight and seek shelter before day break. Ideally, a daytime shelter is dark and tight. Small cracks in the doorways of homes, garages, and cars make perfect hiding spots. Often moths may be found clustered together in particularly favorable sites. Since cracks often continue into the living space of a home (or a garage, car, etc.) a ‘wrong’ turn may lead them indoors. At night, the moths emerge from the daytime shelters to resume their migratory flights and feed.

The return flights (mountains to the plains) in early fall usually span a shorter period of time, typically beginning in the latter half of September. However, since the majority of moths die during the summer the return flight is less obvious.

The number of miller moths in late spring is primarily related to the number of army cutworm caterpillars which occurred earlier in the season. Outbreaks of the army cutworm are usually followed by large flights of miller moths.

Many things influence cutworm outbreaks. Wet weather and extremely cold winter conditions may kill many of the caterpillars. The effectiveness of natural enemies, such as ground beetles and parasitic wasps, help regulate cutworm populations.



Figure 1: Army cutworm moth. (Photo courtesy of J. Capinera.)

Plowing fields where cutworms develop kills many, as does tilling gardens.

Miller moths may concentrate around buildings more intensively during some years. The presence of flowering plants and local humidity conditions are suspected as being important in concentrations of miller moths. This effect is seen particularly during drought years when there are few natural sources of flowering plants at lower elevations. The presence of certain highly favored flowering plants, notably Russian olive, is frequently associated with localized nuisance problems.

Damage by Miller Moths

The caterpillar stage of the army cutworm is sometimes an important crop pest in the spring. For example, during outbreak years thousands of acres of alfalfa, winter wheat, and other crops are treated with insecticides for army cutworm control. Army cutworms are also common early season pests of gardens and feed on lawn grasses along with sod webworms and other cutworms.

However, the adult miller stage is primarily a nuisance—albeit a considerable nuisance at times. Moths in the home do not feed or lay eggs. During the migratory flights, the moths do not produce nor lay eggs. Furthermore, they do not feed on any household furnishings or food. Moths in the home will eventually find a way outdoors or die without reproducing.

When large numbers die in a home there may be a small odor problem (due to the fat in their bodies turning rancid). Also, unless they are cleaned out, old moths may serve as food for carpet beetles and other household scavengers. These secondary insects may become problems in subsequent years.

Miller moths also may spot drapes or other surfaces, such as unfinished wood because they excrete fluid for most of their adult life. This

product is slightly acidic and is sprayed by the moth. Presumably the purpose of this is defensive, although it is not particularly irritating.

Probably the greatest damage created by millers is the lost sleep resulting from their flying about the room and the needless worry that they may reproduce in the home and cause harm to household furnishings.

Natural Enemies of Miller Moths

The caterpillar stage of the army cutworm has many natural enemies.

Predatory ground beetles, and many birds

eat cutworms. Adult millers may be eaten by bats or birds.

One commonly observed phenomenon involving birds is swallows concentrating at intersections where they feed on miller moths. (House sparrows and other birds also are found at these sites, feeding on wounded moths.) This likely occurs because many miller moths seek shelter in automobiles and emerge while the cars are idling at stop lights. Furthermore, many moths are released as drivers open vehicle windows at intersections to let the moths escape.

Other wildlife feed on miller moths as well. For example, they can be an important part of the grizzly bear's diet in the Yellowstone National Park area. Grizzly's feed on the fat-rich moths that rest under loose rocks.

However, factors that determine the abundance of miller moths from season to season are largely unknown. Undoubtedly, certain weather patterns have a great effect.

Miller Moth Control around Homes

Before miller moth migrations, seal any obvious openings, particularly around windows and doors. Also reduce lighting at night in and around the home during flights. This includes turning off all unnecessary lights or substituting non-attractive yellow lights.



Figure 5. Miller moth feeding at a flower. (Photo by W. Cranshaw.)

Landscaping may affect the number of millers you'll see because it may provide food (nectar) and/or shelter. Some of the flowering plants most readily visited by miller moths along the Front Range include lilac, cherries, spirea, cotoneaster, horsechestnut, raspberry, and Russian olive. Dark, dense plants such as cotoneaster shrubs, spruce, and pines will be used most often as shelter by miller moths. Landscaping considerations can be important in the tendency of miller moths to linger around a home.

Once in the home, the best way to remove the moths is to swat or vacuum them, or attract them to traps. An easy trap to make is to suspend a light bulb over a bucket partially filled with soapy water. Moths attracted to the light often will fall into the water and be killed. (If this is attempted some wetting agent, such as soap or detergent, must be added or many moths will escape. Also, there are obvious dangers when bringing water and electrical equipment in close proximity and great care should be given to the situation. This includes use of a GFI receptacle for safety.)

Army cutworm moths are very sensitive to certain noises, making erratic flying movements in response. Among the sounds which elicit greatest response are jingling keys, dog tags, rattling coins, and crumpled pop cans. The likely reason for this is that certain sound frequencies are produced to which the moths are sensitive. Many cutworm moths make evasive movements in response to frequencies used by bats during echolocation of prey. Since bats are an important predator of night flying moths, rapid evasive movements are a means of protection. Regardless, jingling keys or making similar noises can disturb many of the moths in the home causing them to seek shelter and can sometimes dramatically speed the capture rate when using the soapy water trap.

Insecticides have little or no place in controlling millers. The moths are not very susceptible to insecticides. Furthermore, any moths killed will be rapidly replaced by new moths migrating into the area nightly.

Source: Extension Fact Sheet: 5.519. Miller Moths by W.S. Cranshaw

The European Paper Wasp

The European paper wasp, *Polistes dominula*, is a newly established insect now abundant in many areas of Colorado. The paper nests of this wasp are commonly observed in yards and gardens and the wasp is involved in stinging incidents. The European paper wasp develops as a predator of caterpillars and some other insects, populations of which have probably been affected by the establishment of this new wasp.

The European paper wasp is a generally black insect marked with yellow. They are fairly slender-bodied insects with a distinct constriction of the body between the thorax and abdomen.

The European paper wasp is superficially similar to and commonly mistaken for various yellowjackets (*Vespula* spp.). Several yellowjacket species are native to Colorado and these historically have been the most significant stinging insects of the region. A somewhat blunter, more compact body form distinguishes yellowjackets from the European paper wasp. Also, the long hind legs of paper wasps tend to trail below when the insects are in flight.

in the 1970s in the Boston area. Since then it has spread rapidly to much of the northern half of the United States and British Columbia. The first Colorado record for the species is August, 2001 from Larimer County, and it likely entered eastern Colorado shortly before 2000. The first Utah record dates from 1995, suggest western Colorado may have been colonized earlier. Wherever it has established, the European paper wasp has usually become a common species within a few years. Currently it is now considered very abundant in every urbanized county in eastern Colorado and the three western Colorado counties of Mesa, Montrose, and Delta. Presently it is not thought to occur in much of the higher elevation counties, but is known in Steamboat Springs.

Life History and Habits

The European paper wasp is a social insect that produces an annual colony in a paper nest. Individual colonies are established anew each spring. The overwintering stage are females (queens), only slightly larger than the wasps typically observed during summer. Female wasps that were fertilized the previous fall survive winter in protected sites in and around a yard. When they emerge from overwintering shelters, they may be seen on warm days as they seek sites to establish new nests. Earliest activity is sometimes seen in the first half of March.



Figure 1. European paper wasp.

Figure 2. Western yellowjacket, the most common species mistaken for European paper wasp.



Figure 3. European paper wasp gnawing on weathered wood.

Introduction of European paper wasp to Colorado

The European paper wasp is the common paper wasp of Europe. It was first found in North America

Nests are constructed of paper, produced from chewed wood fibers of weathered fences, porch

decks and similar sites. Initially, a few hexagonal paper cells are formed and eggs laid in the cells. Upon hatch, the wasp larvae are fed crushed insects, usually caterpillars that the overwintered queen discovers in foraging trips among nearby plants. When full grown the larvae then seal over the cell and pupate. Development of the wasps to the adult form is usually completed in 3 to 4 weeks after eggs are laid. The new wasps assist in colony activities of nest construction, foraging, and caring for young. The original queen increasingly remains restricted to the nest as new workers take over colony activities.

The colony continues to grow through the summer and may contain several dozen individuals by the end of summer. The nest is continuously expanded and reconstructed through the summer and may contain a hundred or more cells by fall. A few of the wasps produced later in summer are males and increasing numbers of the females become sexually mature at that same time. Mating occurs and the mated females are the surviving overwintering stage. Males and non-reproductive females do not survive winter and the nest is abandoned by late fall.

The fertilized overwintering females seek protected sites for shelter during the cold season. Often they find winter shelter outdoors but occasionally they will find suitable areas behind walls or in other areas of the house. These wasps sometimes will move about during warm periods and may find themselves within the living space. Such wintertime encounters do not indicate the presence of an active nest, only that some wasps have found some pocket of winter shelter within the building. Overwintered females emerge from these areas in spring and search out sites to establish nests in the neighborhood.

Nests are almost always established in new locations each year and several kinds of nest sites are particularly favored (new nests sometimes are established at the same site the following year). Dark cavities are often used, including those found in outdoor grills, large bells, pipes, rock cavities, and hollow spaces behind walls. Nests are also commonly attached to wood on the underside of

porch decks, eaves of homes or other overhangs. Nests are almost always attached to either wood, roughened metal surfaces, or rock.



Figure 4. Developing wasp larvae and capped pupae.



Figure 5. European paper wasp nest.

Paper wasp nests are not covered with a surrounding envelope of paper. Paper envelopes that surround a nest are characteristic of yellowjackets (*Vespula* spp.) and hornets (*Dolichovespula* spp.), the other social wasps found in Colorado. Yellowjackets nest underground or, occasionally, behind walls; hornets make conspicuous football-sized nests attached to branches or under eaves.



Figure 6. European paper wasps nesting in clothes line.

The European paper wasp is capable of stinging. Among the stinging insects found in the state European paper wasp is relatively non-aggressive, and somewhat less likely to sting than are most yellowjackets and bumble bees. Stings from

European paper wasp occur almost exclusively when nests are accidentally disturbed.

European paper wasps rear their young on live insects. They do not produce nuisance problems around outdoor dining that characterize scavenging species, such as the western yellowjacket. European paper wasps will sometimes feed on sweet materials, including honeydew produced by aphids. On rare occasions, they also may feed and damage ripe fruit. This habit is particularly notable in cherries and some other well-ripened stone fruits grown on the West Slope, where they may be serious pests.

European paper wasps have become one of the most important natural controls of many kinds of yard and garden insects. Most commonly they feed on caterpillars, including the larvae of hornworms, cabbageworms, and tent caterpillars. Sawfly larvae are also commonly taken prey.

European paper wasps can be encouraged to nest in nest boxes. Artificial nest sites can be useful if one wants the benefits of these insects with a known nest location so accidental disturbances can be avoided. A typical nest box would be made of wood and at least 4-in x 4-in x 4-in, open at the bottom. They should be mounted several feet above ground on a solid post.



Figure 7. A nest box designed to house European paper wasp.



Figure 8. European paper wasps in nest box.



Figure 9. Golden polistes, *Polistes fuscatus*.

Other Paper Wasps of Colorado

Three other species of paper wasps are native to the state— *Polistes fuscatus* (golden paper wasp), *Polistes apachus* and *Mischocyttarus flavitarsus* (western paper wasp). There is no evidence that the new species has significantly affected their activities. In rural areas, away from buildings and human structures, these native paper wasps are the predominant species of paper wasp one will likely find. All of these other paper wasps have generally similar biologies to the European paper wasp.



Figure 10. *Polistes apachus*, a native species of southeast Colorado.



Figure 11. Western paper wasp, *Mischocyttarus flavitarsus*.

Control of European Paper Wasp

If nests are not in a location where they are likely to be disturbed, it is usually best to leave them in place. The nests will be abandoned at the end of the season and they then can be safely removed.

Individual nests can be destroyed. Insecticides are often used for this purpose and a wide variety of “wasp and hornet” marketed products are effective. If nests are treated it is recommended to apply treatments in the evening. At this time most of the wasps have returned to the nest so that they can be killed and, after dark, flying activities are greatly reduced.

After the nest has been killed it should be removed and destroyed. This will eliminate larvae that were within capped cells during spraying. These usually survive and later will emerge. It is also recommended that after a nest is removed the area also be washed with a jet of water to eliminate

colony odors. These practices will inhibit surviving wasps, not present on the nest when it was destroyed, from attempting to reestablish a nest upon return.

There are no traps or lures that can be used to control this species. Commercially available ‘wasp traps’ are designed to attract certain kinds of yellowjackets and contain baits such as fruit juices, fresh meat, or heptyl butyrate (found in many retail wasp lures). None of these are attractive to the European paper wasp. There has not been any type of trap identified as effective for this species. (Large numbers of the native western yellowjacket, *Vespula pensylvanica*, and prairie yellowjacket, *V. atripilosa*, are captured by these traps.)

Source: W. Cranshaw, Colorado State University Extension entomology specialist, and professor, bioagricultural sciences and pest management

AG BUSINESS

Marketing Wheat in Challenging Times: Avoid Common Mistakes

R. Brent Young

Professional tennis players make 80% of their shots while amateur tennis players miss 80% of their shots. Given this fact the best way for an amateur tennis player to improve their game would be to eliminate their mistakes.

Many farmers consider themselves to be amateurs when it comes to marketing their grain. If you believe the tennis analogy, then it would stand to reason that the best way for farmers to improve their grain marketing ability would be to eliminate their marketing mistakes.

Edward Usset, Grain Marketing Specialist for the Center for Farm Financial Management, University of Minnesota compares tennis players to farmers as he introduces his presentation titled “Five Common Mistakes in Grain Marketing”. I have taken Ed’s thoughts and made a couple of minor changes to reflect winter wheat marketing in the Great Plains.

Not knowing your cost of production (COP) is first on my list of common mistakes (not included in Ed’s list for mid-west farmers). Locking in a profitable market price should be a driving factor in making any marketing decision. The first step in determining if the market is offering an acceptable price is knowing your COP. The secret to knowing your COP is having good farm financial records that allow you to conduct enterprise analysis. If your current record keeping system does not allow you to calculate your COP there are several reasonably priced, computerized accounting packages available that will help you to complete this important task.

In my revised list the second mistake is reluctance to pre-harvest price crops. In most years the market will provide opportunities to price the crop that will result in a return greater than pricing only at harvest time. Producers can utilize forward contracts, futures and options contracts to accomplish this task.

Mistake number three is the failure to understand and track local basis. Basis is the difference between the local cash price and the nearby futures price. While futures prices can vary year to year and season to season, basis tends to follow similar patterns year to year. In many cases grain pricing opportunities are the result of changes in basis and not upward movement in the futures market.

If you are interested in tracking local wheat basis, I would suggest that you utilize the Kansas State University Interactive Basis Tool <https://www.agmanager.info/grain-marketing/interactive-crop-basis-tool> . This web based tool tracks most of the winter wheat markets in eastern Colorado and will also provide 3 and 5 year weekly averages.

Failure to have a pricing strategy is mistake number four. How many of us have missed an opportunity to sell our grain at a profit because we thought the market would go up a nickel and then we would wait to sell only to watch the market go down 15 cents. A pricing strategy (a component of a marketing plan) allows us to take some of the emotion out of marketing and make decisions based on our cost of production. Pricing strategies can be either price and/or timing driven.

Some grain market analysis like to quote what they call the 11th commandment of winter wheat marketing, “Thou shall not hold un-priced winter wheat in the bin past April 1st”. This commandment relates to my fifth common mistake in winter wheat marketing, that being holding unpriced grain in storage too long. The most egregious example would be selling last year’s winter wheat crop just in time to place this year’s crop in the bin. Not only have you sold last year’s crop at the typical market year low, you have the expense of storing the old crop for an entire year.

If you’re like many grain producers and feel that when it comes to marketing you are more of an amateur than a professional limiting your grain marketing mistakes could pay big dividends.

Dr. R. Brent Young – Regional Extension Specialist
– Agriculture & Business Management, CSU
Extension, Phone: 970-522-7207, Email:
brent.young@colostate.edu

AG MARKET PRICES

Dennis Kaan, Golden Plains Area Director

LIVESTOCK CASH PRICES			Week Ending 5/25/18		
			Current ¹	One Month Ago ²	One Year Ago ²
Colorado Auction Feeder Cattle, Medium & Large Frame #1					
Steers,	500-550 lbs	/cwt	No Reports	No Reports	No Reports
Steers,	600-650 lbs	/cwt	During Summer	During Summer	During Summer
Heifers,	500-550 lbs	/cwt	Season	Season	Season
Heifers,	600-650 lbs	/cwt			
Colorado Weekly Weighted Average Direct Slaughter Cattle, FOB the Feedyard After 3-4% Shrink					
<u>Live Basis Steer Sales</u>	Hd Count	Wt Range	/cwt	/cwt	/cwt
Over 80% Choice	1,633	1,250-1,475	\$108.00-111.50	\$119.00-124.00	\$132.50
65-80% Choice	434	1,350-1,475	\$108.00-111.50	\$119.00-124.00	\$132.00-132.50
35-65% Choice				\$119.00-124.00	\$132.50
0-35% Choice					
<u>Live Basis Heifer Sales</u>	Hd Count	Wt Range	/cwt	/cwt	/cwt
Over 80% Choice	973	1,250	\$108.00-110.00	\$119.00-124.00	
65-80% Choice	59	1,275	\$108.00		\$132.50
35-65% Choice				\$118.00	
0-35% Choice					
Mountain Area and Western U.S. Direct Sheep Report, Medium and Large 1-2					
	Hd Count	Wt Range	/cwt	/cwt	/cwt
Feeder Lambs, CA			\$200.00	No Trade	No Trade
				Reported	Reported
Hogs, As of 11/18/13					
Base Market Hog, 200 lb. Carcass Basis, Plant Delivered					
	0.9-1.1" Back-Fat, 6.0/2.0 Loin Area/Depth	/cwt	\$58.00-65.81	\$52.00-58.95	\$65.00-73.00
Iowa -Minnesota Daily Negotiated Purchases 200 lb Carcass Basis					
	1.0" Back-Fat, 6.0/2.0 Loin Area/Depth	/cwt	\$61.50-66.00	\$52.00-59.00	\$65.00-73.00
Western Cornbelt Daily Negotiated Purchases 200 lb Carcass Basis					
	1.0" Back-Fat, 6.0/2.0 Loin Area/Depth	/cwt	\$61.50-66.00	\$52.00-59.00	\$65.00-73.00
LIVESTOCK FUTURES PRICES			5/25/18		
Live Cattle – CME			Current ¹	One Month Ago ²	One Year Ago ²
	Jun	/cwt	\$104.55	\$106.91	\$122.41
	Aug	/cwt	\$102.33	\$107.04	\$118.72
	Oct	/cwt	\$105.75	\$105.89	\$115.10
	Dec	/cwt	\$111.36	\$113.79	\$115.74
Feeder Cattle – CME					
	Aug	/cwt	\$144.84	\$148.19	\$146.80
	Sep	/cwt	\$144.42	\$148.29	\$146.38
	Oct	/cwt	\$144.36	\$148.29	\$145.95
	Nov	/cwt	\$144.84	\$147.25	\$144.11

¹ Commodity specifications apply to the current period only. Specifications may have been different for prior period listings.

² Prices reported for the one month ago and one year ago periods are taken from previous issues of this publication.

Source: U.S.D.A. Agricultural Marketing Service <http://www.ams.usda.gov/market-news>

Chicago Mercantile Exchange <http://www.cmegroup.com/>

CASH GRAIN PRICES**5/25/18**

		Current ¹	One Month Ago ²	One Year Ago ²
#1 HRW Wheat				
Fleming, Haxtun, Julesburg, Holyoke, Paoli, Amherst	/bu	\$4.79-5.05	\$4.41-4.56	\$3.17-3.43
Yuma, Wray, Brush, Akron, Otis, Anton	/bu	\$4.74-4.89	\$4.22-4.27	\$2.84-3.00
Burlington, Seibert, Flagler, Arriba, Genoa, Hugo	/bu	\$4.69-4.74	\$4.27-4.40	\$2.97-2.98
#2 Yellow Corn				
Haxtun, Julesburg, Fleming, Holyoke, Paoli, Amherst	/bu	\$3.56-3.61	\$3.42-3.54	\$3.27-3.34
Yuma, Wray, Brush, Otis, Anton Seibert, Arriba, Burlington, Flagler, Bethune, Stratton	/bu	\$3.61-3.76 \$3.51-3.54	\$3.34-3.49 \$3.33-3.40	\$3.14-3.52 \$2.99-3.19
Northeast Colorado, Western Nebraska Beans				
Pinto Beans	/cwt	\$21.00	\$21.00	\$28.00
Great Northern Beans	/cwt	\$21.00	\$21.00	\$28.00
Light Red Kidney Beans	/cwt	\$35.00	\$35.00	\$33.00
White Millet				
E Colorado / SW Nebraska	/cwt	\$6.50-8.00 Mostly \$7.50	\$6.50-7.75 Mostly \$7.00	\$5.50-6.25 Mostly \$5.50
Sunflowers				
E Colorado / SW Nebraska	/cwt	\$18.00	\$18.00	\$17.00

GRAIN FUTURES PRICES**5/25/18**

		Current ¹	One Month Ago ²	One Year Ago ²
Wheat, Kansas City Board of Trade				
Jul	/bu	\$5.42	\$4.99	\$4.37
Sep	/bu	\$5.59	\$5.15	\$4.50
Dec	/bu	\$5.78	\$5.38	\$4.72
Mar	/bu	\$5.94	\$5.55	\$4.91
Corn, Chicago Board of Trade				
Jul	/bu	\$4.05	\$3.98	\$3.74
Sep	/bu	\$4.14	\$4.05	\$3.81
Dec	/bu	\$4.24	\$4.14	\$3.92
Mar	/bu	\$4.33	\$4.20	\$4.01

CASH HAY PRICES**Week Ending 5/25/18**

		Current ¹	One Month Ago ²	One Year Ago ²
Colorado Hay Report, Northeastern Areas				
Large Square Bales, FOB Stack				
Supreme Alfalfa, 180+ RFV (On Contract)	/ton		No Reported	
Premium Alfalfa, 150-180 RFV	/ton	\$175.00	Quotes	\$90.00-100.00
Good Alfalfa, 125-150 RFV	/ton			
Fair Alfalfa	/ton			
Utility Alfalfa Delivered	/ton			
Premium Grass (Large Squares)	/ton			
Premium Grass (Small Squares)	/bale			
Straw (Large Squares)	/ton			
Corn Stalks (Large Squares)	/ton			
Oats (Large Squares)	/ton			
Cane Hay (Large Rounds)	/ton			
Millet Hay (Large Squares)	/ton			

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