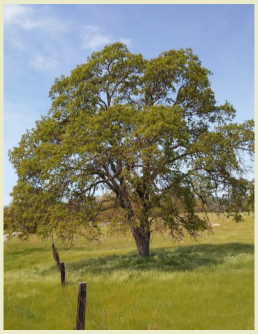

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## News Briefs

### 2018 San Joaquin Livestock Symposium

UCCE Madera, Fresno, and Kern Counties hosted their annual Livestock Symposium on February 21-22, 2018. Topics included residual dry matter management, beef cattle mineral deficiency, parasite control options, and a Q&A session on the new 2018 antibiotic use regulations with a veterinarian from CDFA.

Presentations from the speakers are available online at http://ucanr.edu/sites/livestockandnaturalresources/Events/

### In the works

The UCCE livestock advisors for Madera, Fresno, Tulare, Kings, and Kern Counties, in conjunction with Point Blue and Sequoia Riverlands Trust, are organizing a rangeland weed management field day. The focus will be on locally invasive species, and will involve classroom and field discussions. The field day will be on Tuesday, May 1, at the Tulare UCCE office.

For more information, including registration information, contact Rebecca at rkozeran@ucanr.edu or at 559-241-6564.


# Upcoming Research: Biochar, in Brief

Biochar is charcoal that is used for a purpose other than burning as a fuel source. Some forms of biochar become activated charcoal for water filtration; others are being studied for their use in soils and other purposes.

You may have seen the term "biochar" used in articles that talk about soil amendments for water or nutrient management, mainly in crop agriculture. Sometimes biochar is mentioned for site reclamation, such as improving soils after a mining or drilling operation is done developing the area. Biochar is being studied for its potential to increase carbon storage in soils, reduce nitrate leaching, help retain water in soils, and many other applications.

### But what is biochar?

Biochar is essentially charcoal, and the main difference is that biochar is not used as fuel. Most often, biochar is made from excess wood, crop byproducts (such as rice hulls), or other vegetation waste, which are all lumped into the term "biomass". Some researchers are investigating if plastic waste can also be a source of biochar.

### How does biomass turn into biochar?

Biochar is created through a process called pyrolysis. We can use Latin roots to break the term into *pyro-* (fire) and *-lysis* (to break). However, pyrolysis specifically tries to avoid creating a normal fire. Essentially, pyrolysis is intense heating of the biomass but in an environment that excludes oxygen. If oxygen were present at these temperatures, the biomass would instead combust (burn) and release most of its carbon in the form of carbon dioxide (Figure 1). After burning, there would be only a small amount of solid material left: ash. Ash is comprised of minerals and has no organic matter. In order to keep most of the carbon in a solid form, then, oxygen cannot be allowed in the pyrolysis process. Pyrolysis then creates a variety of products – biochar itself, but also gases and liquids that can be used as fuel for energy generation[1].

### What is the point of making biochar?

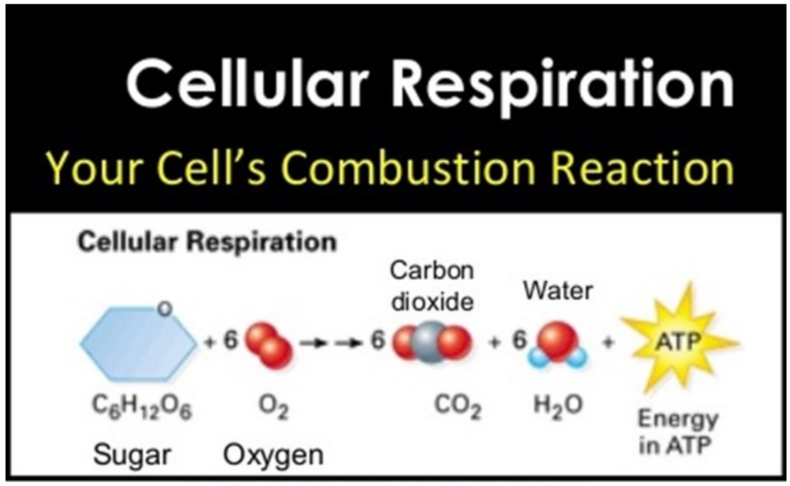
There are a few reasons that biochar has recently become popular in the US. First, many businesses and organizations want to invest in carbon storage or sequestration. The carbon in biochar produced at high temperatures (above around 400°C, or 750°F) is stable (resists chemical or microbial decomposition) and therefore can persist in solid form for years, and maybe for centuries[1]. The stability of biochar carbon makes it an appealing option to offset carbon emissions and sequester carbon for the long term.

Second, in California especially we have a major problem with excess tree mortality. Approximately 129 million trees are estimated to be standing dead in our forests, and they can fuel catastrophic fires such as the Railroad Fire (Madera County) and the Detwiler Fire (Mariposa County)[2,3].

*This article continues* ▶

*Figure 1. Combustion is the same process by which humans and other animals get energy from food, which is why we need to breathe – we need oxygen for combustion. We create the same products as a fire: carbon dioxide, water vapor, and energy. Fire energy is mainly expressed as light and heat. Our energy is partly released as heat, but also helps move small and large parts of our bodies.*

*Combustion in our cells, at its most basic, occurs when sugars combine with oxygen to produce energy, water and $CO_2$. In contrast, pyrolysis to create biochar is a different reaction, that avoids releasing $CO_2$.*




(C) I Wonder Why Science 2015. Available at https://www.slideshare.net/JuliePen/ecgs-module-12

*Biochar cont'd*

We also have limited biomass processing plants (where trees can be turned into electricity) and high competition with agricultural biomass in the form of old orchards and vineyards. Until or unless there are major policy and funding changes regarding biomass burning, California needs all possible mechanisms to reduce the amount of standing biomass. Turning excess biomass into biochar and removing the fuels from our forests might also justify biochar production in California.

**How does this relate to rangeland or livestock management?**

Great question! I don't know yet. In fact, that's what I plan to find out. In some agricultural studies, biochar increased the water holding capacity of sandy soils. Other studies examined whether biochar might reduce the loss of some nutrients, such as nitrate, to leaching. My research questions are:

- Does biochar increase the availability of water in our rangeland soils? If so, will annual grasses stay green for a longer amount of time on biochar-treated soils than on untreated soils?
- Does biochar-treated soil support more productive grasses? In other words, do we grow more grass on treated soils than on untreated soils?

Ultimately, the effects of biochar on forage production will need to offset the costs of creating, transporting, and applying biochar to rangelands in order to justify biochar as a reasonable range soil amendment. If our grasses grow larger and stay green longer with biochar added to our rangelands, it may be a worthwhile investment.

*If you would be interested in hosting a biochar experiment on your ranch, contact Rebecca at 559-241-6564.*

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2. CalFire. 2017. Record 129 Million Dead Trees in California. Available at http://www.fire.ca.gov/treetaskforce/.
3. CalFire. 2018. 2017 Statewide Fire Map. Available at http://calfire.ca.gov/general/firemaps.

# Forage Futures

## What can we expect this year?

*Cages such as the one pictured here are one way to exclude grazing from small areas. We can then measure total forage production at the peak of the growing season.*

Forage production is tough to predict, especially without good long-term data to show the possible maximum and minimum. Consider this: you purchased a new parcel of grazing land from an owner with no grazing or production records, in a different part of the state, where different forage species grow. With all of those changes, it would be a challenge to figure out how many animals it could feed in an average year., let alone that first year that you owned the land.

This is one of the biggest reasons why we like to measure forage production—to get a better idea of the land's potential, and to better manage grazing over time.

When we measure forage production, we often measure **peak standing crop**: the total amount of forage when it reaches its maximum growth, right around the end of the spring rainy season. Peak standing crop represents the total forage that would be available if the area were not grazed, which has advantages and disadvantages. For example, this method doesn't account for the possibility of forage regrowth after grazing. One major advantage, however, is that it means we only need to measure once a year to have useful information.

Thanks to a long history of partnerships between UCCE, the US Forest Service, and the NRCS, we have forage production records going back to 1936 at the San Joaquin Experimental Range (SJER), a research ranch in the foothills of the Sierra Nevada near Coarsegold (Madera County).

### What has production been like in years similar to this one?

Granted, no two years will provide us with the exact same timing and amount of rain. But we can look back at historical rainfall and forage production records to see how they compare.

Generally, years of high rainfall are associated with adequate to high production, and years of low rainfall are associated with low production. However, you can see variation in the amount of forage produced even when multiple years had similar total rainfall (see Figure 1).

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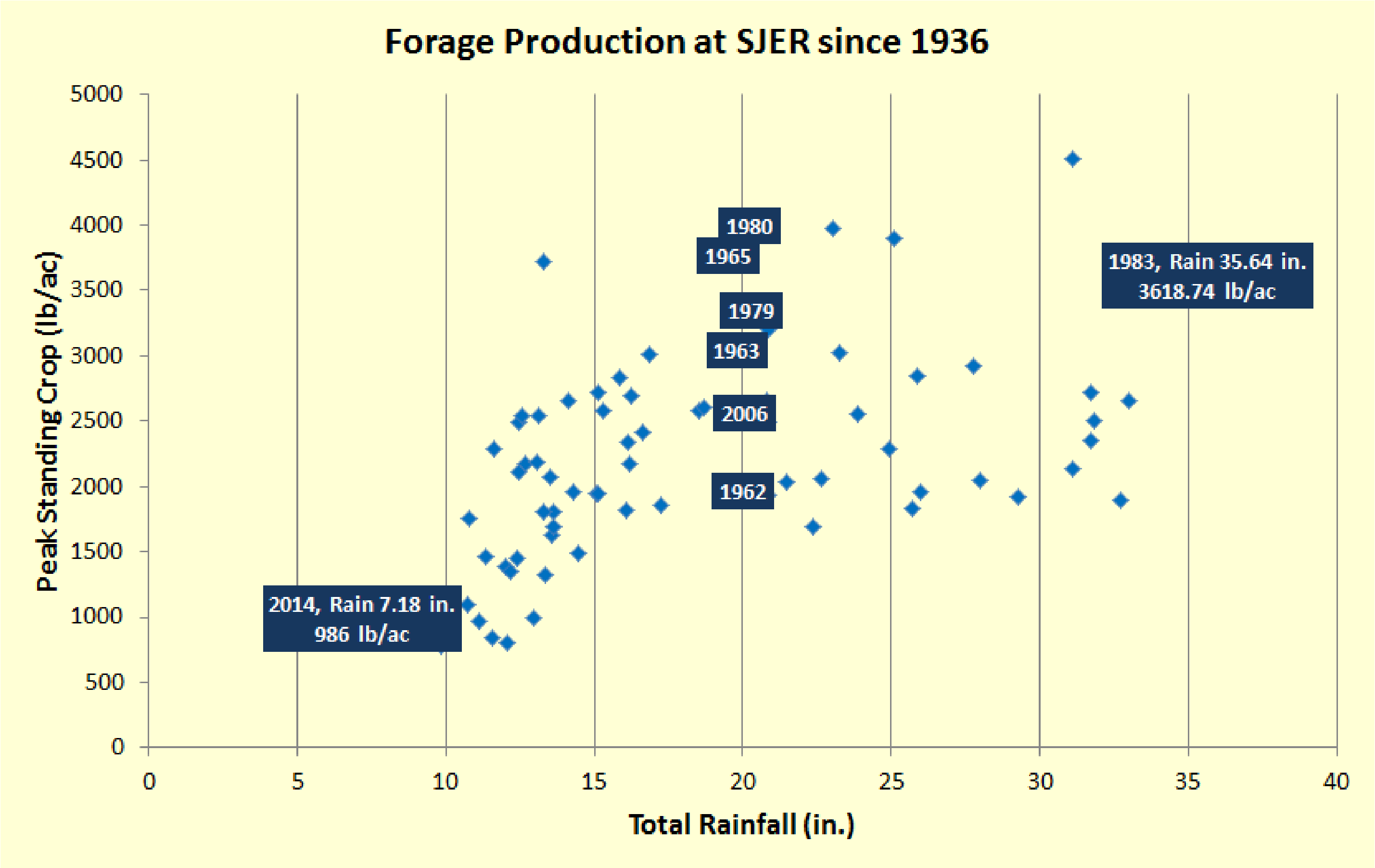
*Forage Futures cont'd*

The biggest causes of this variability include the timing of rainfall - fall versus spring rain, for instance - and the temperatures of the growing season.

*Figure 1. Forage Production at the San Joaquin Experimental Range (SJER) from 1936-2017. Rainfall in 2014 was the lowest recorded in this time frame, but 2014 did not have the lowest forage production. Similarly, the highest rainfall year (1983) did not have the highest forage production. Selected years have been labeled to show how total rainfall is only one factor of forage production each year. For example, with 20 in. of rain, forage production was as low as 2000 lb/ac (in 1962) and as high as 4000 lb/ac (in 1980).*




UC Publication 8018 (download here: http://anrcatalog.ucanr.edu/pdf/8018.pdf), describes forage production patterns in years with different temperature and precipitation patterns in fall, winter, and spring. Colder temperatures slow down plant growth. Winter growth is usually slower than fall due to both lower temperatures and fewer hours of light each day. In contrast, our relatively warm winter temperatures earlier this February would encourage more rapid growth, if we had the rainfall to support it.

Unfortunately, our weather pattern this year looks a lot like the pattern seen in 2014. In 2014 the total precipitation received by the end of the growing season was very low. At the San Joaquin Experimental Range, for instance, total precipitation was only about 7 inches - the lowest in the 80-year recorded history there. *This article continues* ►

*Forage Futures cont'd*

Total forage production was less than 1000 lb per acre as a result. This year, as of the end of January, SJER has received around 4 inches, and February has been unusually warm and dry.

Without good spring rain, we are headed for a low-production year. Using the historical data from SJER, I predicted forage production for three total rainfall scenarios. Keep in mind, your property may have differences based on elevation and prevailing weather patterns in your area. This prediction model is best for the Sierra Nevada foothills on the eastern sides of Madera and Fresno Counties, around 1000-1500 ft elevation. Predicted standing crop is shown in the table below, plus or minus one standard error.

| Weather Pattern | Potential Total Growing-Season Rainfall (in.) | Predicted Peak Standing Crop (lb/ac) |
|---|---|---|
| **Dry winter, dry spring** | **7** | **1053** ± 206 |
| **Dry winter, average spring** | **15** | **2076** ± 82 |
| **Dry winter, wet spring** | **21** | **2527** ± 91 |

If we have a year like 2014, we can expect similarly low forage production. However, if we get some good spring rain, we may get almost double the forage despite the concerning lack of rain to date. Interestingly, even with a very wet spring (averaging 7 inches of rain in each of March and April), we won't see much more forage than from an average spring. Either way, it is clear that a decent spring would provide slightly below average production, while a dry spring will limit production significantly.

Finally, an issue related to forage production in dry years is that some weedy or poisonous species excel relative to desirable forages. Weeds like tumbleweed, yellow starthistle, horseweed, and tarweed fiddleneck (see images on the next page) are often more abundant when rain is limited. Hungry animals may be more likely to eat them because preferred grasses like soft chess are often less abundant in dry years. In large quantities, fiddleneck can be poisonous to horses and cattle, and yellow starthistle can be poisonous to horses, so you may want to restrict these animals' access to areas where either of these weeds is the dominant available plant. Goats and sheep are not as vulnerable to fiddleneck and goats may actually enjoy munching on starthistle if not much else is available.

Good livestock and grazing management is a key component of drought management. Although you want to ensure your animals have enough feed and water, if you over-utilize pastures during drought they will take longer to recover and might be more vulnerable to soil erosion, weed infestations, and future drought years.
Early weaning as a strategy to manage livestock during drought is discussed in another article in this newsletter.

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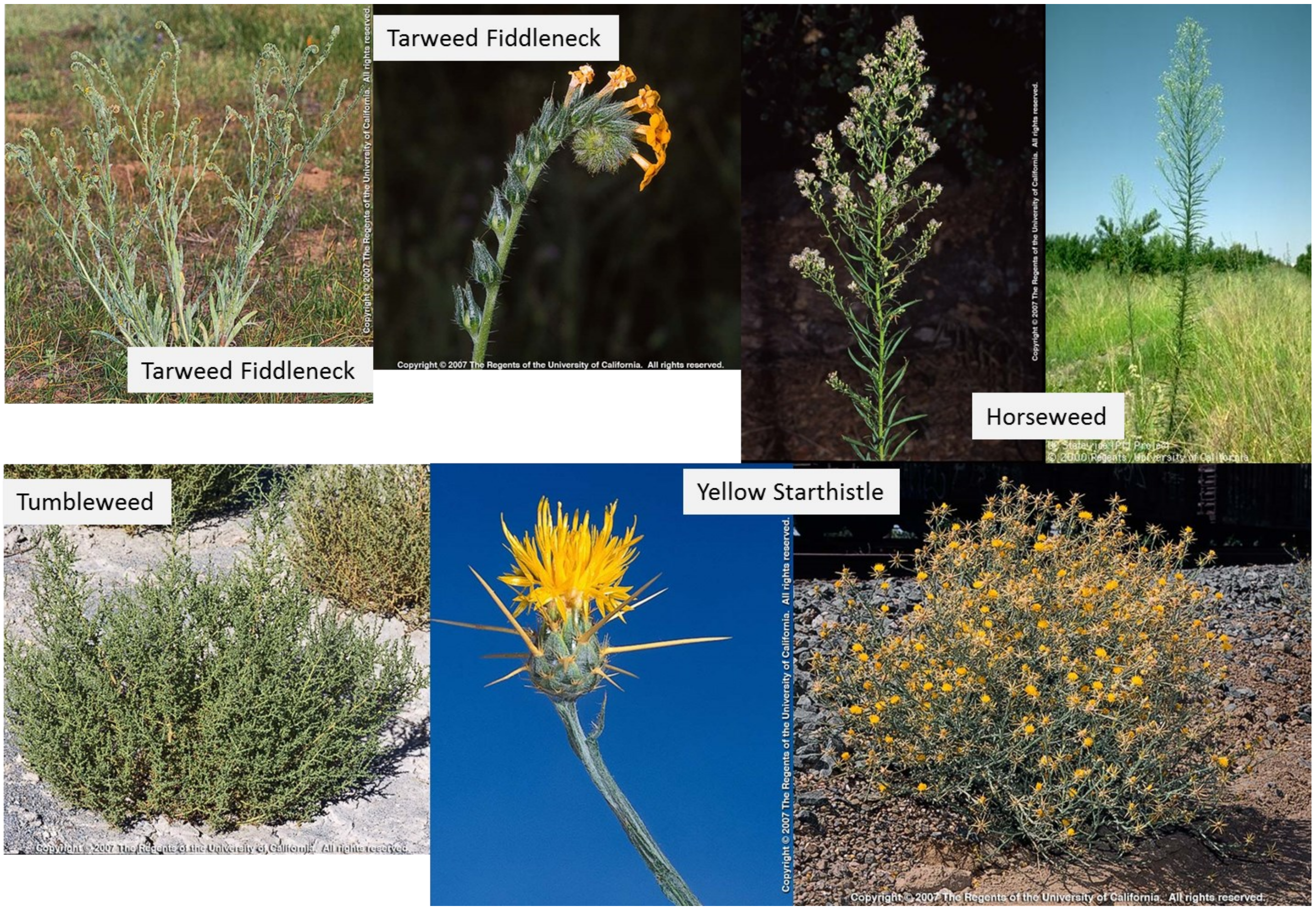


*Forage Futures cont'd*

## Additional Resources

UC Publication 8034 (download here: http://anrcatalog.ucdavis.edu/pdf/8034.pdf) advises drought livestock management practices, including moving livestock to the most productive pastures you have – such as pastures with oaks, if available, which will support more forage under their canopies – and making sure there is abundant fresh water available for livestock.

Stephanie Larson, UCCE Livestock & Range Management Advisor for Sonoma and Marin Counties, compiled several strategies for managing livestock during drought. You can read her drought strategies here.

The NRCS can also help you to identify and implement management practices and infrastructure to mitigate against drought years. For more information on drought management, contact your local NRCS Service Center or UC Cooperative Extension office.

Fresno NRCS Service Center: 559-276-7494 — Fresno UCCE Office: 559-241-7515
Madera NRCS Service Center: 559-674-4628 — Madera UCCE Office: 559-675-7879 x.7211

# A Survey of Annual Grass Forage Quality

## by Julie Finzel and Ralph Phillips

*Editor's note: The information for this article is sourced from a newsletter that Ralph Phillips authored in April 1992. Ralph did a fair amount of work putting that article together and the nutritional values remain applicable today. Julie Finzel is a Livestock and Natural Resources Advisor in Kern, Kings, and Tulare Counties.*

Any article on the nutritional value of forage should include some discussion of crude protein and crude fiber. Crude protein and crude fiber are two good indicators of forage quality. High crude protein values are an indication of high forage quality. There is considerable difference in these values between plant species. Generally speaking, clovers or legumes are highest in crude protein, followed by forbs and then grasses. Also, plants are higher in crude protein during the early stages of growth. Crude protein values usually start to decline at the flower stage and continue to decline until plants have matured and dried. Rain, snow, and sunlight will further reduce protein after maturity. The opposite is true for crude fiber; crude fiber values increase up to maturity. The fiber values in plants remain constant after maturity if the plants are not leached by rain or snow. Plants with low crude fiber are more digestible. This information simply reinforces what we already know, plants are more digestible and more nutritious in the earlier stages of growth.

To summarize, important nutrients that are often lacking in matured annual grass forage are energy (carbohydrates), protein, vitamins A, and some minerals. Rain will leach out carbohydrates (sugar and starch), soluble protein and some of the minerals. Phosphorus is the mineral most affected by leaching and forages are usually low in phosphorus. Leaching can create serious phosphorus deficiencies in forage.

If we consider forbs, and look only at filaree, calcium values stay fairly constant as the season progresses and hover around 2 to 2.5% even in dry, weathered plants. Phosphorus and potassium are higher in young plants and decline as the filaree plants age and dry. Finally, protein can be as high as 30% in young filaree plants, though the average is typically closer to 25%, and falls to around 10% as the plant matures and dries. Filaree seeds, without the beak, can have as much as 30% protein in them.

**Table 1** shows the differences between forbs and grasses. Early season forbs are higher in protein and lower in fiber than grasses, thus indicating that most forbs are a better cattle feed than grasses during the early part of the season. By the dry season, the protein value of grasses and forbs is about the same, but grasses are higher in fiber.

**Table 1.** Average crude protein and crude fiber values from 27 forb species and 8 grass species over three years from the San Joaquin Experimental Range.

| | **Forb Species** | | **Grass Species** | |
|---|---|---|---|---|
| | % Crude Protein | % Crude Fiber | % Crude Protein | % Crude Fiber |
| Early Green | 24.3 | 13.7 | 20.8 | 23.0 |
| Mature | 14.1 | 21.3 | 7.8 | 33.0 |
| Dry | 5.2 | 30.2 | 5.0 | 35.0 |
| Weathered | 3.7 | 33.8 | 3.0 | 44.0 |

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*Forage Quality cont'd*

**Table 2** shows crude protein and fiber values for filaree, bur clover, soft chess and wild oats. Again, the forbs (bur clover and filaree) are higher in protein and lower in fiber than grasses (soft chess and wild oats) in the early part of the season. By the time the forage has dried and leached, the protein values are very close for forbs and grasses.

**Table 2.** Average crude protein and crude fiber values from nine ranches over two years.

| | | |
|---|---|---|
| **Filaree** | **% Crude Protein** | **% Crude Fiber** |
| Green | 20.9 | 12.3 |
| Mature | 11.7 | 24.9 |
| Dry | 7.1 | 26.9 |
| Weathered | 4.9 | 31.7 |
| **Bur Clover** | | |
| Green | 29.6 | 14.0 |
| Mature | 23.3 | 19.0 |
| Dry | 16.3 | 30.0 |
| Weathered | -- | -- |
| **Soft Chess Brome** | | |
| Green | -- | -- |
| Mature | 12.4 | 27.1 |
| Dry | 8.5 | 27.1 |
| Weathered | 5.1 | 33.2 |
| **Wild Oats** | | |
| Green | 10.7 | 29.5 |
| Mature | -- | -- |
| Dry | 5.9 | 32.0 |
| Weathered | 2.8 | 35.8 |

**Table 3** compares protein, calcium, phosphorus and potassium values in filaree and soft chess brome over the course of the grazing season. While protein values appear to be high in weathered soft chess, values calculated with no seeds, and just the remaining plant material shows an average of 1-2% protein. It should also be assumed that values will continue to drop as forage weathers under the summer sun and especially if there is any summer rain to leach nutrients and further break down forage.

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*Forage Quality cont'd*

**Table 3.** Average crude protein, % calcium, % phosphorus, and % potassium for filaree and soft chess brome as collected over three years from the San Joaquin Experimental Range.

| Filaree | % Crude Protein | % Calcium | % Phosphorus | % Potassium |
|---|---|---|---|---|
| Green | 25.7 | 2.1 | 0.78 | 4.36 |
| Mature | 18.6 | 2.8 | 0.45 | 2.99 |
| Dry | 11.7 | 2.8 | 0.41 | 2.76 |
| Weathered | 8.9 | 2.7 | 0.21 | 2.73 |
| Seeds, no beak | 30 | 1.4 | 1.54 | 1.43 |
| **Soft Chess** | | | | |
| Green | 21.1 | 0.67 | 0.45 | 4.27 |
| Mature | 14.2 | 0.39 | 0.45 | 2.9 |
| Dry | 7.9 | 0.23 | 0.27 | 1.5 |
| Weathered | 6.3 | 0.22 | 0.22 | 1.23 |
| Seeds, mature | 12.5 | .242 | .401 | 1 |

If there appears to be a difference in the values in the tables, please remember the information came from different locations and different years. The nutritional values of forages change from year to year and location to location. In order to get an accurate value for your ranch, you would need to collect many forage samples and have them analyzed. This represents a significant amount of time and expense. The University of California has reference material that can be used to estimate nutritional values throughout the season and provide good, workable values that can be used to make management decisions.

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# Consider Weaning Early if Drought Persists

*by Matthew Shapero*

The rains have not come this winter. At the time of writing, seasonal rainfall in Ventura County has been measured at 1.21 inches (Santa Paula) and in Santa Barbara County at 2.50 inches (Santa Ynez). The California forecasts I am seeing are calling for showers in the first part of March, possibly reaching down into Ventura and Santa Barbara Counties, but April is projected to be drier and warmer than usual. None of this is especially good news for rangeland forage production this spring, nor for rangeland-dependent livestock operations.

If these dry conditions persist, you might consider early weaning as a strategy to cope with the lack of available feed. No doubt, your decision of when to wean will be influenced by a combination of things: the market price of calves, the amount of feed in your pastures come spring and summer, and the body condition of your cow herd. With that said, if feed quality or quantity in your pastures becomes low, leaving a calf on its mother when her milk production has declined is of little benefit to calf or mother. The result is a relatively light-weight calf for its age and a mother cow with low body fat reserves going into late summer.

Consider the following two diagrams. Figure 1 shows the Total Digestible Nutrients (TDN), or energy, that a cow-calf pair requires each day over the course of the year. On the vertical axis is pounds of TDN per day. Months of the year are on the horizontal axis. If your herd is fall calving, the "calf born" arrow (between months two and three) occurs sometime around August-December. By Month 5 on the diagram (2-3 months after calving), your mother cow is lactating most heavily and her TDN requirements (densely dotted bar) peak at around 15 lbs TDN/day, right around the time she is bred. In your fall calving system, this would be around November-February, when the available feed resources on rangelands can sometimes be at its lowest. Combined TDN requirements of cow and calf are highest from this time until weaning, peaking between Months 9 and 10 in the diagram, or late spring/early summer in the fall calving herd.

Figure 1.

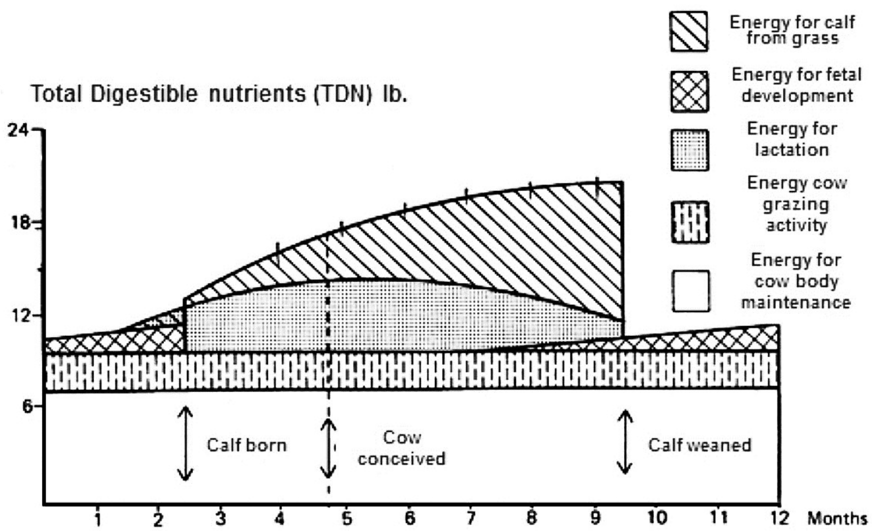


Figure 2 shows how weaning a calf early can benefit both the mother cow and the range resource. Weaning at 4.5 months (say March 1) rather than 7 months (May 15) reduces the herd's overall demand for forage by removing the nutritional requirements each cow has for lactation.

Furthermore, selling those light calves March 1 rather than May 15 can remove their added grazing pressure on your pastures (diagonal lines, bar on the top). A March 1 sale might also benefit from a higher price per pound on calves than you'd fetch come May 15.

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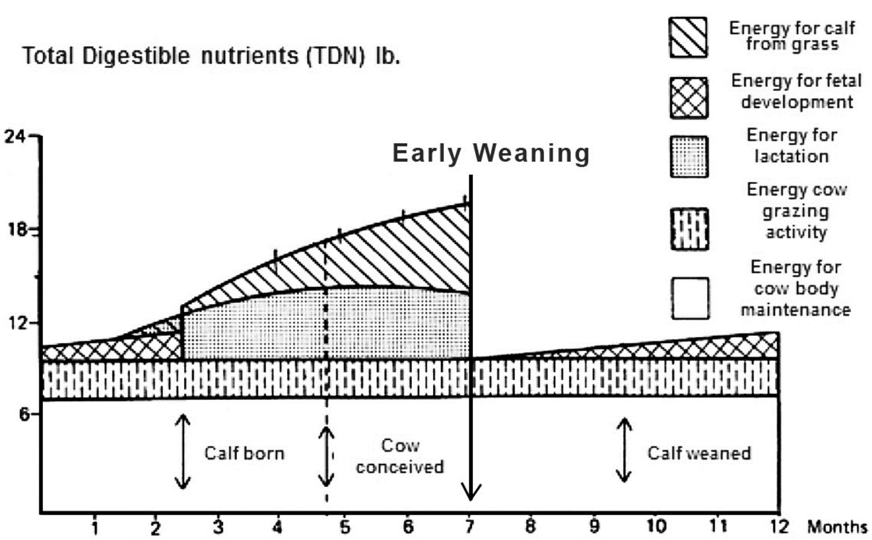
*Early weaning cont'd*

Figure 2.




The research that has been done in recent decades has reinforced that early weaning can be used as an effective strategy to mitigate drought.

Research supports a couple of critical things:

- **Early-weaned cows maintain higher body weights (BW) and body condition scores (BCS) compared to normal-weaned cows.** One study found that the cost of supplementing the normal-weaned cows to get them back up to the same body condition score of early-weaned cattle could cost as much as $100/cow.
- **Weaning early can substantially extend the grazing season for the mother cow herd**. A study out of Wyoming suggests that dry cows grazed 72% less than cow-calf pairs.
- **Early-weaned cows breed back much sooner than do normal-weaned cows,** which can help ensure a regular calf crop every 365-day interval.
- **Early weaning can reduce the need to cull older cows in your herd**
- If you retain your light calves and creep feed them, **there is no difference in body weight between early-weaned calves fed on creep feed and normal-weaned calves.** Directly feeding early-weaned calves is more efficient economically than supplementing their mothers to support continued lactation.

Much of the research work that has been done on early weaning has happened in either the Midwest or Intermountain West and on spring calving herds. There is currently a proposal, however, for a three-year study of the fall-calving herd at the University of California's 6,000-acre working ranch, the Sierra Foothill Research and Extension Center. The study will compare an early weaning group (March 1) and a traditional weaning group (June 1) and will look at cow and calf BW, cow BCS, forage utilization, forage quality, and the economic implications of each approach.

Prices for light weight calves are currently up, but ultimately, the decision to wean calves early needs to fit into the other constraints of your ranch. The final decision of when to wean calves should balance the feed resources on your ranch and current market economics.

*Editor's note: Matthew Shapero is a Livestock and Range Advisor in Ventura and Santa Barbara Counties.*