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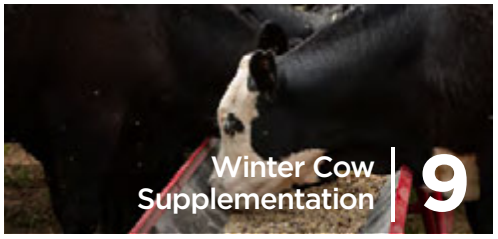
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NOBLE NEWS & VIEWS

WILDLIFE

Hunter Data Can Help Manage Deer Populations

by Will Moseley, wildlife and fisheries consultant | wamoseley@noble.org
Josh Gaskamp, technical consultation manager and wildlife and range consultant | jagaskamp@noble.org

Last month we discussed how to use hunters to help collect survey data. This article will discuss how we can use harvest data from hunters. Most harvest reports focus on number of animals harvested, weights and estimated ages. While these numbers are important, this article will focus on other interesting aspects that we can learn from the harvest data.

All hunters on Noble Research Institute properties complete a cloud-based survey on their smartphone every time they hunt. They provide information such as location, hours hunting, harvest data and observation data. We can use this data to learn more about hunter effort than could from a typical harvest sheet at a check station.

Harvest is a major focus of good deer management. For most properties, the best population management strategies involve shooting more does and less bucks. Sounds easy, right? But how much time does it take to harvest does and bucks in an unfed, free-range deer herd? Do your hunters view doe harvest as work or as a great opportunity to put tasty venison on the table? When is the best time of the season to hunt? Let's take a look at results from hunters on Noble Research Institute properties.

Story continues on page 3

HUNTER DATA

All hunters on Noble Research Institute properties complete a cloud-based survey on their smartphone every time they hunt. They provide information such as location, hours hunting, harvest data and observation data.

FIGURE 1

MAN HOURS PER HARVESTED DEER BY METHOD.

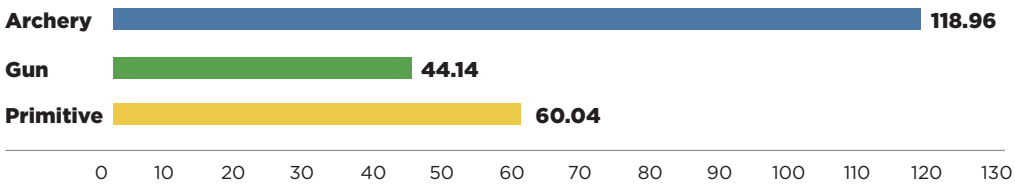


FIGURE 2

MAN HOURS PER HARVESTED DEER BY HUNTER.

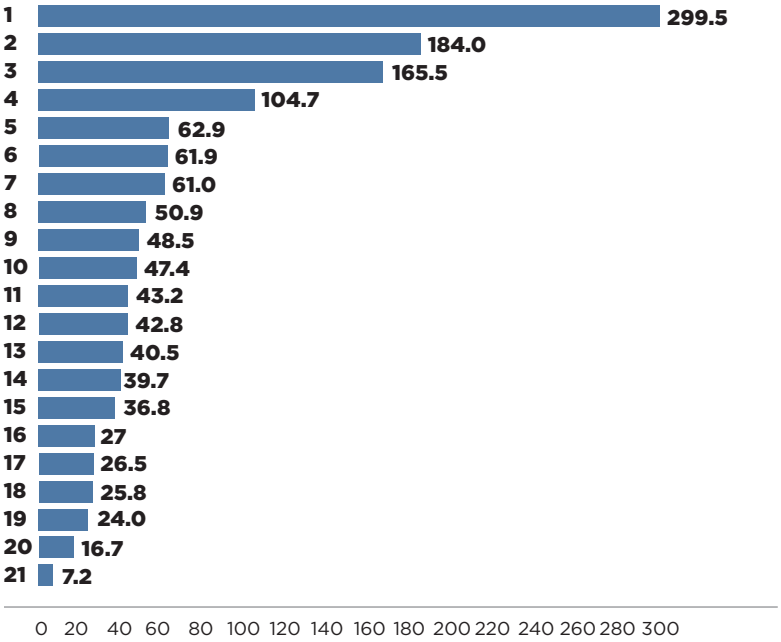
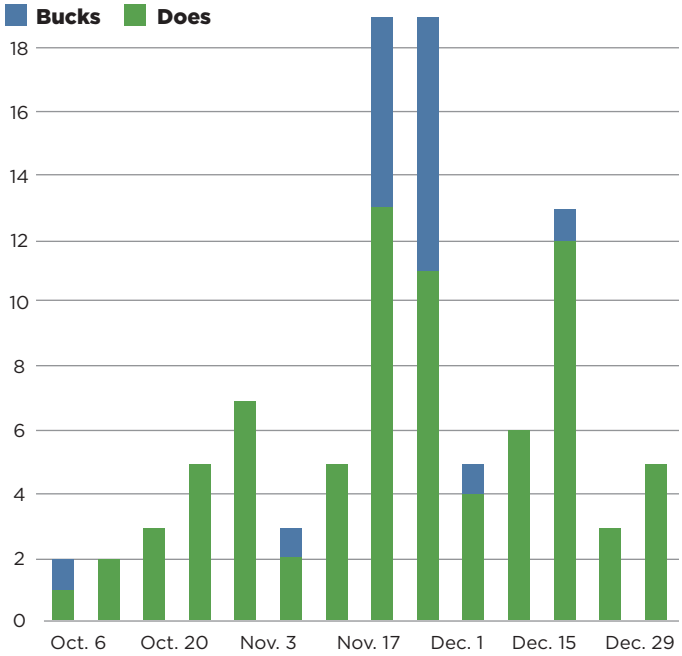


FIGURE 3

NUMBER OF DEER HARVESTED PER WEEK OF DEER SEASON.



NOBLE HUNTERS: HOURS TO HARVEST

We found that it takes, on average, 71 hours to harvest a doe and 350 hours to harvest a buck across all methods. Noble hunters are allowed to harvest one buck per year. These bucks should be a minimum 130 inch gross Boone and Crockett score, which adds to selectivity of buck hunting, increasing time needed to harvest a buck.

Hours per harvested deer differs by method. As expected, it takes less time to harvest a deer with a gun than it does with a bow (Figure 1). Also, we learned some hunters put more effort into deer harvest than others (Figure 2). This could be because some hunters are actively targeting does, while some are only buck hunting and have no interest in killing a doe.

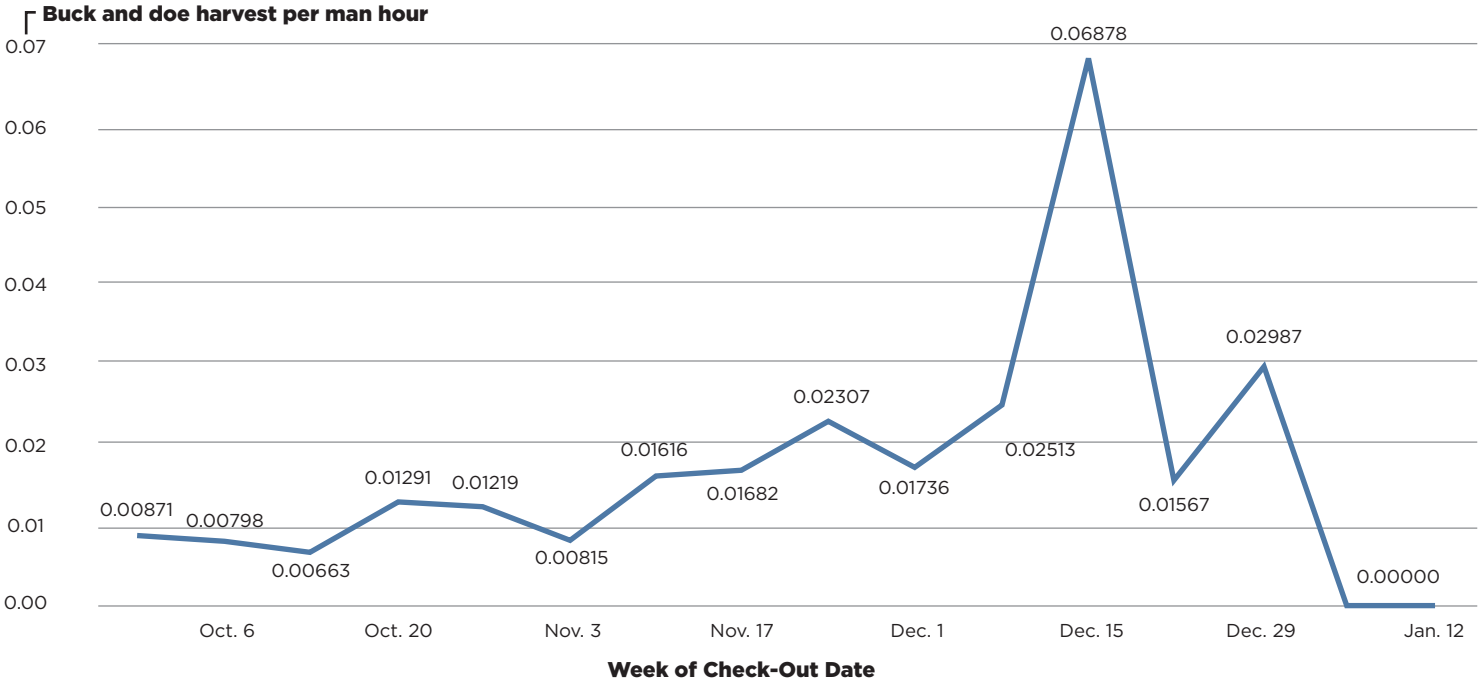
There is an incentive to harvest does. A hunter can gain preference points for the next season's draw if they harvest does. We noticed there is a peak in buck and doe harvest (Figure 3) during rifle season (late November through early December) but the effort (harvest per hour) does not change very much during that time (Figure 4). This is a product of more people spending more time hunting. However, there was another spike in doe harvest in mid-December and a corresponding increase in hunter efficiency. This could be because does were moving more compared to earlier, during rifle season. However, it could also be because hunters were focused on doe harvest during December, when bucks were not legal with a gun, and were more apt to harvest a doe when presented with an opportunity. Maybe mid-December is a good time to focus on doe harvest.

FIND HUNTERS TO MATCH YOUR MANAGEMENT

So how does all this impact deer population management on your property? Bottom line is it takes time to harvest deer. It takes more time to harvest deer with a bow than a rifle. Some hunters will harvest more does than others. If doe harvest is a focus of your management, find hunters who want to harvest does and don't pass up opportunities when they are available.

FIGURE 4

DEER HARVEST PER EFFORT OVER OKLAHOMA DEER SEASON



SOILS

Building Soil Organic Carbon With Plant Roots

by Larry York, Ph.D., assistant professor | lmyork@noble.org; Jeff Goodwin, conservation stewardship leader and senior pasture and range consultant | djgoodwin@noble.org

Soil health has become an important rallying point for many people involved with regenerative agriculture, including researchers, food companies and producers.

Noble defines regenerative agriculture as the process of restoring degraded soils using practices based on ecological principles. In general, that means focusing on the capacity of the soil to sustain fundamental processes essential for microbes, plants, animals and people to thrive.

Soil carbon is widely regarded as one of the most important metrics of soil health and refers to the amount of carbon (primarily in organic matter) found in the soil. We can recognize soils high in soil carbon by their darker color and rich, earthy smells.

Increasing soil carbon is linked to greater water infiltration and holding capacity of the soil, which can help grazing lands withstand droughts. At the same time, drawing soil carbon from the atmosphere could help decrease atmospheric CO^2 levels.

So, if soil carbon is so good, what can we do to build soil carbon? The answer is complex and requires a little deeper understanding of the carbon cycle.

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REGENERATIVE AGRICULTURE IS THE PROCESS OF RESTORING DEGRADED SOILS USING PRACTICES BASED ON ECOLOGICAL PRINCIPLES.

CARBON CYCLE BASICS

Plants pull carbon from the atmosphere during the process of photosynthesis to build sugars that they use for growth and energy. Investment of this sugar to build and maintain healthy root systems is a major component of the plant's carbon budget.

Roots take up water and nutrients, and they release many different compounds known as root exudates that range from mucilage to small molecules like sugars. These exudates are commonly thought to feed the soil's complex microbial community, in effect transferring carbon from the plant to microbial cells.

When either roots or microbes die, they decay through chemical and biological decomposition, which frees more carbon to enter soil fractions. The two major soil fractions are believed to be particulate organic matter made of larger fragments and mineral-associated organic matter made of smaller molecules that are bound to soil mineral particles. Particulate organic matter is thought to be shorter lived than mineral-associated organic matter.

HOW CAN WE BUILD SOIL CARBON?

Applying the five soil health principles serves as a great foundation because each principle can influence the processes involved with building soil carbon.

A precursor to building healthy soils is keeping them protected and covered. Keeping plant litter and living shoots on top of the soil acts to conserve soil moisture and regulate temperature, which will promote plant growth, including the root system to feed soil microbes. Together, these will act to increase carbon inputs and, ultimately, ensure that the soil is protected from disturbances that disrupt natural soil activities.

Tillage exposes fresh soil, along with its carbon and microbes, to oxygen. This leads to a widely documented "burning off" of soil carbon. Soil carbon burn-off is caused by a microbial population explosion that consumes all the carbon as energy and is released as CO_2, just like when a person breathes out.

Soil disturbances also disrupt soil structure, which is important for exposing mineral surfaces that act as binding sites for soil carbon. Luckily, activities of roots, microbes and soil biology all lead to greater porosity with regenerative capacity.

INCREASING BIODIVERSITY

Increasing plant diversity is another way to aid in building soil health. Plant diversity has been seen to promote overall plant community growth, which drives greater root growth and carbon inputs. At the same time, the rich underground environment made through diverse roots and exudates leads to greater microbial diversity and functioning.

A focus on plant diversity provides a pathway to promote plants that keep living roots in the ground all year. This principle has two effects, one by increasing the total input of dead roots, and the other by increasing the input of exudates (microbe chow.)

Dead roots may lead to greater particulate organic matter, while exudation may lead to greater microbial activity and eventually greater mineral-associated organic matter.

Importantly, keeping these processes sustained over time leads to a more stable soil community that is more resilient. Ultimately, the management of these plants with a focus on ecological processes should be facilitated by properly integrating livestock.

Livestock promote other principles directly by promoting plant growth, including the roots when plants aren't overgrazed and increasing plant diversity. Livestock manure also serves as a rich source of soil carbon.

ROOT FUNCTIONS

Although plant leaves produce more than 95% of the food for the plant on a dry weight basis, the roots, provide the framework for plants to function while providing direct benefits to multiple organisms.

Plant roots provide multiple functions but core to those are:

- Plant anchorage.
- Nutrient and water uptake.
- Nutrient transfer.
- Energy storage.

TYPES OF ROOTS

Some plants have strong, thick tap roots, more consistently found in broadleaved herbaceous plants, which can aid in breaking up soil compaction.

Story continues on next page

Root systems with many fine roots that are densely packed, most commonly found in grasses, can grow quite deep and provide considerable soil stabilization to stream banks, riparian areas, or other areas prone to wind or water erosion. So, one way to manage soil carbon is using roots as scaffolding that prevents erosion and keeps hard-earned soil carbon in place.

PLANTS AND MICROBES

Plants need specific nutrients and water to survive, and most of those are facilitated through the plant's roots. While plants can uptake water and nutrients themselves, they do not have the luxury of any method of travel when limitations occur. However, they do have the ability to develop symbiotic relationships with organisms that help extend their reach.

Many plants develop associations with mycorrhizal fungi. Mycorrhizal fungi attach themselves to the plant roots, and in return, for energy from the plant, it provides a mechanism for water uptake and is even known to aid in solubilizing phosphorus.

Ultimately, plants provide an energy source for a multitude of biological soil organisms. Plants produce and exude compounds that feed soil microbes, providing nutrients like nitrogen in plant available forms.

ROOTS AND CARBON

Roots and crowns are important for energy storage in perennial plants. When perennial plants come out of dormancy, they need the carbohydrates stored in the crown and roots to use as reserved energy until the plant has the ability to form enough leaves early in the spring to start charging its batteries, so to speak.

In the end, roots help plants transfer carbon in all three states of matter: liquid (plant exudates in solution), solid (plant root material) and gas (such as CO_2 or CH_4). All three states have an impact on the ability for us to sequester carbon in our soils by targeting the various soil carbon fractions.

BUILDING SOIL CARBON

Typical soils range from 1-5% percent soil carbon by weight.

Because of carbon cycling by microbes, building soil carbon is complex and does not simply equal the carbon inputs from roots and plant litter.

Typically, we expect more degraded soils with lower carbon levels to have the capacity to build soil carbon faster, as long as the soils can sustain plant communities. Recent evidence suggests that soil mineral surfaces can become full, or saturated, which may limit mineral-associated fraction that acts as a long term storage. Still, high levels of particulate organic matter can be sustained and have been shown to continue building even after the minerals are saturated.

TEST YOUR SOIL CARBON

We recommend having your soil carbon tested today and challenging yourself to build this carbon. In doing so, you will become a more intentional producer and have a realistic, objective metric for the regeneration of your operation.

RESEARCH

These alfalfa roots are from a field infected with cotton root rot at Noble's Red River Ranch in Burneyville, Oklahoma. The root on the left was taken from an area with no disease, while the root on the right was a survivor from a diseased area. The roots were analyzed with the RhizoVision Crown platform and software developed at Noble. Red lines represent roots less than 2 millimeters in diameter. The healthy root exhibits a strong taproot and few fine lateral roots (lateral length: 2 feet), while the diseased plant lost its taproot and compensated by forming many lateral roots (lateral length: 9 feet). This shows that even the same plant species can have tap-rooted or fibrous root systems.

This data can be found in a free scientific article about root rot in alfalfa by Noble researchers Larry York and Carolyn Young.
https://doi.org/10.1094/PBIOMES-12-18-0062-R

5 Myths People Believe About Roots

by Larry York, Ph.D., assistant professor | lmyork@noble.org; Amy Hays, adult education manager | aehays@noble.org

We all know roots are important to the plant even if we don't always see them and a lot of what they do remains hidden. In our work at Noble Research Institute, we see that producers are very interested in learning more about roots.

There are some good ideas out there, but there are also some misconceptions. Here we'll do some myth busting based on common questions and ideas encountered with producers.

MYTH 1

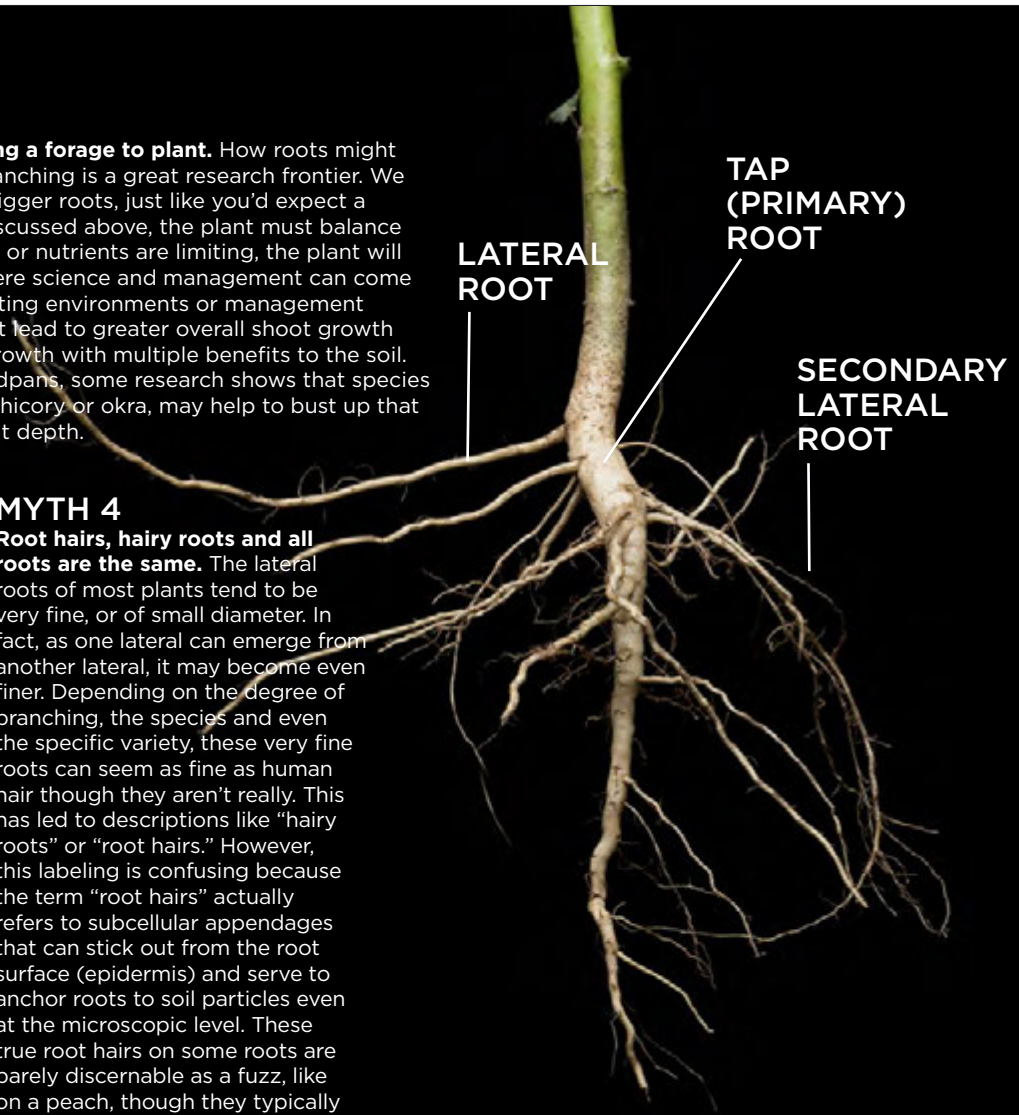
Balls of roots are always good when you pull up a plant.

All else being equal, we can say that more roots are better. However, all else is not equal and there are negative reasons why plants might produce extra roots. First, roots are very costly to the plant — 50% of the sugar the plant makes from photosynthesis is typically used for root construction and maintenance. Therefore, it's very important that plants balance giving just the right amount to building the right size and shape root system to drive plant growth. Fact is, if a plant only invested in roots and not leaves, it would not live very long. As mentioned, there are negative reasons that roots might proliferate. For example, it's well known that roots proliferate in order to scavenge for water and nutrients. Therefore, very prolific root systems may indicate soil or plant deficiencies that may actually be limiting plant growth. If a main root is damaged by disease, worms or insects, it often has more lateral (or branch) roots.

Story continues on next page

MYTH 2

You can't pick good roots when selecting a forage to plant. How roots might improve the soil for more regenerative ranching is a great research frontier. We typically expect bigger shoots to have bigger roots, just like you'd expect a tall person to have longer legs. As we discussed above, the plant must balance investment to the roots, and when water or nutrients are limiting, the plant will typically invest more in roots. This is where science and management can come in. Varieties bred to thrive in growth-limiting environments or management practices, such as rotational grazing, that lead to greater overall shoot growth will also generally lead to greater root growth with multiple benefits to the soil. In the case of fields or pastures with hardpans, some research shows that species with thick, dominant tap roots, such as chicory or okra, may help to bust up that pan and allow greater water infiltration at depth.



MYTH 3

There are only tap-rooted and fibrous root systems. This is a bit of a misconception. In fact, all plants that grow from a seed initially have a tap root. This is the root that first emerges from the seed before the leaves do and is known as the radicle or the primary root. In most species, this root can grow very deep as long as it doesn't become damaged or die. The element of truth in this myth is that many broadleaf plants have a large, prominent tap root. Carrots are an extreme example, but this is also true for alfalfa, dandelions, beans and okra. In general, it may be that the thicker the tap root, the deeper it grows — but that's not always true. Many grasses, including bermudagrass or fescue, and cereals like wheat, are described as having fibrous root systems because the tap root is small and there are many other thin roots that look like a mat. However, many varieties or species may be somewhere in the middle, like sunflower that has a fairly strong tap root but also many fine roots near the base of the tap root. Therefore, we encourage you to look a little harder and consider descriptions like a strong or weak tap root and the degree of lateral branching or fine rooting.

MYTH 4

Root hairs, hairy roots and all roots are the same. The lateral roots of most plants tend to be very fine, or of small diameter. In fact, as one lateral can emerge from another lateral, it may become even finer. Depending on the degree of branching, the species and even the specific variety, these very fine roots can seem as fine as human hair though they aren't really. This has led to descriptions like "hairy roots" or "root hairs." However, this labeling is confusing because the term "root hairs" actually refers to subcellular appendages that can stick out from the root surface (epidermis) and serve to anchor roots to soil particles even at the microscopic level. These true root hairs on some roots are barely discernable as a fuzz, like on a peach, though they typically break off when removing from soil. The International Society of Root Research has tried to avoid some of this confusion by defining four major root types: the tap root, shoot-borne roots, basal roots and lateral roots of other roots. Basal roots are those that form above the seed but not on the shoot. Therefore, the term fine roots to describe laterals of fine diameter may cause less confusion than hairy roots that may incorrectly be associated with root hairs.

Story continues on next page

WANT TO READ MORE?

Fewer Roots for Deeper Rooting and Greater Fertilizer Uptake?
www.noble.org/news/research-updates/fewer-roots-for-deeper-rooting-and-greater-fertilizer-uptake/

Why Roots Matter to Soil, Plants and You
www.noble.org/news/publications/ag-news-and-views/2018/june/why-roots-matter-to-soil-plants-and-you/

Grazing Affects Plant Root Growth
www.noble.org/news/publications/ag-news-and-views/2015/january/grazing-affects-plant-root-growth/

Measuring the Hidden Half of Forages
www.noble.org/news/publications/ag-news-and-views/2019/august/measuring-the-hidden-half-of-forages/

Teaching Tools in Plant Biology – Measuring Roots (includes lecture slides and notes)
www.plantcell.org/content/29/9/tpc.117.tt0917

RhizoVision Crown Root Imaging Platform (free journal article)
spj.sciencemag.org/journals/

RhizoVision, developed in the laboratory of Larry York, Ph.D., allows researchers to visualize and study the intricacies of root structure.

MYTH 5

It's better to plant so each plant has room versus crowding plants together. Some producers worry about planting seed mixtures because of overcrowding. Plant competition is definitely an important consideration in cropping systems or introduced pastures. Seeding rate is a major determinant of overall forage yield, where yield typically increases as seeding rate increases and then plateaus before eventually falling off as competition becomes too great. On the other hand, the concept of species complementarity suggests that by mixing plants with different forms and time of activeness (for example between cool-season die-off and warm-season growth), the overall performance of the ecosystem is improved. Belowground, there is evidence that some roots can occupy the more shallow area, while others use the deeper soil layer so that the overall soil is better explored. Some species may also use different sources of nitrogen and phosphorus. Therefore, even as the same seeding rates, mixtures may actually have less competition and perform better than their monoculture counterparts, with numerous other benefits. A great continued frontier of study in grazing systems is to understand how native grassland systems work and whether competition and complementary growth can provide insight into management of both native and introduced pastures.

KEEP DIGGING

Our tip for producers is to keep wondering and keep digging. Many plant biologists have the same misconceptions about less studied roots. By knowing your roots and soils as well as you know your pastures and fences, you can more effectively manage your land.

LIVESTOCK

Winter Cow Supplementation: Protein and Energy Explained

by Caitlin Hebbert, livestock consultant | cshebbert@noble.org
Ryon Walker, Ph.D., livestock consultant | rswalker@noble.org

In the article "Nutrient Synchrony: Protein and Energy Working Together," we discussed how protein and energy act synergistically in the rumen to booster animal performance: Each requires the other for peak function. We also mentioned how winter supplementation often consists of a protein supplement but that protein is not always the limiting nutrient. In this article, we will talk about both protein and energy supplementation and how to know which is the limiting nutrient and when to feed it.

NUTRITIONAL NEEDS FOR SPRING- VS. FALL-CALVING COWS

In a spring-calving system in the southern Great Plains, if warm-season forages are managed for grazing through the early part of the dormant season (stockpiling), cow maintenance requirements after weaning can be met going into December. Keep in mind forage type and maturity typically affect forage quality.

Story continues on next page

In fall-calving cows, protein and energy requirements for lactation and maintenance are typically not met by warm-season stockpiled forages as they transition into dormancy. At this point, lactating cows will start to lose body condition. It's not unusual to hear someone talk about how their cows look a little "hard" after coming through winter, even though they fed a supplement. Nine times out of 10, this is because they were protein-forward in supplementation all the way through winter.

MYTH: COWS ONLY NEED PROTEIN TO MAINTAIN CONDITION THROUGH THE WINTER.

Let's look at nutrient requirements during the fall/winter for both calving systems.

If you're on a spring-calving schedule with a February to April calving window (Figure 1 and 2, green line), you can expect a cow's nutrient requirements to be the lowest for both crude protein (CP) and energy (total digestible nutrients, TDN) close to and following weaning around September/October.

If you're on a fall-calving schedule with a September to November calving window (Figure 1 and 2, yellow line), you can expect a cow's nutrient requirements to be the highest for both CP and energy during the same time.

EXAMPLE SCENARIO

For example, CP and energy requirements of a spring-calving cow close to and following weaning drop to approximately 6% (CP) and 46% (TDN) of total dry matter intake (DMI) around September/October (see Figure 1 and 2). In a fall-calving cow, CP and TDN requirements during the first two months of lactation (September/October) are as high as 10-12% CP and 60-65% TDN of total DMI (Figure 1 and 2). This range in nutrient requirements in a fall-calving cow during lactation is dependent on cow size, cow age, peak lactation potential and DMI.

For a spring-calving system going into the fall, this gives many producers a sense of relief. They met high nutrient requirements during the growing season, were successful in meeting nutrient needs throughout the summer, weaned a healthy calf and now the cows can be self-sufficient until spring again. For a fall-calving system going into the fall, the relief just ended.

ENERGY (TDN) DROPS IN FORAGE WHEN COW NEEDS IT MOST

As fall transitions into winter, the nutrients available in most forages begin to decline, particularly energy. Good quality native pasture will usually hold CP fairly well during the dormant season and can meet much of a dry cow's CP requirements through fall and maybe early winter. Even well-managed

Story continues on next page

FIGURE 1

NRC CRUDE PROTEIN REQUIREMENTS FOR MAINTENANCE

Crude protein requirements for maintenance of a 1200 pound fall-calving (beginning in September; yellow line) and spring-calving (beginning in February; green line) cow with 20 pounds daily milk production – NRC (2000).

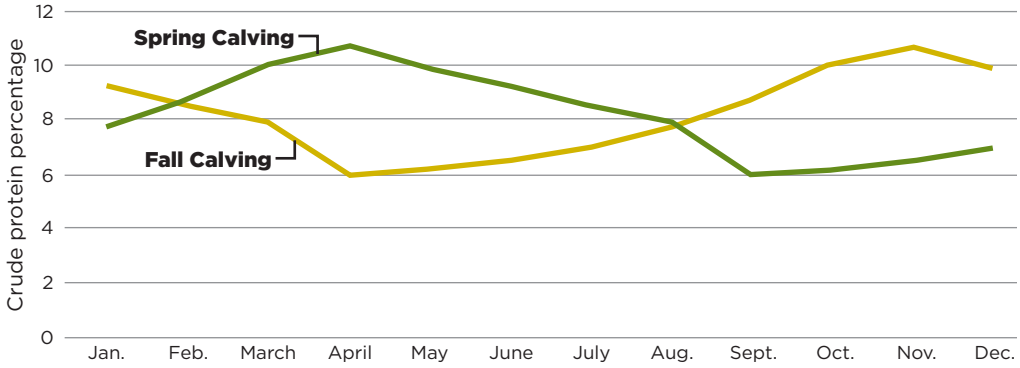
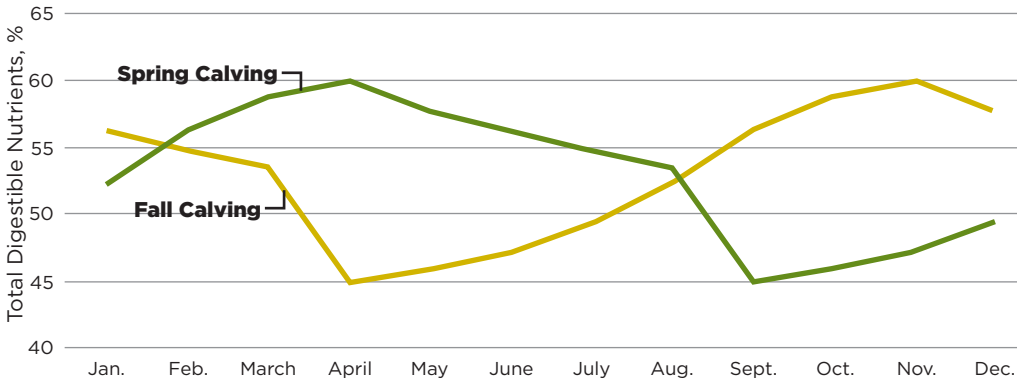


FIGURE 2

NRC TOTAL DIGESTIBLE NUTRIENT REQUIREMENTS FOR MAINTENANCE

Total digestible nutrient (TDN) requirements for maintenance of a 1,200 pound fall-calving (beginning in September; yellow line) and spring-calving (beginning in February; green line) cow with 20 pounds daily milk production – NRC (2000).



bermudagrass can hold CP levels through December, depending on how wet the winter is.

However, it's important to remember that the dry cow is also the gestating cow and approximately 67% of fetal weight occurs during the last three months of gestation. This requires a significant amount of nutrients, specifically energy. Not only is the cow requirement now steadily increasing starting around December (again, considering calving season begins in February), but the fetus is starting to impose on rumen capacity as it grows, reducing her dry matter intake.

EVEN WELL-MANAGED BERMUDAGRASS CAN HOLD CP LEVELS THROUGH DECEMBER, DEPENDING ON HOW WET THE WINTER IS.

Therein lies the conundrum: she is eating less but needs more. And while she may be lacking in protein, the initiation of that latter trimester initiates a switch in the limiting nutrient — energy, which is now a priority.

KNOW CATTLE SIZE AND FORAGE QUALITY

There is no graph or chart that can be made to point you to the perfect supplement for the winter months. It all relies heavily on two things: cow type (size, age, stage of production and lactation potential) and forage (both quality and availability). It is critical to know the size of your cattle rather than just guessing and to test your forage in order to meet requirements without overspending and underfeeding one nutrient or both.

In December:

- A 1,400-pound cow with 20-pound peak lactation and a February calving date requires 1.5 pounds more TDN per day (14.2 pounds vs. 12.6 pounds) and 0.15 pounds more CP per day (2.1 pounds vs. 1.86 pounds) than a 1,200-pound cow with the same lactation potential.
- A 1,200-pound non-lactating cow that is seven months pregnant with a February calving date requires 4.5 pounds less TDN per day (11.8 pounds versus 16.3 pounds) and 1.2 pounds less CP per day (1.6 pounds versus 2.8 pounds) than a 1,200-pound lactating cow three months after calving.

WHICH NUTRIENT IS NEEDED?

In order to know what nutrient is limiting, you need to have a good understanding of the nutrients that you have available and how much you have available through the winter period. Then based on animal type and stage of production, you can identify which nutrient is limiting and how much. At that point, you can shop for supplements that provide the right nutrients at a reasonable price.

For example: If you are a producer whose property and resources favor feeding range cubes and who is on a spring-calving schedule, it usually is most financially sound to feed a high-protein cube (30-38%) up until December then switch to a less protein-dense cube (20-25%) up until calving. This way you can increase pounds of supplement to meet energy requirements without overfeeding protein and overpowering your feed budget.

If you are feeding a commodity ration, your nutritionist may be more forward with a higher protein base (cottonseed meal or soybean meal) early in the winter and incorporate more energy (corn or corn byproducts) closer to calving.

MOST COWS NEED WINTER SUPPLEMENT

Most cows in most production systems are going to require some form of supplementation during winter in order to support and promote fetal development, as well as to meet her own maintenance requirements. Every producer benefits from becoming more informed about the nutrients available to cows in the pasture, as well as what the cow requires throughout the year relative to her size, production state and production potential.

Knowing when to invest in protein, or when to invest in energy, to meet cow requirements as they fluctuate is sure to yield a healthier, more productive herd and to increase the effectiveness of dollars invested in the cow herd.

NOBLE
NEWS&VIEWS

IN THIS ISSUE

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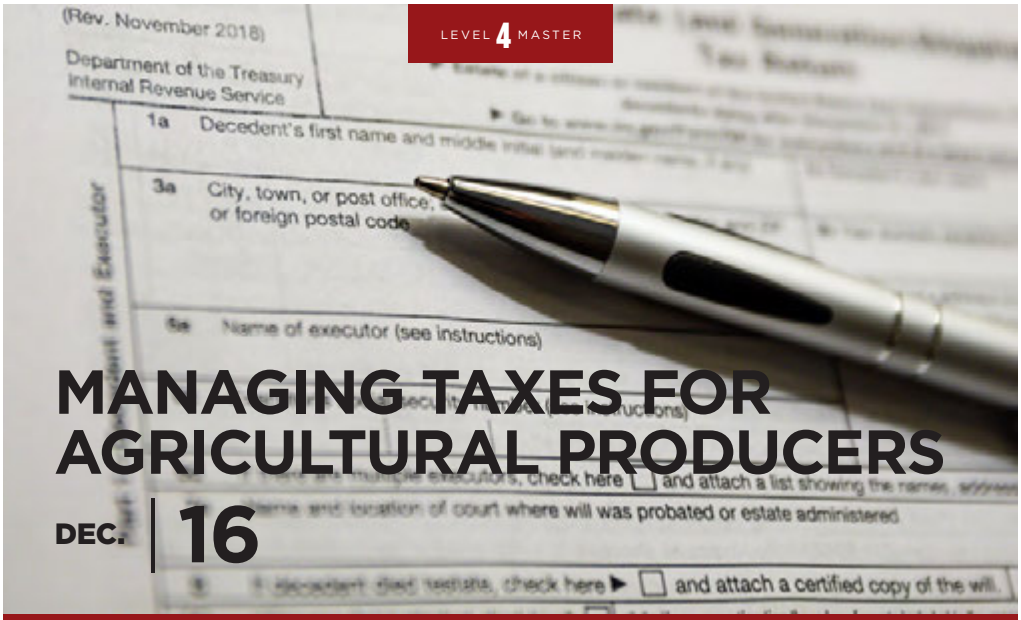
CHECK NOBLE.ORG FOR EVENT CANCELLATIONS

All educational events will move to live online learning for the remainder of 2020. Please check www.noble.org/events for the most current information on times and dates and to register for log-in information.



MANAGING TAXES FOR AGRICULTURAL PRODUCERS

DEC. | 16

The Internal Revenue Service has issued many changes to certain regulations as a result of COVID-19. It is important for taxpayers to stay informed of these changes in order to do the best job of managing their taxable income. These details will be discussed at this seminar. Tax professionals will be present to help answer questions.

Check noble.org/events closer to event date for times and registration

APPLYING BEEF QUALITY ASSURANCE PRACTICES

APRIL | 21

Beef Quality Assurance is going to the ranch. Beef producers looking to improve their best management practices and ensure quality beef products in the food chain should join us. During this workshop, you'll see various demonstrations and gain hands-on experience with practices vital to beef cattle production.

Check noble.org/events closer to event date for times and registration