MECHANICAL ADVANTAGE: PRE-CUTTING AS AN ADDITION TO FORAGE PROCESSING

Jarrod McGinnis, Production Systems Manager, & Mark Schmidt, Principal Scientist, John Deere

Forages are a foundational and necessary dietary component in animal nutrition among ruminant animals and other livestock. They are one of the most important dietary program components factoring into feed palatability and consistency, as well as nutritive value.

Achieving quality forage must include a focus on in-field production with attention to the form of forage that will support the goals of the animal production system. Quality forage can be achieved in higher moisture forms like baleage, haylage, and silage, as well as in low moisture forms like round bales with dry hay or forage that is not ensiled.

In recent years, there has been significant research focused on innovation in the hay and forage production system with resulting product improvements to meet quality and nutrition needs. In part, these innovations have focused on in-field production and post-production processing as a final step before feeding. Nearly all of these innovations have been enabled by some form of equipment and mechanical interactions – providing a mechanical advantage.

One area of focus has been on the processing of forages to effect fiber and particle length. Managing these factors can provide production advantages by increasing bale density and improving the potential for higher quality ensiled forages. They can also provide potential benefits around feed preparation and consumption by reducing selective feeding, increasing options for mixing forages within total mixed rations (TMR), and matching fiber length and particle size to the dietary needs of the consuming animals. Research also has shown processing to be an effective means to manage high fiber material and reduce the time that forages are retained in the rumen.

While processing can be an important determinant for managing and preparing forages for animal nutrition, it is important to start with quality forage. No form of processing can make low quality forage good, but it can enhance low quality forage and its use by altering its physical and chemical properties potentially to improve feed mixing, increase the speed of digestion, and improve forage consumption.

Mechanical processing of forages in this manner are usually done through the use of tub grinders, bale processors, and other equipment that chop, grind, and/or shred forages. As a post-harvest step (i.e., post-production), grinders and processors provide benefits in effecting a high amount of surface area to increase the speed at which animals digest forages, decrease digestion time which increases intake of both low quality and high quality forages, aid blending and mixing of forages and additive by deconstructing baled or loose hay in reducing particle sizes, and serve as an effective process for reducing particle size on an as-needed basis versus precutting all bales. Both can also mix dusty and lower quality material with higher quality forages to reduce waste.

Disadvantages of mechanical processing through these grinders and processing are that it is often an additional step completed by a third party, it can increase potential for the loss of leaves and other valuable forage components through wind loss or loss through the mechanical interaction, and it often requires different or additional equipment to handle or feed ground hay or forages. Also, ground or processed forage needs to be fed in a bunk as losses can increase dramatically when fed on the ground. Also, it may involve an additional production step and piece of equipment. Neither method will necessarily increase forage quality as processing forages under the wrong conditions can increase dry matter losses.

With research confirming the benefits of grinding and processing to manage forage fiber length and particle size, precutting is an additional method for mechanical processing forages in the field to enable new benefits in a hay and forage production and feeding system. It offers some of the same benefits of post-production mechanical processing, but enables those benefits in the field to improve high and low moisture hay and forage baling and preparation.

Precutting is a process achieved through the addition of vertical knives on a rotor just behind the pickup of a round or large square baler. As the forage is gathered during baling, the knives cut the forage fibers reducing the fiber length and particle size after pickup, but before the forage enters the baling chamber. While precutting is now becoming more common on new balers, the process has been used in a similar manner on self-loading forage wagons for collecting high moisture forages for silage. Self-loading forage wagons with this feature are popular in Europe.

Precutting can also provide benefits in a forage feeding system by reducing forage fiber length as an advance in-field step to augment what may be done as a post-production processing step through grinding and/or bale processing prior to feeding forages. Precutting in the baling process can reduce the loss of valuable dry matter in forage leaves by processing the hay or forage while the moisture is higher.

By using precutting to reduce forage fiber length, a producer can form bales with higher density because shorter forage fibers pack more tightly in the bale chamber as a bale is being formed. Denser bales also can allow for more forage material to be transported from the field in the same volume. If the goal is to transport bales offsite as in a commercial production operation, denser bales can help address issues around loads reaching volume limits before reaching transport weight limits. Denser bales can also provide storage benefits by putting more material in a smaller space. If in-
field production of haylage or baleage is the goal, then denser and more tightly packed bales can aid improved ensiling in a more tightly packed bale with better structure. Such a bale may also require less wrapping for proper ensiling and storage.

Forage from precut bales also can eliminate waste in feeding as animals may increase feed consumption with less waste due to selective feeding. Increased consumption can lead to liveweight gains and potential economic benefits to the producer. Precut forages can also make for easier processing in TMR feeding for dairy cattle as denser precut bales can be easier to deconstruct, process, and mix. In this manner, the use of precut forages can result in reduced processing time and lower labor inputs.

While precutting can offer many advantages as another form of mechanical processing, it can have some disadvantages. As an added mechanical function, it can increase the cost of the baler and require more tractor horsepower to power the baler. But, if a producer looks at the total costs of all operations in a production system, the potential disadvantages may be offset by eliminating some of the grinding and/or processing costs and disadvantages incurred through post-harvest processing prior to feeding. While it may not be a disadvantage, precut bales may also require some handling refinements as shorter smaller forage particle sizes and lengths in the bale may result in an added need to contain the hay or forage as a bale with precut components is broken apart prior to feeding.

While precutting shows the potential to created added and tailored processing benefits in a forage feeding operation to achieve producer goals, there are several options available to process forages in a production operation. These options have spanned both incremental and more disruptive innovation with equipment manufacturers paying attention to producer needs and crafting innovation to deliver more efficient and effective value around these needs. It will be important for any producer to consider the appropriate options that best match their needs, goals, and expectations. Continued grower and producer input will be important to continue the process of equipment and process innovation.