Small grain grasses, like triticale, can offer variable silage yield and quality depending on plant variety and harvest timing.

Mike Rankin

GET THE MOST FROM SMALL GRAIN SILAGES

BARLEY, oats, rye, triticale, and wheat are cool-season annual grasses that have a starchy endosperm within their caryopses, or grains. Given the starchy structure of their grains, this group of cool-season annual grasses is alternatively called small grain grasses or cereal grain grasses.

Small grain grasses are commonly grown on dairy farms for at least two reasons. First, dairy farmers grow small grain grasses as cover crops to protect the soil from erosion or to manage the nutrients in the soil once a warm-season crop, such as corn or sorghum, is harvested in the fall.

Second, the biomass of small grain grasses is utilized as a feed ingredient for dairy cattle rations. Although these species can be grazed in a pasture or harvested for hay, in the case of dairy farming, the forage biomass is typically harvested and stored as silage.

Variety trials

For the last few years in our dairy nutrition laboratory, we have been investigating how to get the most from small grain silages. To evaluate the effect of maturity at harvest, we performed a plot study in which we planted two varieties of barley, two varieties of rye, and four varieties of triticale. For each of these, we planted six plots at three locations for two years (288 plots total), giving us six different environments to evaluate.

Within each environment, we harvested three plots at the boot stage of maturity when the seedhead is still enclosed within the uppermost leaf sheath, and three plots at the soft dough stage of maturity when grain in the emerged seedhead takes on a semi-solid consistency. One of the most important findings of the study has been that harvesting at the soft dough stage of maturity delayed the harvest by 33 days. This can have a substantial impact on the following crop, especially if it is corn for silage.

Another interesting finding is the variation that exists among varieties. For example, one variety of rye had not reached the boot stage of maturity before another variety of rye had already reached soft dough. This observation highlights that rye is not always the fastest growing small grain crop and that variation within species should be carefully considered when selecting varieties.

From a nutritional perspective, it has been interesting to observe that differences exist mostly between the two maturity stages but not so much among species. In general terms, harvesting at

the boot stage resulted in forages with higher concentrations of crude protein and lower concentrations of neutral detergent fiber (NDF) than harvesting at the soft dough stage. In addition, harvesting at the boot stage of maturity resulted in forages with more digestible NDF than harvesting at the soft dough stage of maturity.

Cost savings explained

One of the most important findings of the study has been the difference in biomass yield. While small grain crops harvested at the boot stage of maturity yielded 1.7 to 2.7 tons of dry matter per acre, small grain crops harvested at the soft dough stage of maturity yielded 4.2 to 5.9 tons of dry matter per acre.

Intuitively, the greater biomass yield when harvested at the soft dough stage of maturity should result in a cheaper forage. Even though this occurred after simulating some budgets, it was interesting to learn that the estimated fixed costs included 20% to less than 50% of the total costs of production. This means that even though a greater yield results in a cheaper forage, the impact of the yield on the forage cost was less than anticipated, with $115 to $143 per ton of dry matter for the boot stage and $88 to $97 per ton of dry matter for the soft dough stage.

In theory, cheaper forages of better quality should result in cheaper diets. Under this context, we formulated rations simulating different scenarios in which we considered low versus high commodity prices, low versus high forage diets (40% and 60% dietary forage, respectively), and the boot stage versus soft dough stage of maturity. When commodity prices were low, the ration formulation software did not include either of the two small grain silages, and this was true for high-forage and low-forage diets. At least two reasons likely explain this.

First, the quality of corn silage is superior to the quality of small grain silage. Second, corn silage is cheaper than small grain silage. When commodity prices were high, the ration formulation software included small grain silages when the dietary forage was low, but not when the dietary forage was high. Because they contain relatively high concentrations of NDF, small grain silages are good ingredients for providing sufficient fiber, especially when feed prices are high. Therefore, the ration formulation software preferred the small grain silages harvested at the boot stage rather than at the soft dough stage most of the time.

Less milk, more methane

Moving forward to the cow level, we conducted two feeding trials in which we fed diets containing triticale silage harvested at either the boot stage of maturity or the soft dough stage of maturity. In one study, the milk production performance of lactating dairy cows was minimally affected, mainly due to the nutritional similarity of both silages.

In the second study, the silages differed more than in the first one. The maturity of the triticale affected milk production in high-forage diets, with milk production being lower for cows consuming triticale harvested at the soft dough stage of maturity.

In addition to cow performance, we also measured methane emissions in the second study. It was observed that methane emissions per cow rose when we fed triticale harvested at the soft dough stage.

In summary, small grain silages are good ingredients to include in diets for lactating dairy cattle, but the inclusion of these ingredients does not always result in the most practical diets.

Harvesting at the soft dough stage of maturity will guarantee greater yields, although the impact on milk production performance is not as relevant as commonly thought. From the agronomic perspective, crop rotation seems to be the most important determinant to decide the optimal time to harvest small grain grasses for silage, either at the boot stage or soft dough stage. ●

GONZALO FERREIRA
The author is an associate professor and dairy management extension specialist with Virginia Tech.