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G84-696 Small Grains for Silage or Hay

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Small Grains for Silage or Hay

This NebGuide discusses the advantages and disadvantages of using small grains for silage or hay, including handling, storage, feeding, animal performance, and nitrate toxicity potential.

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Small grain crops are potentially important sources of high quality forage. Harvesting small grains for hay or silage rather than as grain may mean increased dollar returns per acre. Small grain silage or hay represents more total nutrient production per acre than harvest as grain and, when fed to ruminants, results in increased animal production.

Advantages and Disadvantages of Small Grain Silage

Harvesting wheat, barley, or oats for silage has many advantages. Early summer crops, particularly wheat and barley, can be used with fall-harvested crops in a year-round forage program. This allows greater use of existing silage facilities during the summer. Following harvest of winter cereals as roughage, many lands can be double-cropped. Harvesting small grain crops for silage or hay decreases the risk of crop loss from rain, wind or hail. And, if fall-harvested crop yields are low small grain forage can be a reserve winter feed source.

Making small grain silage or hay has disadvantages, however, especially for farmers who specialize in small grain production. To harvest such cereal crops as forage you must 1) invest in harvest and storage equipment, 2) use more labor than for grain production, and 3) merchandise the crop through livestock. In

addition, yield and nutrient composition vary greatly with stage of maturity (*Table I*) and grain-to-forage ratio. And, as the stage of maturity progresses rapidly, it is difficult to harvest at the most nutritious stage.

Handling and Storing Small Grain Silage

Making good quality silage with minimal nutrient loss depends on several factors—harvesting at the best stage of maturity, wilting to the correct moisture content if needed, and packing to exclude air in the ensiled mass.

Table I. Stage of maturity affects yields and nutrient content of wheat forage. (Oltjen and Bolsen, KSU, 1978).

Item	Boot	Milk	Dough
Relative Dry Matter Yield/Acre	54	91	100
Dry Matter %	17.5	33.4	47.7
Crude Protein %	14.9	11.1	9.8
In Vitro DM Digestibility %	64.1	57.7	55.9
Relative Digestible Dry Matter Yield	62	94	100
Relative Protein Yield	80	95-100	100

Moisture in Small Grain Silages

A range of 60 to 70% moisture for forage going into the silo may be acceptable, but 65 to 70% is best for most horizontal silos. Larger diameter upright silos and deeper trenches or bunkers permit drier forage to be stored.

Small grains may become excessively dry if harvested when the grain is in the dough stage. In this case, water may need to be added or a high moisture green chopped forage mixed with the small grain forage.

Anaerobic Conditions

Small grain stems are hollow and filled with air as they approach maturity. Fine chopping (3/8 to 1/2 inch knife setting) is necessary to exclude entrapped air for good packing. The crop should be harvested rapidly, the silo filled as quickly as possible, and the forage packed well. Cover with a plastic cover immediately after the silo is filled to minimize fermentation and storage losses.

Influence of Stage of Maturity

Small grains are commonly harvested for silage in the boot, heading, flower, milk or dough stages.

Boot—Head remains inside stem and visibly distends sheath of flag leaf. Head of main stem usually enters boot stage first, followed by tillers. This stage lasts about 7 to 10 days.

Heading and Flowering—Head emerges above flag leaf. A few days later flowering occurs (anthers emerge to shed pollen). Unless the crop is observed closely, these two stages may not be noted as separate stages of growth. Together, the two stages last about 10 to 14 days.

Milk—White, milky fluid fills the kernel, some leaves die, embryo develops fully. This stage lasts 7 to 10

days.

Dough—The kernel has dough consistency, leaves are dying, plant changes from green to yellow. This stage lasts 7 to 10 days.

The forage quantity increases and the quality decreases as the plant matures (*Table I*).

Digestible protein and energy percentage is highest in the boot stage, but dry matter production per acre is low. When harvested at this stage of growth, small grain forage approaches mid- to early bloom alfalfa in feed value. Silage harvested in the boot stage must be wilted to a desirable moisture content before ensiling.

When harvested in the heading to flowering stage, small grain forage should be equal to or better than early cut grass forage. When growing conditions produce a tall straw, protein production per acre may be higher than other stages and digestible energy production will closely approach the maximum for a tall growing crop.

Milk-stage silage is the least palatable to livestock, and usually produces slower and less efficient gains than dough-stage silage.

Dough-stage silage, although lowest in crude protein, produces the greatest forage yields and usually the greatest total digestible nutrient yield per acre. The exception is when plant growth is tall and grain yields are low, especially if the crop "goes down" and harvest is difficult.

When varieties or weather conditions produce a short straw with low tonnage of forage, harvest at the early dough stage to take advantage of the grain produced (which is apt to provide a relatively high percentage of the total dry matter harvested). When the plant is tall, harvesting at the heading or flower stage of growth may have the greatest potential. The decline in digestibility and protein content of the stalk from heading to early dough may offset the increased dry matter production from the grain that would develop. Weather conditions that favor forage growth are often less than optimum for high grain yields, thus spreading the grain-to-forage ratio even farther apart.

Optimum harvest time is short for small grains compared to corn or sorghum. Harvesting at a specific stage requires good management because each stage is so short. When harvesting at the dough stage, it may be necessary to add water or blend direct cut high moisture forage with the small grain chop at the silo in order to get a firm pack.

Expected Silage Tonnage

In Kansas research, winter wheat, winter barley and spring oats produced similar yields of 2 to 3 ton dry matter/acre (years and varieties differed some). Short strawed varieties may be more valuable for growing and finishing rations than tall varieties. Barley usually has the highest grain-to-forage ratio, followed in order by soft wheat, hard wheat, and oats.

Expected Animal Performance

Yearlings can be expected to gain 1.5 to 2.0 pounds per day when fed rations containing good quality, high grain, small grain silage supplemented with appropriate protein, minerals and vitamins. Weight and condition of the cattle, weather severity, dry matter intake, and nutrient and dry matter content of the silage all affect rates of gain. In one trial, steers fed barley silage gained as well as those fed corn silage—

1.9 to 2.7 pounds per day; those fed wheat silage gained less—1.5 to 2.3 pounds per day. Dry matter intake of barley silage was similar to that of corn silage, and usually 1 to 4 pounds per day more than wheat silage. Because the protein content of wheat and barley silages were higher than corn silage, less supplemental protein was required when they were fed.

Cereal silages may be a valid alternative to other silages as a roughage source for feedlot rations. Finishing steers fed wheat or corn silage rations (10 to 20% of the ration dry matter) consumed similar amounts in Kansas trials. However, steers fed corn silage gained slightly faster than those fed wheat silage.

Small Grains for Hay

Small grain crops can make good quality hay as well as silage. Harvest and storage as silage has a potential for greater animal production per acre than harvest and storage as hay. However, hay making equipment is available on more farms and is usually more available for custom harvest.

Factors Determining Hay Quality

Plant characteristics that contribute to the highest yield of dry matter per acre and maximum animal production per acre for small grain silages are also appropriate for getting top yields of high quality small grain hays.

Existing data suggest little consistent difference between barley, wheat, or oats forage when used as hay. Quality differences are more likely due to differences in maturity, handling, rain damage, and protection during storage. Quality differences may occur between varieties, but this has not been adequately demonstrated. Many factors that contribute to quality differences in small grain hay or silage may be related to growing conditions. These include grain content of the forage, grain quality, and protein and fiber content of the forage.

Hay or Silage?

Assuming the same stage of maturity, any quality differences between small grain silage and small grain hay are likely to be in favor of small grain silage. Leaf loss and kernel shattering are important factors contributing to quality loss in more mature small grain hay. Research in South Dakota showed 24 to 48% loss advantage for oat silage over oat hay. This difference included the effects of field losses, storage losses, waste during feeding, and differences in forage quality and animal use. In addition, their data showed 21 to 27% faster gains for oat silage over oat hay when each feed comprised the entire ration. Kansas State researchers also indicate that wheat silage has 10 to 20% greater feed value than wheat hay. When substantial amounts of grain are fed, the difference in animal performance between silage and hay would be decreased.

Rough Awn Varieties

Some new barley and wheat varieties are being bred to have a rough awn for harvesting advantages in areas where small grains must be swathed to dry prior to combining. If made into hay, rough awn varieties may cause considerable soreness and irritation to the mouth, lips, gums, and lower surface of the tongue in cattle. If rough awn varieties are to be used for forage, preference should definitely be given to ensiling over harvest and storage as dry hay.

Nitrate Potential

Nitrates can accumulate in potentially toxic amounts in small grain forages at the hay making stage. Circumstances that interrupt normal plant development (i.e., periods of cool cloudy weather, hail damage, frost and drought), may contribute to high nitrate accumulation. Oat hay appears to accumulate more nitrates than other cereal hays. Small grain silages are less likely to contain dangerous levels of nitrates than hays made from the same crop since a 40 to 60% reduction of the nitrate level normally occurs during ensiling.

Laboratory analysis for nitrate levels in a representative sample of hay should be considered if abnormal weather occurs just before hay harvest when hay is harvested in the flower or earlier stages of growth. Toxic nitrate levels are very unlikely to occur in plants where growth conditions permit attainment of normal maturity and kernel development in hay harvested at the dough stage.

Feeding Guidelines

1. Because small grain forages are so variable in nutrient content, a protein analysis of a sample or samples (using good sampling procedures) is valuable for making most efficient use of the silage or hay.
2. Where grain-to-forage ratio is high, the feed value of small grain forage may approach that of corn silage. When harvested at the flower or earlier stages, forage should be equal to grass hays of approximately the same protein content. When harvested at the early dough stage with low grain-to-forage ratio, the feed value may be only slightly more valuable than straw.
3. On occasion, small grain hays (particularly oats hay) have had enough nitrate to cause death. When small grain forages are to be fed as the only feed or the major feed, you should be concerned about the nitrate toxicity potential. Hays harvested at the boot to heading stage are apt to be higher in nitrate than those harvested at later stages. Hays harvested during or just following a period of cloudy weather may be higher in nitrate content. Hays that get damp from rain or snow just prior to feeding seem more apt to cause nitrate losses than hay that is consumed dry. This may be due to some conversion of nitrate to nitrite before it is consumed, and also because the damp hay is more palatable and is consumed at a faster rate.
    - Small grain silages are usually low enough in nitrate that nitrate poisoning seldom occurs from feeding these silages.

4. Low magnesium levels in some low quality small grain forages is a possibility. Where these forages provide the main feed for long periods of time, we recommend feeding a high magnesium mineral supplement. This is particularly important for a month just before calving and during early lactation.

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