

Measuring the trade-off between alfalfa yield and quality in 4 harvests

Our improving knowledge of the relationships among alfalfa *yield*, *quality*, and *persistence* has greatly influenced harvest recommendations made to farmers. Consider this time line of how alfalfa harvest management has evolved through the years (Figure 1).

We know that, when we give the plant more time to grow before harvesting, yield increases, but at the expense of feed quality. We also know that, when we cut the plant early, we capture a higher quality feed, but this is at the expense of total yield.

Previous studies of the trade-off between yield and quality usually examined this relationship on an annual basis. However, a recent study had a different approach. 1) What is the trade-off between yield and quality *for each cutting within the growing season*? 2) When does harvest management have the greatest impact on potential milk production?

The study

Our study was conducted at three locations – central Pennsylvania, south central Wisconsin, and south central Idaho – during the 2005 crop season. We plant-



Deciding when to harvest alfalfa has always been a trade-off between yield and quality. This study measured the magnitude of this trade-off across four harvest periods.

ed three varieties at each location with similar fall dormancy, disease resistance and recovery after cutting.

At each location, alfalfa was harvested during four periods – spring, early summer, late summer, and fall. During each harvest period, different plots were cut five times, each cut five days later than the previous one. The date of first cut for each harvest period was as follows: May 11 (spring), June 18 (early summer), August 4 (late summer) and September 12 (fall).

The results

- Yield was highest for the spring harvest period at all three locations (Figure 2).
- Quality, which was measured as neutral detergent fiber digestibility (the portion of the total NDF that is

Figure 1. Harvest goals have changed over the years from an emphasis on yield to one on quality.

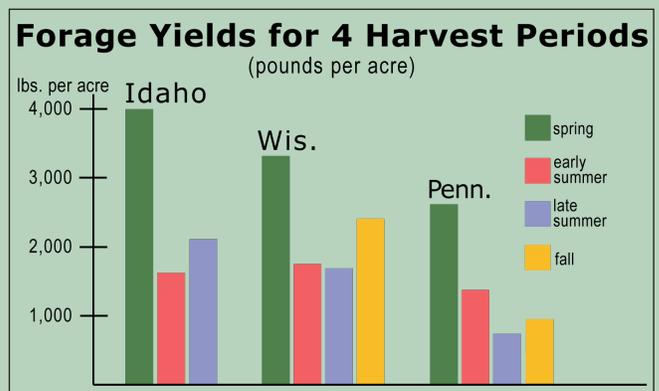
Time frame	Farmer's goal	No. harvests	Growth stage at harvest
1920-1950	Persistence, yield	1-2	Full flower
1950-1960	Nutrient yield, persistence	3	First flower
1970's	Nutrient yield ¹	4	First flower
1980's	Nutrient concentration ²	4	Bud

¹Total amount of nutrients harvested

²Favorable percentage of nutrients in the plant

Sheaffer, 1990

Figure 2: Alfalfa yield was highest in the spring harvest period at all three locations.



actually digested), was highest for the spring harvest period for two of the three locations.

- In Pennsylvania and Wisconsin, the greatest rate of dry matter production occurred during the spring or early summer harvest periods due to optimum temperatures and moisture.
- In Idaho, forage production was dependent on and maximized under irrigation beginning in early summer.
- At all three locations, forage quality declined most rapidly in the early summer.
- In Pennsylvania and Wisconsin, the decline in forage quality is slowest in late summer.

Expressed on milk basis:

Another way to express the results is by using an index (Milk 2000) that combines forage yield and quality into a single term to estimate milk production. It is based on potential pounds of milk per acre versus alfalfa maturity. During the spring harvest period, milk per acre plateaus approximately 10 days after vegetative stage (Figure 3). During the late summer harvest period, potential milk production continues to increase because yield is increasing while forage quality does not decline as rapidly as in early summer (Figure 4).

Summary:

- 1) Forage yield and quality are usually highest in the spring.
- 2) Under conventional management (no irrigation), forage yield increases and forage quality declines *most rapidly* as alfalfa matures during the spring and early summer.
- 3) Harvesting within 10 days after vegetative stage in the spring and early summer provides optimum milk production and dairy quality hay.
- 4) Harvest in late summer can be delayed because digestibility declines more slowly than during the spring and early summer. □

Contact: Geoff Brink
Phone: 608-890-0052
Email: geoffrey.brink@ars.usda.gov

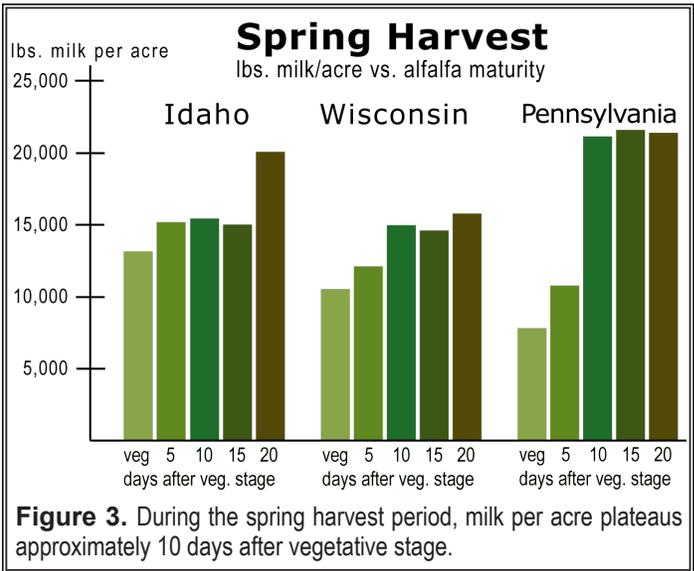


Figure 3. During the spring harvest period, milk per acre plateaus approximately 10 days after vegetative stage.

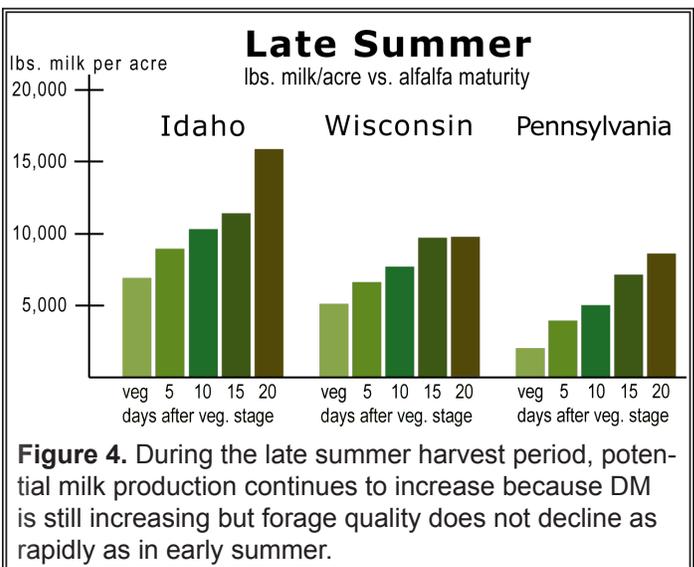


Figure 4. During the late summer harvest period, potential milk production continues to increase because DM is still increasing but forage quality does not decline as rapidly as in early summer.

(This fact sheet based on a study conducted by Geoff Brink, Neal Martin and Rick Walgenbach, USDFRC; Dan Undersander, University of Wisconsin; Marvin Hall, Pennsylvania State University; and Glenn Shewmaker, University of Idaho.)