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My experience with pasture goes back a long way, and has a spotted history. I've had very limited experience with organic milk production. As a teenager in the 40's, our family produced organic milk, we didn't call it that, until the sprayer brought in by the county sprayed DDT on the cows and everyone present. End of organic standards. I had other varied experiences with grazing in the 50's as a student working on the University Farms and as a herd manager.

I joined VA Tech faculty in 1965. Some work was published in the mid-60's about grazing in *Journal of Dairy Science*, but little if any was published afterwards until 1986 (Polan et al., *J. Dairy Sci.* 79:1581-1589), which was a compilation of studies for eight grazing seasons starting in 1975. I surveyed the *Journal of Dairy Science* for numbers of papers where pasture was mentioned (not necessarily in the topic) and found: 1990-1, 1995-1, 2000-10, and 2005, 67. Although interest in pasture research has increased, there is not enough research published that has been directed towards or provides solid answers to the questions this board have posed or may have.

Pasture vs Confinement

Personally, I prefer grazing, in season, to be used as much as possible. It is natural for animals, cows are happy with it, and it is aesthetically pleasing. Pasture is apparently advantageous to cows. There is enough survey and anecdotal evidence to be convincing that cows produce more lactations when grazed. Grazed cows have less mastitis and better udder health than confined cows (Goldberg et al., *J. Dairy Sci.* 75:96-104; 1992) and it is conceded that less feet and leg problems occur in grazed cows. Either of these may at times be the result of what is termed hotter rations and probably are a major impact on reduced longevity.

The milk fat content of grazed cows contains 2-fold levels of conjugated linoleic acid (Kelly et al., *J. Dairy Sci.* 81:1630-1636, 1998; and Dhiman et al., *J. Dairy Sci.* 82:2146-2156, 1999) which is considered to be a healthful fatty acid. That's a plus for milk fat, but many consume lower fat milk.

On other hand, cows on pasture usually have higher urea nitrogen in the milk and in the blood, the latter a cost factor that may adversely affect milk and reproduction. Often, production and concentrations of milk fat and proteins are less, and if pasture is a big part of the diet, cows become thin (may be healthful?). Some grazers refer to them as more athletic or in better shape.

Time on Pasture

What scientific evidence is available to indicate the amount of time cows should be on pasture? The evidence doesn't exist in my judgment. Experiments would have to be designed for this purpose, they would be long, involve large numbers of animals and be costly. Cows are very flexible and can do well under confinement, pasture, or switching from one to the other. (Polan et al., *J. Dairy Sci.* 69:1604-1612, 1986).

The better question might be: what is expected by the organic dairy consumer? They may be more concerned about antibiotics, hormones, or herbicide-pesticide residues than the percentage of pasture in the diet.

On pasture 120 days. What counts as a day? My judgment is, if a meaningful amount of pasture has been consumed, that would count as a day. If that should be 30% of the diet, the producer could strive for it in season. If 30% of the cow's annual intake from pasture is expected, that is far more difficult. This is because a significant amount of grain and stored feed must be fed. Adding more difficulty are the potential for drought and natural disasters. It seems that would have to be some leniency in the requirements for such occurrences. Except for perhaps very large herds, the economic winners, in my opinion, are going to be those that use the quality pasture resource as fully as possible because it can be the lowest cost source of protein and other important nutrients.

Pasture Intake

How to measure or document intake from forage? Researchers have tried a number of techniques to get a measure of pasture intake, but with limited success. Some of these techniques requires the use of indigestible makers or chemicals that would not be acceptable for organic milk – also, they require intense methods and are very costly, so these methods would not be useful for the purpose needed here. There are some simpler, yet cumbersome, ways to get estimates of pasture intake. In rotational systems, estimating herbage before and after grazing provides an estimate. But

considerable training, record keeping, and calibrations of instruments would be needed. Most people probably won't want to do it. Another method that might prove easier with help of a certifying agent, is to estimate cow intake from the energy requirements for production and maintenance. For example, if the producer records the intake of silage and concentrate for the herd, the calculated energy required for maintenance and production minus the energy supplied from silage and concentrates equals the energy supplied by pasture. This could be converted to an estimate of pasture intake. Is it worth it? Maybe not. A certifying agent will easily know the producers that rely heavily on pasture by observing grain intake and pasture management practices. Those producers that rely more heavily on stored forages fed during the grazing season would raise more questions about whether a minimum standard is met. Can the knowledgeable certifying agent determine if the requirement is met?

What factors affect pasture intake? We could make a big list. To get the most grazed feedstuff into a cow in the shortest time, palatable pasture should be young and actively growing, dense and abundant, and ideally six inches tall. This is an ideal pasture and is difficult to maintain throughout the season. But a much wider description should be readily acceptable for the purposes of organic milk production. Pasture intake may be less on lesser quality pastures, but still be a preferred feed source by the animal and a major contributing feed source. Intake is affected by whether or not other feeds are consumed before grazing, heat-humidity, time of day (usually eat more after 4 pm than after 8 am) and time allotted to pasture. It may be difficult to get enough grazed forage into a grazing cow in July, but she may be grazing in earlier or later months, when a cow farther north is eating stored feeds.

Pasture Quality

Should regulations include forage nutritional quality factors such as ADF etc.? Such values would certainly define the quality of the available forage if the total process was properly conducted. Such a process would probably be costly and time consuming if done frequently. Also, the person sampling would need training in proper sampling and subsampling techniques. Such things as procedures to secure samples that represent the paddock, whether taken at the height an animal grazes or at soil height, i.e., attempting to get samples that represents what the cow consumes. Some producers may voluntarily test pasture plots anyway to aid in feeding management decisions. But is it desirable to add another dedicated

procedure, set of records, and reports? It could be simplified a great deal by perhaps sampling and testing at fixed intervals such as weekly, biweekly, or monthly and maintaining a record of test results. The question is; would any of this improve the definition of organic milk?

In Summary

I'm here as a dairy cattle nutritionist that has had a research interest in confined feeding as well as grazing. Because of increased longevity of grazed cows, I have to conclude that they must be healthier. Why may be due to a number of reasons. Space on pastures away from concentrated contaminants may be a part of it. Some would say less stress (whatever that is) contributes. Some possible causes were mentioned previously.

However, to indicate that a certain quality or quantity of pasture is advantageous to the well-being of the cow or the product compared to confined feeding has not been documented. Improved quality and quantity of pasture contribute greatly to the nutrient intake of the grazed cow, but the nutrients can be supplied by other means if the intake of pasture is less or non-existent.

So, the bottom line to me is, what does the consumer of organic dairy products want the definition to be? Beyond that, who is going to pay the bill for the cost of assuring additional requirements are met?