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Questions Related to Pasture for the Dairy Symposium
Contained in the Advanced Notice of Proposed Rulemaking (ANPR)

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Reasons for changing the regulations on pasture (questions related to Pasture and Natural Resource Management)

One of the reasons cited for changing the role of pasture in the current regulations has to do with consumer expectations. Under this reasoning, it is said that the role of pasture should be increased because consumers expect that organic milk comes from dairy cows raised on pasture.

1) Are there market-based or other types of research to substantiate this expectation by consumers?
2) Do consumers feel differently about organic milk than other types of organic livestock products, including other organic dairy products, because of pasture?

Answer: I do not have an answer for this question and will defer to the presentation by the *Market Expectations and Perceptions Panel.*

3) Is there evidence, data, or other types of research that the current role of pasture as it exists in the regulations does not support consumers' beliefs about the relationship between organic milk and organic dairy cows?

Answer: Most of the organic milk cartons that I have seen in the market place show pictures of cows grazing on pasture. Consumers are being told (in pictures) that this is how cows, providing milk going into those cartons, are managed.

4) Is there a specific minimum of time spent on pasture to ensure the spirit and intent of an organic livestock operation? How much time is required?

Answer: There needs to be a minimum number of days required to ensure the spirit and intent of an organic livestock operation as well as a minimum amount of dry matter harvested *per animal per day.* The minimum number of days suggested are 120 days during a calendar year. I feel that this amount is very lenient and farms that cannot meet this minimum time period and minimum dry matter intake should not qualify for organic dairy certification. These minimum numbers have been agreed upon by all major groups of organic dairy producers across the country from Maine to California (Northeast Organic Dairy Producers Alliance, Humboldt Creamery Organic Dairy Farmers, CROPP Cooperative, Michigan Organic Dairy Producers, and Organic Choice).

5) Is there evidence in dairy or animal science literature that supports an appropriate minimum amount of time that dairy cows (or other ruminant animals) should be kept on pasture?

Answer: There are numerous pieces of literature to substantiate the benefits and attributes to keeping dairy animals on pasture. I have included as an addendum a long list of research findings supporting this well-known fact. I am aware that the NOSB has also provided numerous research reports to support the many benefits of pasture including environmental, economic, animal health, and increased nutritional value of the meat and/or milk. By providing access to edible pasture, producers are putting the cows back in their natural environment where they can walk on soft, cushiony ground, harvest edible, nutritious forage, and have access to fresh air & sunlight. Many producers that I work with in Vermont have set up their milking systems in such a way that the cows are milked quickly & efficiently and sent out on fresh

pasture after each milking. In situations like these, the cows are on pasture for at least 20 hours a day. Number of grazing days in Vermont can vary based upon the land base of each farm. Most farms in Vermont can have their cows on pasture by the middle of May (though this year, I have seen cows out on pasture already) and many farms can have them grazing as late as November.

6) Is the minimum amount of feed derived from pasture alone enough to ensure that the spirit and intent of an organic livestock operation is met?

Answer: Creating a measurable minimum feed requirement derived from pasture that is clear, consistent and enforceable will ensure that dairy animals are being managed in a way intended for the production of organic milk. This minimum requirement will assure consumers that organic livestock products are produced to meet a consistent standard.

7) What is the minimum amount of feed that should come from pasture?

Answer: The minimum amount of feed coming from pasture, measured on a per cow/per day basis, for livestock over 6 months of age, should be 30% of the dry matter intake. Many dairy farms in Vermont are meeting over 70% of their dry matter needs per cow per day from pasture for greater than 150 days a year. Requiring the minimum 30% dry matter intake is very achievable.

8) What evidence supports your reason for this minimum amount of feed from pasture?

Answer: This minimum amount was determined after thoughtful discussions including many organic dairy organizations from throughout the United States. Variations in climate including growing season, and annual precipitation, were taken into consideration.

9) Should age and reproductive cycle of the animal be taken into account in determining the minimum amount of time an animal spends on pasture or the amount of feed derived from pasture?

Answer: A minimum age should be established and the age recommended is 6 months. Reproductive cycle of the animal should not be used in determining the minimum amount of time an animal spends on pasture or the amount of feed derived from pasture

Changes that have been suggested (questions related to Pasture and Natural Resource Management)

1) What is the appropriate contribution of pasture to ruminant animal nutrition overall?
2) It has been suggested that organic dairy rations should have a minimum dry matter intake (DMI) of 30 percent derived from pasture. Is this an achievable goal? What evidence is available to support 30% as a benchmark?

Answer: In an ideal world, ruminants should be receiving most if not all of their nutrition from pasture during the growing season. Some producers are moving towards a system where the concentrates fed per cow is just a few pounds of grain a day or no grain at all. Asking for a minimum benchmark of 30% dry matter from edible pasture is a very reasonable request and has been agreed upon by producers across the United States.

3) What factors could affect this dry matter intake, and are they important?

Answer: Some of the factors affecting dry matter intake on pasture include, maturity, palatability and plant species in the pasture sward. Other factors include how adapted the livestock are to grazing (animal behavior) and if they are going out to pasture hungry or full from harvested feed.

4) Can the quality of pasture affect DMI? Can DMI be affected by factors beyond the producers control, such as weather-related events (e.g., flood or drought)?

Answer: Quality of pasture can affect DMI. In the event of inclement weather such as flood or drought, as already written in the NOP standards, temporary confinement of the livestock is allowed.This period of time would be documented in the Organic System Plan and in records maintained by the operation.

5) Can a single benchmark or a single measure, such as minimum DMI, be uniformly established for all dairy operations in the US and all foreign organic operations who want to be certified to the NOP standard, regardless of location, climate, size, cost structure, age of the animal, stage of development, animal species, or other variation in farming operation?

Answer: A single benchmark such as a minimum DMI *can* be achieved for all dairy operations on the US and all foreign organic operations wanting to be certified to the NOP standard. If a farm is unable to meet these minimum requirements, then they may not be suited for organic production. We need a benchmark to create those minimum requirements so that consumers can be assured that organic livestock products are produced to meet a consistent standard.

6) Should the role of pasture in the regulations be expanded to include forage nutritional quality factors such as crude protein, ADF, NDF, and NEL? Is this level of detail adequate to ensure the role of pasture is met for organic livestock management under NOP regulations?

Answer: No. This level of detail and oversight would be beyond the scope of certification. It is of the producers best interest to ensure that the pasture is providing quality feed for their livestock. For some producers, there will be a learning curve, as there is a learning curve in other parts of organic production.

7) What evidence in dairy science or animal literature helps explain the appropriate amount of minimum time that dairy cows should be kept on pasture?
8) Is the minimum time spent on pasture based primarily on the quality of the pasture, or the quantity of the feed provided by the pasture?

Answer: The minimum time spent (days) should be determined and a minimum quantity of feed (30% DMI) provided by the pasture. Managing the pasture so that there is nutritious feed for the cows to harvest is the responsibility of the producer. Thankfully, there is a wealth of information and technical support for individuals wanting to learn more about grazing management prior to transitioning to organic production. This technical information is also available for those organic producers wanting to improve their current pasture system.

9) Should the livestock feed requirement uniformly specify how much feed comes from pasture? Should all dairy livestock producers comply with the same minimum requirement?

Answer: The livestock feed requirement should be a uniform *minimum* feed requirement for all operations applying for USDA Organic Certification.

10) Some have suggested that dairy animals should spend at least 120 days on pasture as a minimum time. What does this allow for the remaining 245 days of the year? How should the 120 days be counted?
11) Should pasture condition or quality be considered? Should there be a minimum pasture quality requirement?
12) Should specific animal-unit stocking rates per acre be considered? How?

Answer: For the remaining 245 days of the year, the animals are not required to be on edible pasture, but should have regular turnout so that they have fresh air, sunshine and freedom of movement. Most of our producers in Vermont easily achieve these minimum requirements and often manage to have

Implications for measurement, enforcement and compliance:

One reason that has been suggested for changing the role of pasture in the NOP regulations is because of a concern that some operations do not comply with the intent of the regulations -- to provide animals with access to pasture including a portion of their feed from pasture. Therefore, if the role of pasture in the NOP regulations is changed, it seems important that any change accomplishes the goal of ensuring that pasture plays the intended role in organic livestock management that the organic community and consumers expect.

1) How should an accredited certifying agent (ACA) measure compliance with specific measures adopted to change the role of pasture? For example, if dry matter intake is used as a benchmark, should it be measured as the average DMI over a certain time period, such as a calendar year or average 12 months?

Answer: DMI should be measured as DMI per animal per day. It should NOT be averaged over any greater period of time as that would create a tremendous loophole and more inconsistencies in how the USDA NOP is interpreted.

2) How should producers and certifying agents verify compliance over time for a herd of cows that are at various stages of growth or have varying states of nutritional needs? Can the producer and certifying agent determine this in the organic system plan?
3) What flexibility should producers have in working with their certifying agents to verify they have accomplished the goals of increased pasture for livestock?

Answer: A simple calculation sheet can be created that producers can use to determine the measurable amount of dry matter needed per cow per day (24-hour period) during for the 120-day minimum time within the growing season. The minimum requirements of 30% dry matter Intake and 120 days is very achievable in Vermont (as an example) where the average dry matter intake per day is over 60% and the average number of days on pasture is over 150 days.

4) Should the OSP be the focus of introducing regulatory changes? In other words, should specific requirements for a larger role for pasture be introduced and required in livestock producers' organic system plans, as was suggested by the NOSB in its guidance recommendation?

Answer: Yes, I think the OSP should implement specific requirements for a measurable amount of dry matter (30%) required per day for a minimum amount of time (120 days) during the growing season.

5) Should a new standard be developed, devoted to addressing a unique role of optimizing pasture in organic ruminant animal production systems?

Answer: I am not sure what you are asking here.

Market and other impacts.

If the role of pasture is changed, there may be impacts on producers and their enterprises (including herd health; milk output, quality, and quantity; and farm revenues and costs), processors, and consumers.

1) What are the effects on a dairy operation's fixed production costs if the role of pasture is made larger and particularly, more specific with regulatory requirements such as minimum time or minimum amount of feed derived from pasture?
2) What are the effects on the operation's variable production costs?

Answer: How the pasture requirements would affect the fixed costs of any operation would depend solely on how that operation is run. There is no general answer; it would have to be reviewed on a case-by-case basis. At NOFA-VT, we provide that one-on-one assistance with farmers to help them determine if organic dairy certification is a direction that they should go in. We help them address changes in management including developing or intensifying a grazing system, seeing if the farm has adequate pasture for the number of livestock, becoming more familiar with approved complementary health practices and products for organic operations, and creating a cash-flow plan or a full business plan.

3) Does the size of the farm have an impact on the ability to comply with the regulations? In other words, does the relation between the number of cows and number of acres on the farm affect the role of pasture in organic livestock management?

Answer: The number of cows in relation to number of acres varies so much from one end of the country to the other. I would suggest that we do not measure this by cows per acre.

4) How would pasture affect the quality of milk? Can increased pasture have a negative impact on milk quality, or does pasture always contribute positively to milk quality?
5) How would a larger role of pasture affect herd disease or health?
6) How do the age of the animal, its stage of development, and feed from pasture, interact to affect milk output?
7) Could a larger role of pasture affect supplies of milk and milk products?

Answer: Questions 4-7 above cannot be answered in general terms. How the farm (and livestock) respond to increased use of pasture depends a lot on the management.

8) What are the effects on consumer prices for dairy products if the NOP regulations includes a larger role for pasture on dairy livestock producers?

Answer: I would not assume that consumer prices for dairy prices would change if the NOP regulations included a larger role for pasture on dairy livestock producers. Consumers already *assume* that there are strong pasture requirements. Clarifying the NOP regulations to require that a minimum amount of forage dry matter intake on a per cow per day basis comes from edible pasture at least 120 days per year will strengthen the NOP and validate consumer perception.

9) Would a larger role for pasture affect the geographical distribution of organic dairy production operations within the United States and foreign countries?

Answer: It is possible that once these measurable standards (30% Dry Matter Intake per cow per day for a minimum of 120 days) are implemented, that some producers and some geographical areas might not be able to qualify for organic production.

Scope of the ANPR:

1) **Is the current role of pasture in the NOP regulations adequate for dairy and livestock under principles of organic livestock management and production? Is the role of pasture adequate for other types of organic livestock?**

Answer: The current role of pasture in the NOP regulations is not adequate for dairy and livestock under principles of organic livestock and production. The role of pasture needs to be more clearly defined for beef and dairy stock.

2) **If the current role of pasture as it is described in the NOP regulations is not adequate in your opinion, explain what factors should be considered to improve the role of pasture within the NOP regulations. Provide any available evidence that supports your view.**

Answer: I fully support the recommendation submitted by the NOSB on November 17, 2005 which states that Ruminants should graze pasture for a minimum of 120 days per year except during certain stages of life: birthing, dairy animals up to 6 months of age and beef animals during a final finishing stage. The producer of an organic operation must not prevent dairy animals from grazing pasture during lactation. Along with a minimum number of days, there should also be a minimum measurable amount of Dry Matter Intake (DMI) on a per animal, per day basis. That minimum amount should be 30% for all ruminants over 6 months of age. The only exception to this rule for dairy animals would be for birthing, those animals less than 6 months of age, or inclement weather including drought or flooding typically lasting only a few days at a time during the grazing season.
There has been so much evidence to support the need for stricter pasture standards and its associated benefits (soil health, livestock health, energy usage, consumer confidence & assurance, nutritional benefits) that it seems redundant to continue feeding these references to the NOP. The NOSB provided a thorough review in their November 17 formal recommendation and has been requesting clearer pasture standards for 5 years. My question to the NOP is why is it taking so long to put this recommendation into final documentation?

3) **Which parts of the NOP regulations should be changed to address the role of pasture in organic livestock management? Pasture appears in the NOP definitions (subpart B, § 205.2), and in subpart C of production and handling requirements under livestock feed (§ 205.237), livestock healthcare (§ 205.238), and livestock living conditions (§ 205.239). Should the organic system plan requirements (§ 205.201) be changed to introduce a specific means to measure and evaluate compliance with pasture requirements for all producers of dairy or other livestock operations? Or, should a new standard be developed just for pasture alone?**

Answer: Again, I fully support the NOSB's Draft Recommendation on Pasture Requirements for Ruminants, submitted on November 17, 2005. The only things that I would add to their draft recommendation is that there be a minimum DMI requirement of 30% edible pasture during the 120 days that the ruminants 6 months and older are grazing. I would also recommend that beef animals can be off of pasture during a final finishing stage *not to exceed 60 days* (NOSB recommended 120 days). There should be specific means to measure and evaluate compliance with pasture requirements for all producers of dairy or other *ruminant* livestock operations.

Below are resources supporting pasture and its benefits. I believe that these were also listed within the NOSB's Draft Recommendation on Pasture Requirements for Ruminants, submitted on November 17, 2005.

Benefits to Animal Health

1. **Bela, B., G. Nagy and I. Vinczeffy. 1995.** ***The influence of grazing on milk production and productive lifetime.*** **Debrecen Agricultural University, Dept. of Animal Breeding and Nutrition. Hungary. Poster presentation at 46th Annual Meeting of the European Association for Animal Production, Prague, Czech Republic.** Pastured cows had lower somatic cell counts (SCC), fewer services per conception and shorter calving intervals than confined cows.

2. **Bendixen, P.H., B. Vilson, I. Ekesbo, and D.B. Astrand. 1986.** ***Disease frequencies in dairy cattle in Sweden.*** **Prev Vet Med. 5: 263.** Confinement resulted in increased intramammary infections, udder edema, and stepped on teats.

3. **Berghaus, R.D., B.J. McCluskey, and R. J. Callan. 2005.** ***Risk factors associated with hemorraghic bowel syndrome in dairy cattle.*** **JAVMA. 226:1700-6.** Use of pasture as part of the lactating ration during the growing season was associated with decreased risk for hemorrhagic bowel syndrome.

4. **Cornell University 2004 Dairy Farm Business Summary. www.cce.cornell.edu** . Cull rates for conventional farms were 29% whereas for organic herds of similar size, it was 22%.

5. **Eberhart, R. J., R. A. Wilson, E. Oldham and T. Lintner. 1987.** ***Environmental effects on teat skin microflora.*** **Proceedings of the 26th Annual Mtg. Natl Mastitis Council, Orlando, FL.** Populations of environmental pathogens on teat ends were lower in pastured than confined herds.

6. **Goldberg, J.J., E.E. Wildman, J.W. Pankey, J.R. Kunkel, D.B. Howard, and B.M. Murphy. 1992.** ***The influence of intensively managed rotational grazing, traditional continuous grazing and confinement housing on bulk tank milk quality and udder health.*** **J Dairy Sci. 75:96-104.** Grazed herds had lower total bulk milk bacteria counts (TBC) that confined herds did in the summer but there was no difference in the winter when all cows were confined. Trends towards fewer udder health problems in grazing herds were also observed.

7. **Pankey, J.W. 1989.** ***Improving milk quality and animal health by efficient pasture management.*** **NESARE final report. LNE89-017. http://www.sare.org/reporting/report_viewer.asp?pn=LNE89-017&ry=1989&rf=0 (last accessed 11/03/05).** Udder disease, including clinical mastitis, udder edema, and teat injuries were consistently less in herds managed on pasture compared with herds managed in confinement.

8. **Parker, W. J., L.D. Muller, S.L. Fales, and W.T. McSweeny. 1993.** ***A survey of dairy farms in Pennsylvania using minimal or intensive pasture grazing systems.*** **Prof. Anim. Sci. 9:159-165.** Authors found fewer hoof disorders and eye disease in herds that pastured vs. confinement.

9. **Regula G., J. Danuser, B. Spycher and B. Wechsler. 2004.** ***Health and welfare of dairy cows in different husbandry systems in Switzerland.*** **Prev Vet Med. 15:247-64.** Risks for lameness and teat injuries increased with increased confinement. Skin lesions on hocks and carpal joints were decreased in cattle allowed to go out at all times rather than cows that were allowed to go out only in good weather.

10. **Rodriguez-Lainz, A. P. Melendez-Retamal, D.W. Hird, D.H. Read and R.L. Walker. 1999.** ***Farm- and host-level risk factors for papillomatous digital dermatitis in Chilean dairy cattle.*** **Prev Vet Med. 42:87-97.** Loose housed cows had a higher risk of PDD, followed by cows in freestalls or in open corrals, compared to cows on pasture all year.

11. **Somers, J.G., K. Frankena, E.N. Noordhuizen-Stassen, and J.H. Metz. 2005.** ***Risk factors for digital dermatitis in dairy cows kept in cubicle houses in The Netherlands.*** **Prev Vet Med. 71:11-21.** Factors increasing risk of digital dermatitis were: restricted grazing time, high concentrate feeding after calving, feeding by-products, infrequent hoof trimming, and housing dry cows with lactating cows before calving.

12. **Somers, J.G., Frankena, K., E. N. Noordhuizen-Stassen and J.H. Metz. 2003.** ***Prevalence of claw disorders in Dutch dairy cows exposed to several floor systems.*** **J Dairy Sci 86:2082-93.** Cows that were not grazed were at high risk for most claw disorders when compared to cows with pasture access. All herds on concrete flooring were affected by digital dermatitis.

13. **Singh S.S., W.R. Ward, K. Lautenbach, J.W. Hughes, and R.D Murray. 1993.** ***Behaviour of first lactation and adult dairy cows while housed and at pasture and its relationship with sole lesions.*** **Vet Rec 133:469-74.** Compared lying time and frequency of lying and sole disorders in pastured herd vs. housed. Pastured cows spent more time lying (which translates into more rumination time) and got up and down less frequently than housed cows. No difference in sole disorders.

14. **Waage, S., S. Sviland, and S. A. Odegaard. 1998.** ***Identification of risk factors for clinical mastitis in dairy heifers.*** **J. Dairy Sci. 81:1275-84.** Heifers kept on pasture in the summer were at a decreased risk for clinical mastitis.

15. **Washburn, S.P., S.L. White, J.T. Green, Jr. and G.A. Benson. 2002.** ***Reproduction, mastitis and body condition of seasonally calved Holstein and Jersey cows in confinement or pasture systems.*** **J Dairy Sci. 85:105-111.** There was no difference in reproductive performance between pasture and confinement herds. Pastured herds had lower body condition scores than confinement. However, confinement herds had 1.8 times more clinical mastitis than pastured and eight times the rate of culling for mastitis.

16. **White, S.L., G.A. Benson, S.P. Washburn, J.T. Green Jr. 2002.** ***Milk production and economic measures in confinement of pasture systems using seasonally calved Holstein and Jersey*** **cows. J Dairy Sci. 85:95-104** Compared confinement cows on TMR vs pasture based cows. Lower milk production on pasture but decreased feed and labor costs. Also decreased culling for pasture based herds.

17. **New York Intensive Grazing Farms (Cornell Dairy Farm Business Summary).** Eight year average (1996-2003) for veterinary and treatment costs per cow were $77 for non-graziers vs. $61 for graziers.

Benefits to Food Safety and Milk Quality

1. **Bailey, G.D., B.A. Vanselow, M.A. Hornitzky, S.I. Hum, G.J. Eamens, P.A. Gill, K.H. Walker and J.P. Cronin. 2003.** ***A study of the foodborne pathogens: Campylobacter, Listeria and Yersinia in faeces from slaughter age cattle and sheep in Australia.*** **Comm Dis Intell. 27:249-57.** Prevalence of *Campylobacter* shedding among different management groups was:

dairy cattle (6%), feedlot cattle (58%), pastured beef cattle (2%), mutton sheep (0%), prime lambs (8%). All dairy cattle were on pasture.

2. **Fossler, C.P., S.J. Wells, J.B. Kaneene, P. L. Ruegg, L.D. Warnick, L.E. Eberly, S.M. Godden, L.W. Halbert, A.M. Campbell, C.A. Bolin, and A.M. Zwald. 2002.** ***Cattle and environmental sample-level factors associated with the presence of Salmonella in a multi-state study of conventional and organic dairy farms.*** **J Dairy Sci. 85:105-111.** Farms with at least 100 cows were more likely to *Salmonella*-positive cattle compared with smaller farms.

3. **Huston C.L., T.E. Wittum, B.C. Love, and J.E. Keen. 2002.** ***Prevalence of fecal shedding of Salmonella spp. in dairy herds*** **JAVMA 220:645-9.** Large herd size, intensive management, use of freestalls, and use of straw bedding were associated with *Salmonella* shedding and chronic dairy herd infection.

4. **Husu, J.R. 1990.** ***Epidemiological studies on the occurrence of Listeria monocytogenes in the feces of dairy cattle.*** **Zentralb Veterinar B. 37:276-82.** Seasonal variation in shedding of *Listeria* spp. in dairy cattle was examined by collecting 3,878 fecal samples over two years. Prevalence of *Listeria* spp. and *Listeria monocytogenes* was higher during the indoor season than in samples collected from animal on pasture.

5. **Josson, M.E., A. Aspan, E. Eriksson, and I. Vagsholm. 2001.** ***Persistence of verocytotoxin-producing Escherichia coli O157:H7 in calves kept on pasture and in calves kept indoors during the summer months in a Swedish dairy herd.*** Fecal samples from calves kept on pasture (n=6) and calves housed indoors (n=6) were cultured monthly for five months. Fecals from calves on pasture were negative for this pathogenic *E. coli* were negative on all sampling occasions. For the indoor housed group, there were between one and six positive individuals at each sampling.

6. **McKinnon, C. H., G.H. J. Rowlands, and A. J. Bramley. 1990. The effect of udder preparation before milking and contamination from the milking plant on bacterial numbers in bulk milk of eight dairy herds. J. Dairy Res. 57:307.** Pastured herds had lower bulk milk total bacteria counts than confinement herds

Nutritional benefits of products from pasture-raised livestock

1. **Ädnøy, T., A. Haug, O. Sørheim, M.S. Thomassen, Z. Varzegi, and L.O. Eik. 2005.** ***Grazing on mountain pastures—does it affect meat quality in lambs?*** **Livestock Prod Sci. 94:25-31.** Meat from lambs raised in extensive systems on mountain range has certain qualities that may be used in promotion of local and regional products.

2. **Aurousseau, B., D. Bauchart, E. Calichon, D. Micol, and A Priolo. 2004.** ***Effect of grass or concentrate feeding systems and rate of growth on triglyceride and phospholipids and their fatty acids in the M. longissimus thoracic of lambs.*** **Meat Sci. 66:531-541.** Muscle lipids characteristic of grass fed lambs fulfilled the recommended features of human food consumption much better than that of stall fed lambs, namely CLA and C18:3n-3.

3. **Dannenberger, D., K. Nuernberg, G. Nuernberg, N. Scollan, H. Steinhart, and K. Ender. 2005.** ***Effect of pasture vs. concentrate diet on CLA isomer distribution in different tissues lipids of beef cattle.*** **Lipids. 40:589-98.** Pasture feeding resulted in significantly increased concentrations of the sum of CLA isomers in Holstein and Simmental muscle tissue.

4. **Elgersma, A., G. Ellen, H. van der Horst, H. Boer, P.R. Dekker, and S. Tammings. 2004.** ***Quick changes in milk fat composition from cows after transition from fresh grass to a silage diet.*** **Anim Feed Sci Tech. 117:13-27.** Average CLA content of milk decreased markedly within two days of switch cows from pasture ration to silage. The milk fatty acid profile of grazing cows was more favourable from a consumer health standpoint than that of silage-fed cows.

5. **Institute of Grassland and Environmental Research. 2004.** Found that organic milk has higher levels of Omega essential acids than the conventional type. Tests carried out on samples at the research centre indicated that organic milk contains two-thirds more omega 3 essential fatty acids than conventional milk.

6. **Kay, J.K., J.R. Roche, E.S. Kolver, N.A. Thomson, and L.H. Baumgard. 2005.** ***A comparison between feeding systems (pasture and TMR) and the effect of vitamin E supplementation on plasma and milk fatty acid profiles in dairy cows.*** **J Dairy Res. 72:322-32.** Milk from cows on pasture or cows feed a TMR supplemented with Vitamin E were compared. Milk from cows grazing pasture had higher CLA, vaccenic acid, and lower trans-10 fatty acids than cows on TMR with supplemental vitamin E. Unknown pasture constituents are likely responsible for the difference.

7. **Nielsen, J., T. Lund-Nielsen, and L. Skibstead. 2004. Danish Research Center for Organic Farming.** Found that organic milk was 50% higher in Vitamin E, 75% higher in beta carotene and higher in omega 3 essential fatty acids than conventional milk. This study tied these qualities to organic cows having room to graze and a diet high in fresh grass and clover, and forage and less maize.

8. **Sonon Jr, R. D. Beitz and A. Trenkle. 2004.** ***Improving Health Benefits of Beef & Milk: A Field Study.*** **A. S. Leaflet R1864, Iowa State University.** Intensively pastured cows produced milk with CLA concentrations that were about 3- to 4-fold greater than initial concentrations. Ribeye steaks from cattle finished on a combination of pasture and concentrate were higher in CLA content than steaks from cattle finished on conserved forages plus concentrates

9. **Ward, A. T., K.M. Wittenberg, H.M. Froebe, R. Przybylski, and L. Malcolmson. 2003.** ***Fresh forage and solin supplementation on conjugated linoleic acid levels in plasma and milk.*** **J Dairy Sci. 86:1742-50.** Fresh forage, compared to conserved hay, increase milk fat vaccenic acid and CLA proportions by 15 and 22% respectively. Addition of solin seed increased these levels further to 41 and 25%.

Estimating Dry Matter Intake for Dairy cows

Example of how to calculate DMI based upon the weight of the cow, and average milk production per cow.

A herd of 100 cows, average weight = 1000 lb/cow, producing 50 lbs of milk. A cow of this size will consume, on average, 3% of her bodyweight per day in Dry Matter.

* 1000 lbs x .03 = 30 lbs dry matter consumed per cow per day (DM Basis)

If 30% of the total DMI is to be consumed by pasture:

* 30 lbs x .30 = 9 lbs per cow per day (DM Basis)

100 cows x 9 lbs DM/cow/day = 900 lbs DM needed per day for the herd of 100 cows

* Note: Pasture, on average is 20% dry matter. With this value, the 9 lbs of pasture on a dry matter basis is equal to 45 lbs of fresh pasture per cow.

Estimated Dry Matter Intake by Subtraction Method

Herd Average Dry Matter Intake

Non-Grazing Feed Ration

Average lbs of Hay consumed	_____	x _____	% Dry Matter =	_____	lbs Dry Matter
Average lbs of Balage consumed	_____	x _____	% Dry Matter =	_____	lbs Dry Matter
Average lbs of Corn Silage consumed	_____	x _____	% Dry Matter =	_____	lbs Dry Matter
Average lbs of Grain Consumed #1	_____	x _____	% Dry Matter =	_____	lbs Dry Matter

TOTAL LBS DRY MATTER _____

Grazing Feed Ration

Average lbs of Hay consumed	_____	x _____	% Dry Matter =	_____	lbs Dry Matter
Average lbs of Balage consumed	_____	x _____	% Dry Matter =	_____	lbs Dry Matter
Average lbs of Corn Silage consumed	_____	x _____	% Dry Matter =	_____	lbs Dry Matter
Average lbs of Grain Consumed #1	_____	x _____	% Dry Matter =	_____	lbs Dry Matter

TOTAL LBS DRY MATTER _____

Non-Grazing Feed Ration – Grazing Feed Ration = Estimated Pasture Dry Matter Intake