Winter is upon us, and cattle traffic areas that in the summer were bare, hard-packed soil will with the wet weather become muddy. While muddy areas can’t be completely avoided, they can be managed to reduce mastitis and production concerns associated with dirty cows and muddy conditions.

The primary ingredients for mud are soil and water. Therefore, the key concept to minimizing muddy conditions is to keep the amounts of soil and water that mix to a minimum. The first step is to lay out and size cattle traffic areas so cattle can move around the farm as needed while keeping the area where grass does not grow due to cattle traffic as small as possible. This will, of course, at times require appropriate fencing to direct cattle traffic. When laying out fence lines, equipment access will also need to be considered.

Depending on soil conditions, some situations may require steps to increase the load-bearing capacity of the soil. While concrete is often an option, its expense may make other options attractive, such as gravel with or without a geo-textile or the use of coal plant fly ash. As with most decisions, initial cost, useful life and maintenance costs should be considered. Proper layout and management should minimize and potentially avoid the expense of increasing the load-bearing capacity of the soil.

A key component in traffic area layout is to divert as much water as possible away from travel lanes and loafing lots. Berms and surface drainage can be used to redirect surface water runoff. For roof runoff, gutters may need to be considered. In some cases, it may be appropriate to use culverts to direct clean water flows under traffic areas.

Even after appropriate water diversions are put in place, it will rain directly into the traffic areas. This means the traffic areas should be designed and managed to minimize water ponding and surface erosion. Ponding will increase mud problems. Erosion tends to increase the time and cost of traffic area maintenance. Ideally, the traffic areas should be sloped enough so that water flows off but not so much that erosion is a problem. The slopes should be oriented in such a way that water flows minimal distances while in the traffic area. In addition, the slopes should be uniform to avoid low spots that will pond water.

Runoff water from traffic areas will likely contain some microorganisms, nutrients and sediment from its contact with manure and soil. The commonly accepted method to address environmental concerns is vegetative filtering. This runoff water is usually directed to flow as a broad, uniform sheet of water into a vegetated filter strip. This provides the vegetation in the filter strip a chance to treat the runoff water to protect any potential downslope streams and ponds.
As with many farming practices, proper maintenance is important. The condition and effectiveness of diversions, fencing and vegetated filter strips should be monitored and maintained. Periodic scraping of the traffic areas may be needed to remove excessive amounts of manure solids. When scraping, care should be taken to maintain slopes and avoid creating low areas where ponding will occur. Any scraped material should be thinly applied as a soil amendment to growing vegetation well isolated from downslope water bodies. To avoid handling the material twice, it should be left in place until suitable conditions exist for land application. If it must be collected and stored prior to land application, it should be protected from the weather to avoid runoff as runoff from stockpiled manure is subject to liquid manure regulations.

For additional information, the publications Runoff Water Management for Animal Production and Environmental Protection (FSA1036); Reducing Mud Problems in Cattle Heavy Use Areas With Coal Combustion By-Products (Fly Ash) (FSA1043); and Beef Cattle Management for Water Quality Protection in Arkansas (MP375) are available at www.uaex.edu/Other_Areas/publications.

Forage Legumes Have a Place
Dr. Dirk Philipp, Assistant Professor
Animal Science

Although Arkansas has a different climate than other regions in the U.S. that might be better suited for commonly used legumes, it is worthwhile to check what the recent literature has to say about incorporating these forage plants into dairy operations.

The benefits appear to be obvious. Because legumes have the ability to use atmospheric nitrogen produced through a symbiotic relationship with Rhizobia bacteria, pastures that contain legumes are higher in nutritive value than grass pastures. In addition, fertilizer costs may be reduced by recycling fixed N through grazing. Researchers from North Carolina State University estimated that the cost of a ton of dry matter (DM) forage in a perennial cool season-legume mixed pasture is about 25 percent lower than in a perennial cool-season grass pasture alone.

Another study from the University of Wisconsin showed that milk yield per acre from mixed grass-legume pastures was about one-third higher than from single-species grass pastures. In addition, data suggested weed-suppressing effects in multi-species pastures, although the challenges of ultimately controlling weeds are well known by those in Arkansas who have tried to establish and maintain legumes in cool- or warm-season pastures.

It is worthwhile to look at New Zealand (NZ), which has been on the cutting edge of using year-round, forage-based dairy systems with clovers as a component. A paper published by AgResearch and DairyNZ asked whether forage legumes have a role in modern dairy farming systems. Although dairies in NZ largely rely on white clover only, the paper offers valuable insight into changes to the dairy sector since the 1980s in that country. To stay competitive after subsidies were phased out, dairies increased milk production via increasing N fertilization, but these farms now face similar problems as other places in the world where fertilizer prices are high in relation to commodity prices. Because of high N fertilization, clovers declined in pastures due to increased competition from grasses and extended grazing intervals. Nevertheless, research conducted earlier in NZ corroborated the observation that intake and milk yield were higher with mixed grass-clover pastures than with single-species pastures.

To improve white clover persistence under the new conditions, a few strategies were suggested by the authors – refined grazing management, clover improvement and growing grasses and legumes as monocultures rather than maintaining mixtures. It appears that having a set rotational stocking cycle; for example, the commonly used 28 days, is not fine-tuned enough to maintain optimum clover levels and/or pasture productivity. Forage growth during the growing season is variable, so adjusting the stocking cycles according to a particular season is necessary. Another suggestion focused on genetically improving stolon and biomass growth in white clover under high N rates. In addition, considered hybrids between white clover and its wild relatives. Condensed tannins potentially improve protein utilization, and efforts are made to express specific genes in white clover leaves. This would improve protein utilization by dairy cows and might reduce some environmental impacts. Further, growing grasses and legumes separately as monocultures in a single pasture has been shown to be advantageous in terms of milk production per unit area. In practice, cows graze both paddocks voluntarily, and studies from NZ reported an increase in milk yields of 25 to 30 percent per animal.

This concept holds some lessons especially for the lower midwestern U.S. If legumes are difficult to maintain as part of mixed pastures, grazing them separately may
enhance the profitability of dairy operations. A study from Mississippi State University supports precisely that, although their research focused on beef cattle. For the other arguments, legumes are well known to have potential for increasing dairy productivity, but this potential has not been used to its fullest extent yet.

Making the Most of This Unplanned Pasture Improvement Opportunity

Dr. John Jennings, Professor
Animal Science

Forage problems resulting from the 2012 drought will extend into 2013. However, many of those problems could be disguised as unplanned pasture improvement opportunities. After assessing the drought’s damage to pastures and to livestock herds, producers should seriously think about possible changes and improvements. Some questions to answered:

- Does that field need to be reseeded and, if so, does it need to be the same forage species or variety?
- Could the grazing and hay systems be made better to avoid such disastrous effects in the next drought?

Good assessment of actual damage and weed pressure will be critical. Soil tests for all pastures will be extremely helpful. The following options can help direct forage improvement efforts.

**OPTION 1 – Do Nothing**

Success with this option will be dependent on severity of drought damage, the existing forage species and willingness of the operator to nurse the field back to health. Tall fescue fields are resilient and often produce enough seed in summer to repopulate a drought-thinned stand in the fall. However, armyworms in spring ruined seed production in many fields. Prolonged grazing during drought reduced plant populations further. Careful field observation in fall and early spring will reveal how much reseeding took place. Clovers died out in a majority of fields. White clover is a prolific reseeder, and that seed should germinate in fall. The unfortunate fact is that weeds will germinate at the same time and may overtake the seedling clover. Bermudagrass fields were severely damaged in many areas. Common bermudagrass produces seed, and any surviving rhizomes will regrow next season. Any fields left “as-is” to regenerate on their own will need to be managed like new seedings. This means good management of fertility, use of weed control and use of deferred grazing. Some thin fescue and bermudagrass fields will eventually fill in, but this may take a year or more. Orchardgrass and clovers will likely need to be reseeded.

**OPTION 2 – Try to Thicken Pastures With the Same Species.**

Adding seed to fill in a thin pasture can prove beneficial, but it should be managed like a new seeding. Make sure weeds are controlled before planting. Guessing at a seeding rate based on percent damage is difficult. It is best to use a full seeding rate and plant it properly to make this option effective. Simply spreading a little seed over a weedy field hoping something good will happen has a high chance of failure. Fescue and orchardgrass should be planted in fall. A good option is to plant wheat or rye with either of those forages to provide spring grazing. Do not plant annual ryegrass with fescue and orchardgrass seed. Ryegrass will crowd out most other forages. Plant bermudagrass in late spring.

**OPTION 3 – Add Legumes**

Thin pastures provide a great opportunity to interseed legumes. Legumes improve forage quality, reduce N fertilizer need and help fill in thin grass pastures. Clover and other legumes can be overseeded into grass pastures and hayfields during fall or late winter. Fall or late winter seeding is recommended for fescue pastures. Fall seeding is recommended for bermudagrass and other warm-season grass pastures. White and red clovers are popular perennial clovers and arrowleaf and crimson clovers are popular annual clovers.

**OPTION 4 – Renovate Damaged Pastures and Convert to Other Forages**

Converting damaged fields to different forage species can help extend the grazing season, improve forage quality or reduce fescue toxicity. Novel-endophyte fescue has been shown to be a good option for the grazing dairies in southwest Missouri, and stand survival in Arkansas after this drought has shown it can be viable here as well. Roundup-ready alfalfa is a good option that can provide hay, haylage and grazing. Well-drained and moderately deep soils are required for alfalfa. A reseeding pasture of crabgrass for summer and ryegrass for fall/spring provides good quality forage for the dairy herd.
Since the development and adoption of artificial insemination (AI) in the late 1940s, the am/pm rule has been used for timing of inseminations. That is, if a cow comes into standing estrus (heat) in the morning, inseminate her that evening, or about 12 hours after detected estrus. The development of electronic estrus detection systems such as HeatWatch® allows for continuous monitoring of cows for onset of estrus and has led to refinement of insemination timing in dairy cattle.

Researchers at Virginia Tech used continuous electronic estrus monitoring on 17 dairy herds and inseminated lactating cows at various intervals after the onset of estrus. The results of the study (Table 1) showed that the optimum time to inseminate lactating dairy cows is 4 to 12 hours after the onset of estrus. Inseminating cows late (over 16 hours) reduced conception rates. Frequent observation of cows for estrus and inseminating earlier than traditional should improve pregnancy rates.

### Table 1

<table>
<thead>
<tr>
<th>Interval from onset of estrus to AI (hours)</th>
<th>Number of cows inseminated</th>
<th>Pregnancy rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 4</td>
<td>327</td>
<td>43.1</td>
</tr>
<tr>
<td>4.1 to 8</td>
<td>735</td>
<td>50.9</td>
</tr>
<tr>
<td>8.1 to 12</td>
<td>677</td>
<td>51.1</td>
</tr>
<tr>
<td>12.1 to 16</td>
<td>459</td>
<td>46.2</td>
</tr>
<tr>
<td>16.1 to 20</td>
<td>317</td>
<td>28.1</td>
</tr>
</tbody>
</table>

*Data from Dransfield et al. (1998) J. Dairy Sci. 81:1874-1882.*

Semens sorted to contain either 90 percent X or Y chromosome-bearing sperm is becoming more widely available and allows the production of mostly heifer or bull calves. Sorted semen is usually loaded into a 1/4 mL straws, contains a reduced number of sperm per straw, and the sperm are typically less viable than conventional unsorted semen. The single-service pregnancy rate achieved with sorted semen is typically about 20 percent lower than what you might expect from conventional unsorted semen. Sorted semen is also more expensive, so it is important to optimize its use in the dairy herd.

Sorted semen should be used in virgin heifers instead of lactating cows, because heifers usually have much higher single-service conception rates. Sorted semen should not be used with fixed-time AI, or you will likely be disappointed with the results. It is important to frequently observe heifers for estrus and inseminate each individual heifer at the correct time. While inseminating earlier than usual improves pregnancy rates when using conventional unsorted semen, the opposite is true when using sorted semen.

Table 2 shows the results of a study conducted at a commercial dairy where Jersey heifers were electronically monitored for onset of estrus then inseminated with sorted semen at various intervals after onset of estrus. The highest pregnancy rates occurred when Jersey heifers were inseminated between 16 and 24 hours after the onset of estrus. When using sorted semen in beef cattle we have observed a similar trend, with the highest fertility when inseminations occur about 16 to 22 hours after onset of estrus. Even with frequent visual observations for estrus, it is possible to miss the actual onset of estrus by several hours. Inadvertently inseminating too late will likely reduce pregnancy rates as much or more than inseminating too early.

### Table 2

<table>
<thead>
<tr>
<th>Interval from onset of estrus to AI (hours)</th>
<th>Number of heifers inseminated</th>
<th>Pregnancy rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 to 16</td>
<td>106</td>
<td>37.7</td>
</tr>
<tr>
<td>16.1 to 20</td>
<td>164</td>
<td>51.8</td>
</tr>
<tr>
<td>20.1 to 24</td>
<td>234</td>
<td>55.6</td>
</tr>
</tbody>
</table>

*Data from Filho et al. (2010) Theriogenology 74:1636-1642*

In summary, the pregnancy rates in lactating dairy cows might be improved by inseminating between 4 and 12 hours after onset of estrus. Sorted semen should only be used in dairy heifers to maximize pregnancy rates. Inseminate heifers with sorted semen about 16 to 24 hours after onset of estrus. If you are uncertain of the actual onset of estrus, play it safe and inseminate heifers no later than 16 hours after detected onset of estrus.