Manure Management in Japan

I recently had a chance to spend a week in Japan. As part of the trip, we spent a day looking at swine barns. As you may imagine, given the difference in agricultural systems between the United States and Japan, which include things like crop rotations (rice as compared to corn and soybean) and farm and field sizes, I knew going in there would be plenty of differences and when it came to manure, there wasn’t a one size fits all, but I was excited to see what they were doing, especially in the barns.

These barns used solid-urine segregation systems to both separate solids and liquids as a means to get the manure out of the barn. While these systems aren’t very common in the US, they have received interest because of both odor control and how the solid separation can impact nutrient partitioning (phosphorus in the solids, nitrogen in the liquid), and improve handling characteristics. However, since we don’t get to see many of these systems, I took the chance to kick the tires and give it a good once over.

So why would we want to do solid-urine segregation? Research as shown much of the ammonia release from manures comes from urease release from the solid particles which turns urea in the urine into ammonia. Getting the two separated quickly limits this and helps keep nitrogen in the manure. In this solid-liquid segregation systems, this was accomplished by a series of sloped gutters below the slatted floor. As the manure was excreted and feel through the slats, the liquid would drain down the slope of the gutter to the center where it flowed into a PVC pipe. Once in the pipe, the liquid drained to one end of the barn, where it was pumped to a second storage.

Figure 1. V-channel gutter with a slot down the center to drain the liquid away.

Solids fall through the slats, then remain on the channel until they are scraped using a V-scrapper. The mechanical scrappers are set up on a timer system, so while there are more moving parts and equipment, there isn’t necessarily more labor. The mechanical system pushes the solids through the barn into a barn cleaner, which moves it over to the composting building. This means all the manure is moved from the barn daily and can have a positive...
impact on air quality within the building, especially during times of lower ventilation.

Figure 2. V-scaper for removal of solids from the gutter channel.

In this system, the liquid fraction went to a wastewater treatment system similar to those used by municipalities. This was done as there wasn’t sufficient cropland in the area to recycle those nutrients, and while treatment added substantially to the cost of production given the situation, there are limited options.

The solids went to a composting facility, where they were aerated to remove odorants and eventually turned into a soil amendment product used by local greenhouses and gardens as Japan makes a fair amount of produce including fruits and vegetables. The compost system was turned by a self-driven unit that road concrete walls on each side of the pile. Making the whole system relatively automated and mechanized. Again adding cost, but helping with odor control and making the manure transportable and usable as a recycled nutrient product in the area.

Figure 3. Compost turning system for raceway composting of the separated solids.

Iowa Manure Balance

The ability to recycle manure as a fertilizer source to help crop production adds value to livestock production and helps protect the environment by encouraging nutrient recycling. Iowa continues to be a national leader in pork and egg production, with strong dairy, beef, and turkey production industries. However, we also have a strong crop production industry and as a result, have lots of opportunities to utilize manure.

Using 2017 Census of Agriculture data, livestock populations and crop production were estimated for each county. Livestock nutrient excretion was estimated based on the livestock population and then typical nutrient excretion rates and nutrient retentions of typical Iowa production systems for each livestock species. The crop nutrient removal capacity was estimated based off reported production and the USDA specified nutrient removal for different crops. Nitrogen removal with soybean and alfalfa hay was not included in this estimate as these plants are legumes and thus are capable of fixing at least some fraction of their nitrogen. The ratio of the amount of manure nitrogen to the estimated crop removal capacity was then calculated.
The results indicated Iowa has enough manure to supply about 42% of the nitrogen removed with crop production or around 1/3 of Iowa cropland probably receives manure. While this indicates Iowa has plenty of capacity to utilize manure as a resource, it is also important to look at this on smaller scales, such as at the county level. Of all the counties in Iowa, only six were at their crop removal capacity in terms of potential nitrogen supply from manures. Four of these counties were roughly in balance, while the other two, Lyon and Washington, have some solid results manure that could be exported from the county.

Overall, while livestock production continues to grow and expand, Iowa remains positioned to continue to utilize its manure as a resource. However, to do we must all focus on what we can do to get the most value from it.

Figure 4. A fraction of nitrogen removal for crop production (not including soybean and alfalfa hay) that could be supplied by manure within each county. Counties higher on the scale counties get a greater share of their potential nitrogen needs from livestock manure.

**RUSLE2 Workshop**

An Introductory RUSLE2 and Iowa Phosphorus Index Workshop has been scheduled for July 25, 2019, at the Polk County Extension & Outreach Office in Altoona, IA. USDA Headquarters in Washington D.C. has indicated a new model, Water Erosion Prediction Project (WEPP) is planned for implementation in the USDA field offices. This model is still being tested for implementation and it was decided to keep efforts focused on RUSLE2 as this is the current model being used and there are folks needing training in its use. This training has been scheduled in a collaborative effort between Iowa-NRCS, Iowa-DNR, and Iowa State University Extension & Outreach. This workshop will provide a brief introduction to WEPP as well for participants to orient themselves to the new upcoming software.

This introductory level workshop provides hands-on RUSLE2 software orientation and uses real field examples to determine risk calculations of the Iowa Phosphorus Index; and how to incorporate these numbers into manure and nutrient management planning requirements. Manure management planning, soil sampling requirements, common errors and the DNR’s review process also will be discussed. Anyone interested in this training can access additional information regarding how to register, agenda, fees, and directions at the [RUSLE2 Workshop Website](#).

**Maintaining Your Manure Storage**

Frequent evaluation and preventative maintenance of manure storage structures can significantly the risk of overflowing or discharging from a storage system.

1. **Monitor the operating level of your manure storage.** Gauge or develop a method to determine the amount of manure currently in storage. This will provide insight into if you have enough storage capacity to make it to the next application window. If you are concerned you may run short on storage, this gives you an early opportunity to evaluate options to handle the situation. Frequent monitoring also can alert you if anything unexpected is occurring.

2. **Conduct a visual structure inspection.** A quick inspection of the storage can tell you...
a lot about the structure. Take a look at the inspection points, connections and where sidewalks connect to the base. Mowing around the storage, cutting down trees, watching for animal burrows, and making sure clean water is being diverted around the storage will make visual inspections easier.

3. **Assess odor.** Once a week, make it part of your routine to evaluate odor intensity and what your neighbors may be smelling. Learn about odor mitigation options at the Air Management Practices Assessment Tool (AMPAT) website.

4. **Evaluate safety.** Review safety protocols and update as needed. Check any fences, escape ladders, and posted warning signs to make sure they are in good shape and readable.

**Events**

**RUSLE2 and Iowa Phosphorus Index Workshop**
July 25, 2019
Altoona, Iowa

**Manure Expo**
July 31 – August 1, 2019
Fair Oaks, Indiana

**Iowa Drainage School**
August 20 – 22, 2019
Nashua, Iowa