Impact of Auto-Sort Systems on Pig Welfare

Janeen L. Salak-Johnson, Ph.D.
Department of Animal Sciences, University of Illinois at Urbana-Champaign

**Alleged auto-sort drawbacks**

(continued from February)

**Current status of auto-sort technology:**
**Producers’ and firms’ assessment**

There are auto-sort systems in operation that have been successful, and those producers have gained the benefits associated with this technology. Some of their testimonials have been reported in trade-press; others have been used by manufacturers as they market their systems. More recent data acquired from a producer that uses an auto-sort barn layout and the “water pen” in conjunction with phase-feeding indicates an improvement in average daily gain, feed to gain, and throughput by 7 to 10 days compared to their conventional small-pen barns (personal communications). This 1,000-head wean-to-finish auto-sort barn also resulted in a feed savings of 38.6 to 48.3 lbs per head. This particular auto-sort layout provides the opportunities for the pigs on the lower end of the body-weight distribution to benefit. Despite the positive benefits gained from this particular auto-sort layout, it is important to emphasize that this layout and management scheme is more complete than simply installing scale units and gates.

Despite this report of success, there are many producers who have adopted large-pen auto-sort technology only to experience unsuccessful results. Some adopters of auto-sort have yet to regain initial capital outlays; others have become frustrated and have removed the equipment from their buildings.

**Current status of auto-sort technology:**
**Some scientists’ assessment**

From a scientific standpoint, at this time the concept of auto-sort technology is still at the theoretical stage. What is known from ample empirical evidence of which we are aware is that this technology is by far more complex than simply installing an automated-sorting scale unit and a set of one-way gates in a hog house. This complexity is evidenced by what appears to be incomplete animal adaptation, various design flaws, and unintended and unexpected consequences of these systems. These problems – among others – have been confirmed by observations both casual and controlled over the past 18 months by a research team at the University of Illinois working on a project funded by the Illinois Pork Producers Association and National Pork Board.

An on-going research study was designed to evaluate the impact that current auto-sort floor layouts have on pig performance and well-being and to further optimize auto-sort layouts based on pig behavior. Currently, experimental auto-sort layouts have been assembled at two separate hog units in Illinois in which we are examining the design and operation of specific components of auto-sort technology: the scale unit, its entries and exits; the one-way gates; the various layouts; location of important resources such as feeders and waterers in each of the various layouts now being employed; novel layout approaches; relative plan dimensions of different zones in respective layouts; and so on. Many thousands of observations and measurements of various kinds already have been made. Video-records and ear-tag-RFID weight and scale-use data from many hundreds of hours of observations of thousands of pigs have been captured. Packer and Pig Champ data have been collected as well.

Through three replicates of 600 pigs per treatment group, careful observations and data analysis has confirmed that many flaws do indeed exist and benefits are there, but not yet optimized. Behavioral vices and patterns are significantly impacted by the various auto-sort floor layouts (food-court, water-pen, and fast-lane). These floor layouts dif-
fer in the location of resources as well as the entrance into and exit out of the system. Early observations revealed that some equipment (e.g., scale and gating) per se and some layouts encourage and provide opportunity for “bad habits” to develop and become engrained if pigs are not adequately trained, and/or equipment malfunctions. For example, in one wean-to-finish operation, it has been observed that pigs will loiter in and around the equipment and use the scale unit as a place to escape the crowd and to perform stereotypic (repetitive, nervous, exploratory) behavior. They also will use gate entryways to guard other pigs from exiting a zone. We speculate that this problem becomes intensified due to inadequate training of pigs, malfunctioning of equipment, and equipment design. Also, oral-nasal-facial behaviors were significantly increased in this operation; thus, when a specific animal acts out these behaviors, a slow-down develops in the system such that pig flow is virtually halted. Scores of pigs were prevented from moving to the zone they wanted to be in, and the traffic jams and back-ups can become enormous, leading to frustration and stress.

More recently, under normal circumstances (independent of inadequate training or malfunctioning equipment), oral-nasal-facial and aggressive behaviors were observed and found to be more prevalent in some auto-sort layouts compared with others. In fact, the majority of the aggressive behavior was observed early in the training phase as well as in the later finishing phase. The aggression observed in the finishing phase was mainly around feeders and waterers; thus it appeared that these resources were restricted. Other important behaviors (i.e., eating, drinking), behavioral sequences, and overall activity are all affected by these various auto-sort layouts as compared to large conventional pens. The alteration in behaviors and behavioral patterns appear to be due mainly to the way pigs access their resources and the location of these various resources that are driven by the floor layout of these different auto-sort systems.

Several other conspicuous problems have been observed as well. Scale hits are not correlated with growth rate. Sort-loss occurs at a higher rate in some of the auto-sort layouts than others. For example data obtained for a third and final group of pigs from an auto-sort system at load-out showed a financial sort-loss to the producer not only due to light pigs but heavies, too. In fact, three heavies cost the producer $14.00 per cwt. Pigs may simply avoid the sorting processes till the very end of their time in the barn. Across all three replicates, on average, sort-loss was least for pigs from a food-court layout compared with all other treatments.

Despite data depicting design flaws with the current auto-sort layouts in this experiment, data collected thus far does reveal some positive attributes of auto-sort technology. In general, the majority of pigs within a group learn rather quickly how to use the auto-sort system regardless of the floor layout. For example, the time to exit the scale on average decreases from 55 seconds per pig on day 1 of training to < 10 seconds per pig by day 2.

From a performance standpoint, in general, feed cost per pig was similar among pigs from auto-sort systems and large conventional pens, with the exception of one auto-sort layout (food-court); feed cost per pig was slightly less. However, on average, feed conversion ratio was similar among all treatment groups. Pig average daily gain was similar among all auto-sort treatment groups. Percentage of lean was consistently higher among pigs from auto-sort systems than from large conventional pens.

Pigs from these auto-sort systems handle better and load faster than do pigs from large conventional pens. And within the different auto-sort treatments there were differences in handling scores and loading times as well. The use of prods during handling and loading was less among pigs from auto-sort systems compared with pigs from large conventional pens. Also, percent-age of vocalizations observed was ~50% less among pigs from auto-sort systems than conventional pens. In fact, pigs in auto-sort treatments appear to be less flighty and fearful of people than those pigs in large conventional pens. Pigs from auto-sort systems move through the packing plant better than those from conventional pens. Finally, there appears to be a reduction in the number of “dead” and “downer” pigs observed at the packing plant from these auto-sort systems.

### Summary

At this point in the middle of 2007, we think it would be unwise to make any concrete recommendations on adoption of auto-sort technology in view of the current lack of understanding of the pig-equipment interfaces in the auto-sort systems currently available on the market. Many factors still need to be addressed and many improvements still need to be made.

Based on our early observations and more recent data collection, we can say with confidence, at least, that in order for auto-sort systems to operate in ways useful to the industry, the designs of these systems first must be optimized based on the nature of the pig (especially pig behavior) while maximizing pig flow through the system without restricting access to critical
resources, such as feeders, waterers, and comfortable resting and dunging places.

Can the current problems observed and recorded, and expressed by users of auto-sort systems and our research team be overcome? Probably. Moreover, some of the proposed advantages of auto-sort technology probably can be realized by producers in a cost-practical scenario. But in order for auto-sort technology to be beneficial, practical, and profitable, we must continue to troubleshoot problems and answer the most pertinent questions about this novel concept with science-based research. Obtaining the necessary information about this promising technology will enable us to optimize the design of auto-sort systems while providing choices so that producers who want to consider adopting this technology can do so regardless of the diversity of unique circumstances at their respective operations.

Auto-sort systems, at minimum, should facilitate the natural behavior of the pig, enhance its overall well-being, increase its productivity, improve its product, and provide the producer with adequate returns on investments of capital and management. Those goals are not now being consistently achieved.

**Acknowledgements**

The author gratefully acknowledges the University of Illinois research team, various collaborators and producers for their support and effort of this project. The author also gratefully acknowledges the National Pork Board and the Illinois Pork Producers Association for their financial support of this project.

This paper was previously published in the 2007 A.D. Leman Conference Proceedings.

**References**


**Sixth Annual Animal Science Alumni Reunion Planned**

The NCSU Animal Science Club and the Animal Science Department are planning their Sixth Annual Alumni Reunion for Friday, April 4, 2008, at the Beef Education Unit on Lake Wheeler Road in Raleigh.

The Animal Science Club Day event will be held the same afternoon beginning at 1 p.m. Feel free to come and watch current students compete for top showmanship honors exhibiting swine, horses, sheep, dairy and beef cattle. Dinner will be provided that evening followed by the infamous Ag Olympics. All attendees are welcome to compete. This is a social gathering with no formal program. It is an opportunity to visit with old friends, faculty and staff from the department. Current members of the Animal Science Club organize the reunion each year and are the primary sponsors.

If you are an Animal Science graduate or a former member of the NCSU Animal Science Club and you have an interest in attending the 2008 event or would like more information, please contact us at the following e-mail address: mabell@ncsu.edu.

You can find more current information about the Animal Science Club at the following Web site: http://clubs.ncsu.edu/asc/. Hope to see you there!

The Beef Educational Unit is located just off Lake Wheeler Road, approximately 1 mile south of Tryon Road in Raleigh. The easiest access is from I-40 on the south side of Raleigh. Take Exit 297. Travel south on Lake Wheeler Road for about 1.5 miles and cross Tryon Road. Then follow Lake Wheeler Road about 1 more mile south, and turn right on Mid-Pines Road. The Beef Unit drive is on the right, and the red-roofed building is clearly visible from Lake Wheeler Road.

Margaret Bell, Historian
NCSU Animal Science Club
ON-FARM PERFORMANCE TESTING: The following breeders with validated herds have tested animals in the past 30 days.

<table>
<thead>
<tr>
<th>Breeder</th>
<th>Address</th>
<th>Breed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bob Ivey*</td>
<td>314 N.C. 111 S, Goldsboro 27530</td>
<td>L,D,Y,CW</td>
</tr>
<tr>
<td>Wesley Looper*</td>
<td>4695 Petra Mill Road, Granite Falls 28630</td>
<td>Y,L,H,D,X</td>
</tr>
<tr>
<td>Thad Sharp, Jr. &amp; Sons</td>
<td>5171 N.C. 581 Hwy., Sims 27880</td>
<td>Y,D,X</td>
</tr>
<tr>
<td>Thomas Farms</td>
<td>8251 Oxford Road, Timberlake 27583</td>
<td>X</td>
</tr>
<tr>
<td>Tidewater Research Farm*</td>
<td>207 Research Station Road, Plymouth 27962</td>
<td>X</td>
</tr>
</tbody>
</table>

*Realtime Ultrasound

2008 CALENDAR OF EVENTS

<table>
<thead>
<tr>
<th>Month</th>
<th>Event</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>March</td>
<td>6-8 2008 National Pork Industry Forum</td>
<td>St. Louis, Missouri</td>
</tr>
<tr>
<td></td>
<td>17-19 Mid-West Animal Science Meeting</td>
<td>Des Moines, Iowa</td>
</tr>
<tr>
<td></td>
<td>18 TQA Training Workshop</td>
<td>Clive, Iowa</td>
</tr>
<tr>
<td>April</td>
<td>4 Animal Science Alumni Reunion</td>
<td>Raleigh, North Carolina</td>
</tr>
<tr>
<td>May</td>
<td>7-9 2008 Pork Management Conference</td>
<td>Destin, Florida</td>
</tr>
<tr>
<td>June</td>
<td>5-7 World Pork Expo</td>
<td>Des Moines, Iowa</td>
</tr>
<tr>
<td>July</td>
<td>15 TQA Training Workshop</td>
<td>Clive, Iowa</td>
</tr>
</tbody>
</table>

*Frank Hollowell, David Lee