Large Group Auto Sort and Large Pen Management

Harold W. Gonyou
Lee Whittington
Prairie Swine Centre
Lee.whittington@usask.ca

Agenda

• Industry survey
• Prairie Swine Centre – behavioural research
• Operating best practices – take home messages

Management

conventional wisdom on large groups

• Keeping large groups of grow/finish pigs may result in:
  – Poor performance
  – Increased weight variation
  – Higher incidence of behavioral vices
  • English et al., 1988

Overview of Survey

• Conducted by Vido Swine Tech Group in 4 Provinces (ON, MB, SK, AB)
• Approx. 120 barns, with over 187,000 pig finishing spaces
• Survey between September and November 2006
• Measured overall producer perceptions, many had more than one type of LGAS unit, where possible this data was captured separately.
Disclaimer/Limitations

- First major survey of the industry – defined challenges
- Based on perceptions and experience of the operators
- Some reported LGH and event ‘forced’ sort, some LGAS
- LGAS are complex systems (ex. 1, 2, 3 way sort; multiple feeds, diff. # feeding spaces, floor space) which confound conclusions with too few data from each type
- Questions of interpretation left to person completing the survey (ex. personnel numbers are not necessarily FTE).
- Developing correlations requires detailed data and follow-up (ex. feed court size vs performance)
- Volunteer effort by both surveyors and surveyed. ‘Stones left unturned’ and questions left blank

LGAS (Large Group Auto-Sort)

A Merging of Two Technologies

- Large groups in intensive conditions
  - Used in extensive conditions for some time
  - Newsham introduced large group intensive housing about 15 years ago
- Electronic scales and sorting gates
  - First used to reduce labour at sorting in hallway scales
  - Can be justified within a pen if large numbers used

Large Group Auto Sort (LGAS)

- Food court
  - Most common system
  - Pen divided into food court and loafing area
  - Pigs pass through auto-sort scale en route to food court
  - Scales set to sort market pigs into separate pen

LGAS system at PSC Elstow Research Farm

Is LGAS Here to Stay?

- Two years ago a workshop was held to address threats to the technology
  - Some producers were decommissioning their auto-sorters
  - Questionable if technology would continue
- VIDO Swine Tech Group survey indicated that 81% of producers with LGAS would do it again (Whittington and Morrill, Banff 2007)

Survey Results - Representative

- Size – Avg. 500-600 pigs/pen, range 250-1000 pigs/pen
- Feed Court - Majority allocated 25%, 2nd most popular design 33% of total floor
- Flooring - 83% fully slatted, 2 respondents partial slat and 1 bedded
- Manure handling - 65% shallow pits under slat, 24% deep pits
- Sorter – Typically 500-650 pigs/sorter, up to 2600. (over 650 these were ‘forced’ or ‘managed’ sorts)
- Feeders – Majority wet/dry (80%), avg 11.4 pigs/spacerange (7.8-17.5 pigs/feeders space
- Space – Avg 8.15 sqft/pig (0.758 sqm). (range 7.5-10.5 sqft/pig, 0.976 sqm/pig)
General Information

• Why LGAS – Before owning LGAS system

Take Home Message #1

• Ease of sorting at market remains the main motivation for incorporating LGAS
• Improved Performance moved up the scale one spot, moving up two spots Reduced Cost of Construction as producers gained experience
• Feed Management went from 4th to 7th – Are we underutilizing capability of system?

Research Topics

• Potential
• Management
• Behaviour

Behaviour and LGAS

• Wild pigs live in distinct small herds that divide but rarely merge
  – Newcomers are attacked to deter them from joining the group
• Pigs in small groups fight when merged
  – Results in production losses
• Do large groups require more aggression to stabilize their social order?

Aggression at Re-grouping

In groups from 10 to 80, pigs did most of their fighting within a sub-group of 7 pigs. Only a few fights occurred among pigs from different sub-groups. (Schmolke et al., 2004)
Aggression Following Group Formation (% of time)

Samarakone, 2006

Moving Pigs Among Groups

Aggression, % of time

Fighting by Pigs, %

Day 1

Day 2

Day 3

Small (18)

Large (108)

Fighting, % time

L to L

L to S

S to L

S to S

Take Home Message #2

Social Attitude in Large Groups includes:

• Aggression during group formation is similar for both small and large groups (time per pig)
• Pigs from large groups will fight less when re-grouped
• Pigs in large groups develop a ‘tolerant’ social attitude and are less prone to fight

Implications of Social Behaviour

• Fear of aggression is overstated
• Ease of moving pigs between groups
  – Carry over into next group
• Facilitate management of treatment pen
  – Pigs separated for treatment can be returned
• Gilt development for group housing

Use of Space in Large Groups

Territorial

Restrict movements to limited area

Use only specific feeders

Closely associated with specific pigs

Home Range

Move freely through most of pen

Use many of the feeders

May or may not remain closely associated with specific pigs
Use of Space in Large Groups

- Sleeping
  - Tend to sleep in specific area
  - Association with specific pigs is less strong
  - Do they locate area by ‘location’ or ‘feature’?
    (Penny et al., 1998)

- Eating
  - In a group of 80 pigs, 80% ate from each of 8 feeders in 24 hr
  - All pigs ate from at least 6 different feeders
    (Schmolke, 2002)

Use of Space in Large Groups

- Although they show consistency in sleeping locations, pigs readily move throughout the pen seeking different feed sources.
- Consistent with an over-lapping home range spatial strategy
- Allows greater flexibility in resource (feed, water, sleeping) location

Are Subordinate Pigs Forced to Use Poor Micro-Environments?

- The good areas (over 80% of pen) will be used first.
- Subordinate pigs will likely be able to avoid problem areas.

Poor Micro-Environments in Large Pens

- Pigs should be better able to avoid poor microenvironments in large pens
- Attention to poor micro-environments may be less critical in large pens than in small, but it is still important
- Avoid the temptation to put off repairs until the end of the turn

Poor Micro-Environments and Small Pens

Specific Micro-Environment Problems

- A micro-environment that encouraged lying near the entrance to the auto-sort blocked access to the food court.
- A change in ventilation, heating, or perimeter is needed to shift lying location.
**Take Home Message #3**

Implications for Space Management:
- Flexibility in planning layout of large pens
- Able to group resources in one area
- Reduces emergencies, but not problems (feeders empty in group less urgent)

**Survey of Producer’s Experiences - Pig Welfare**

- How does your LGH system compare with smaller conventional pens with respect to pig welfare?
  - Welfare appears improved with LGH according to 56% of respondents
  - Considered improvements in reduction of vices and aggression
  - Individual pigs may experience worse welfare (Negative comments regarding health of compromised pigs missed at health check and not removed from LGH quickly enough)

**Take Home Message #4**

- 60% perceive LGH is neutral or has improved herd’s health. LGH increased management concern when serious diseases like PCVAD strike.
- The potential for LGH is to improve welfare overall but concerned individual pigs may experience worse welfare than in small pens

**Survey of Producer’s Experiences - Training Pigs**

- Top 2 factors considered when developing pig training on sorter is:
  - pen layout
  - relationship of food court to auto-sorter
- Gradual conditioning is preferred over forced sort as a training method
- When training fails the sorter is used as a weekly forced event sort and all other times the one-way return gates are left open

**Training Research**

Shaping
Reward animal for approximating desired behaviour. Gradually set higher standards until very complex pattern is achieved.

Gradual Training
Begin with one-way gates open, auto-sort open, and pass-through gate open. Close one-ways Close pass-through Activate auto-sort Remove ‘dummies’

**Survey of Producer’s Experiences - Training Pigs**

- Pigs that never learn to use the system? - YES
- One third reporting challenges, that ranged was 10-20% of pigs
- In spite of challenges only 1 producer in the ‘over-10%’ group would return to a small pen system

- Over 10% ‘dummies’
- Less than 3% ‘dummies’
Implications for Training

• Keep it simple and low labour
• Let pigs do the training
• Don’t spend excessive time on dummies
  – Less than 3% of pigs
  – Pen, create special care area

Survey of Producer’s Experiences –Training People-

• The Number 1 training issue relates to the auto-sorter itself. Learning the computer, using the data to accurately predict shipping time.
• Second training issue was management of individual pigs (health checks) within the pen
• Overall attitude is they have adapted and would not go back to a small pen system.

Survey of Producer’s Experiences –Training People-

• Have staff attitudes changed? 80% responded YES
• Those attitude changes recorded:
  • Less anxiety in barn with pigs and staff
  • Shipping is less stressful for staff as pigs move easier
  • Increase dissatisfaction with mechanical problems associated with sorter functioning
Take Home Message #5

- Training takes time. Be aware of impact on feed intake and well-being through the Training Process.
- Gradually conditioning to Auto-sorter, lessens the impact.
- Understanding your barn design and limitations and the relationship to your herd’s behavior is key in developing a farm specific training procedure to lessen impact.

Survey of Producer’s Experiences - Pig Performance -

- Since installing LGAS have you observed improvements or deterioration, relative to your previous small pens, in growth rate?
  - 56% found ADG declined in LGH
  - 37% found no change
  - 7% found improvement

Results & Discussion: ADG

- 3% difference between group sizes ($p = 0.0002$)

![Graph showing ADG (kg/day) for Small and Large Group Size]

Results & Discussion - ADG

- Past studies use empirical methods (space as sqft or m²/pig)
  - Allometric equation: $**Area = k * BW_{0.667}**$
    - Decreased ADG¹, ADFI¹, poorer feed efficiency²
    - Gonyou and Stricklin, 1998; Brumm et al., 2001; Wolter and Ellis, 2002; Turner et al., 2003
    - Harper and Konesney, 1983; Holick et al., 1998
  - Increased lameness³ and tail biting⁴
    - Gonyou et al., 1999
    - Baxter, 1985
  - $k > 0.035$
    - Uncrowded
    - Optimal gains, FI, feed efficiency

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  - $k > 0.035$
  - Uncrowded
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**Area in m², BW in kg

Practical Space Allowance

- Diurnal pattern of eating
  - Depends on lighting program
  - Morning/afternoon peaks if using a light:dark cycle
  - Mid-day peak if lights on continuously

- Obtain hits/pig/day
  - What does it tell us
  - How long is a pig in the food court, and for how many meals per hit?

Meal Frequency

- Small groups
  - 12 meals/day
- Large groups, without sorter
  - 9 meals/day
- Large group, with sorter
  - 3-4 ‘hits’/day
  - Does each hit represent 3 meals?

Street, 2005
Use of the Food Court

- Pigs eat and rest in the food court
- Resting in the food court may limit access to feeders
- Preference to reduce resting in food court
  - Would increase hits/day
  - Hits/day relates more to throughput than to time spent eating

Meals and Duration of Eating

Small Groups  Large Groups

<table>
<thead>
<tr>
<th></th>
<th>Small Groups</th>
<th>Large Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td># of meals</td>
<td>11.70</td>
<td>9.15**</td>
</tr>
<tr>
<td>Meal length</td>
<td>5.26 min</td>
<td>7.35**</td>
</tr>
<tr>
<td>Total duration</td>
<td>55.7 min</td>
<td>60.4</td>
</tr>
</tbody>
</table>

Street, 2005

Behavioural Ecology: Cost/Benefit

- Getting to feeder is more costly in large pen (distance)
- Must increase benefit by staying longer
- Fewer but longer meals, for same total duration

Large Group vs Crowding

<table>
<thead>
<tr>
<th></th>
<th>Large Group</th>
<th>Crowding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fewer meals</td>
<td>9.15 vs 11.70</td>
<td>8.7 vs 10.9</td>
</tr>
<tr>
<td>Longer meals</td>
<td>7.4 vs 5.3 min</td>
<td>6.2 vs 5.8 min</td>
</tr>
<tr>
<td>Same total duration</td>
<td>60 vs 56 min</td>
<td>49 vs 60</td>
</tr>
<tr>
<td>Motivation (appetite)</td>
<td>same in small and large groups</td>
<td>Motivation (appetite) is reduced in crowding</td>
</tr>
</tbody>
</table>

Does not adjust meal length to maintain intake

Street, 2005

Feeder Space in Large Groups

- First week
  - Total eating duration of 130 min/day
    - Maximum pigs/space is (1440/130) * 80% = 9
- 7th week
  - Total eating duration of 57 min/day
    - Maximum pigs/space is (1440/57) * 80% = 20
- Feeder space is most crowded during first week
- Total duration of eating depends on pig size, feed form, and feeder type. Appropriate pigs/space will vary on each operation.

Samarakone, 2006

When is Production Restricted

Large Groups  Crowding

<table>
<thead>
<tr>
<th></th>
<th>Large Groups</th>
<th>Crowding</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd week</td>
<td>1.024 vs 1.083 kg/day</td>
<td>0.962 vs 1.067 kg/day</td>
</tr>
<tr>
<td>Production most affected</td>
<td>early in production</td>
<td>end of grow-out</td>
</tr>
<tr>
<td>when adaptation to large group is occurring (training, feeding, feeder space)</td>
<td>intake and health</td>
<td></td>
</tr>
</tbody>
</table>

Street, 2005
Correlation with Feed Court Size

<table>
<thead>
<tr>
<th>Size of Feed Crt (%) of total floor space</th>
<th>Health</th>
<th>Growth</th>
<th>Var’tn</th>
<th>Feed eff.</th>
<th>Carcass</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (12-16%)</td>
<td>1</td>
<td>-2</td>
<td>0</td>
<td>-1</td>
<td>0</td>
<td>-2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Neutral</td>
</tr>
<tr>
<td>Medium (23-26%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Most pleased</td>
</tr>
<tr>
<td>High (30-34%)</td>
<td>-1</td>
<td>-4</td>
<td>-2</td>
<td>-2</td>
<td>0</td>
<td>-8 least pleased</td>
</tr>
</tbody>
</table>

*Limitations of survey analysis: some cells contain only 1 response; not weighted for the number of pigs; a value of 1 given to +ve and -ve responses, a value of 0 given to = responses; cells show net score (-ve responses subtracted from positive & neutral). The term ‘pleased’ equates to least change from previous system.

Take Home Message #6

- Do not crowd large groups, the same laws of space requirements prevail
- Have adequate feeders for pigs
  - Based on youngest pigs in pen
  - Keep occupancy rate under 80%
- Ensure all feeders are accessible
  - Well spaced in food court
  - Allow pig movement between feeders
  - Keep away from entrance and exits
- Ensure pigs know where feeders are
  - Place pigs in food court rather than loafing area

Survey of Producer’s Experiences - Sorting Equipment -

- Are you happy with your current auto-sorter?
  - 80% almost completely or fully satisfied
  - 20% not satisfied or very unhappy
  - All respondents had some concerns with sorter reliability

Survey of Producer’s Experiences - Sorting Equipment -

- What improvements would you like to see in your sorter?
  - Electronics – half the respondents reported reliability problems with load cells, scale heads, gate actuators, electrical connections, and computer software.
  - Strength/durability – Early adopters comment on older equipment not standing up. Comments that newer equipment (incl. Better bushings and stainless) appear much better.
Survey of Producer’s Experiences
- Sorting Equipment -

• What improvements would you like to see in your sorter?
  • System problems – Poorly designed one-way gates (pigs reversing, noisy), and ability of two small pigs to enter the scale at once (requiring labour to move them), are frustrating.
  • High mortality events due to piling too many pigs in a small shipping pen was a very common experience. Human error (settings) and equipment failure equally to blame.

Sorting Accuracy

• Most producers reported a number of light pigs in market group
• Most scales are accurate when tested
• Occasionally a pig will ‘add’ weight to another pig

• Assuming a 1% inaccuracy rate
• In one day you have 500 pigs x 3 hits = 1500
• 15 light pigs
• In one week you could have 105 light pigs

Advice for Autosort

• Buy a good product with service
• Include ‘commissioning’ of equipment in package
• Work at it
• Select management options
  – Training
  – Continuous vs intermittent sorting
  – Re-weighing
  – Sort for feed
  – Sort for Paylean

Take Home Message #7

Sorting Accuracy:
• “Set it and forget it” does not work
• Keep sort period short
  – Empty the food court
  – Sort overnight or for 1-2 days
• Re-Weigh the day before marketing
  – Set up penning to run sorted pigs through again
Survey of Producer’s Experiences

-Pig Performance-

- How do you find moving pigs housed in your LGH system? 
- Within the barn during grow-out period

More difficult 25%
Easier 69%
No difference 6%

- How do you find moving pigs housed in your LGH system? 
- During load out onto truck at shipping

No difference 6%
Easier 94%

LGAS and Handling Ease

<table>
<thead>
<tr>
<th>Large Groups</th>
<th>Small groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prod use</td>
<td>5.9</td>
</tr>
<tr>
<td>Time to load</td>
<td>56 sec</td>
</tr>
<tr>
<td>Temperature (barn)</td>
<td>39.1 C</td>
</tr>
<tr>
<td>(truck)</td>
<td>40.1 C</td>
</tr>
<tr>
<td>(plant)</td>
<td>39.1 C</td>
</tr>
<tr>
<td>Meat pH</td>
<td>5.73</td>
</tr>
</tbody>
</table>

Preliminary data from current study.

Take Home Message #8

Ease of handling:
- Producers and truckers report LGAS pigs easier to handle (than pigs from small pens)
- Recent research substantiates this

SUMMARY

Take Home Messages
- Ease of handling remains the main motivation to adopt LGAS
- Pigs in large groups develop a ‘tolerant’ social attitude
- Pigs in large groups utilize the entire area and resources allowing for flexible facility design
- Potential for LGH is to improve pig welfare

SUMMARY

Take Home Messages
- Training takes time, gradual conditioning preferred
- Do not crowd large groups
- Sorting equipment is reliable but do not ‘set it and forget it’
- Handling of pigs from LGAS is easier
SUMMARY LGAS Potential

- Sorting for market
  - Improvements will be made
- Sorting for feed
  - Food court layout and delivery systems
- Sorting for Paylean or other additive
- Meat quality advantage with less stress and aggression?
- Create zones for pigs, not the average
- Create specialized areas (toilets?)
- Source for ‘socially tolerant’ sows