Setting Up an Effective Farm Trial

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The pork industry is blessed with a number of innovators. I recall surveys from decades ago that compared the speed of adoption of new technology by the various commodity sectors, and pork producers were always very near the top of the chart. Perhaps it is the rapidity of turnover in the barn that lends itself to seeing a difference in management quickly. Maybe the intensive agricultural systems attract a certain type of person with a curious mind? Whatever the reason, it is without a doubt that all pig farms participate to a greater or lesser extent in experimenting to improve productivity, reduce costs, or make management easier. Sometimes the results of such experimentation are as expected – For example the pigs on the higher energy, more expensive diet grew more quickly. Often however the results, the time and effort and money required to innovate and experiment results in more questions than answers and does not lead to an innovation being adopted on the farm as part of a new long-term management strategy. This paper will help to explain why results are not always what we expect and how to improve your odds of success in future on-farm trials.

Why you should do an on-farm trial

Many new technologies come with all the work completed including the change we can expect, the confidence in the statistical approach used to analyze the test, plus the economic benefit of implementation under a standard set of economic assumptions. So why would you want to take on organizing an on-farm test yourself? There are several reasons to test something on the farm. Typically the top reasons given by innovative producers are:

1) "The proof is in the pudding" or "My situation is different and I don't believe just because it works elsewhere it will work on my farm".

2) "The idea is mine and I don't know of anyone else that has tried it so I need to find out for myself."

3) "I read/heard about this idea from another country and think it might work here."

Yes no two barns are exactly alike, even though they may be designed to operate the same; the people factor adds a unique component that makes a significant difference on the outcome of many practices or products used. For example, we can standardize feeding times, amounts fed and diet formulation but can we be sure the ventilation system is managed the same, or how the pigs are handled is identical? This latter point was reinforced with Paul Hemsworth's work two decades ago where the interaction between the stockperson and pig varied significantly from farm to farm based on the previous handling experience of the animals – some herds were curious and approach, others generally fearful and flee from people. So there are differences between barns and thus reasons to believe that an on-farm trial would produce a more reliable result than information gathered on other farms.

There are of course circumstances that lead us to think it is not necessary to do my own on-farm trial. For example to confirm the effectiveness of a vaccine or pharmaceutical treatment specific to a disease and to test the product would require you to allow an outbreak of the disease on your farm. Not a good candidate for an on-farm trial.

Most on-farm trials have an economic decision they are trying to address. This adds to the complication of the study because the experiment should be able to capture both positive and negative results. What is the benefit we are hoping to achieve and what is the cost to achieve it? The cost is often easy to find (example, feed cost per kg, or drug cost per dose) but the performance result in the barn, the statistically tested part, is much more difficult. A review of any scientific publication will focus on the significant p value. That is, the results are not random and there is a 95% probability that the effect seen from the intervention is from the treatment given ($p < 0.05$). So how do I achieve this level of confidence that the intervention (feed, drug, etc) worked and should be considered as part of my ongoing management of the barn? There are two related questions because not all studies result in a statistically significant conclusion. What if the intervention didn't work – was it the product in question or was the experimental test just not sensitive enough to detect the small improvement? Should I then not use this intervention on my farm? Lastly the results are unclear and other information is required to make the decision. Perhaps the trial was not designed properly and cannot answer the question you ask.

Why on-farm tests often fail

The reasons are many but break down into five main categories (First noted by Deen 2009):

1) The trial design would not provide the answer you seek. This sounds very basic and avoidable but likely accounts for a majority of the on-farm test failures. What happens if the intervention has multiple outcomes? For example, a small improvement in average daily gain, feed efficiency and improvement in one or two carcass features. Do the combined improvements in each of these areas justify the intervention? When the improvement in feed efficiency alone is enough to justify the intervention the answer is clear – adopt the new technology. What if only small gains are made in each area? Likely the reality is the study needs to be redesigned to include many more pigs to identify small gains (increase the

analytical power of the test by having more groups of pigs on trial)? (Deen 2009)

2) Consideration of prior knowledge of the item to be tested and the pig barn we are testing in. If the item we are testing has a history of performance under other circumstances (even in species other than pigs) that gives us a clue as to how big a difference we are seeking to measure. What is the variation located within the test herd prior to the test? This knowledge of health status, quality of pig, and variation in key factors such as daily gain are the inherent background 'noise' within the barn. We need to account for this 'noise' to ensure our test can be interpreted.

3) Danger of believing your test analysis when actually it is worthless. Statistically a negative result of a single study cannot be interpreted as supporting a negative conclusion. This really only means that we are not satisfied 'beyond a doubt' ($p<0.05$% probability) that the product performed as expected.

4) "A micrometer question is often measured with a 'yard-stick'. …The scale of the economic benefit required to justify an intervention is much smaller than the capability of the statistical test created." (Deen, 2009). Lets use an analogy to explain this concept. If we are trying to measure the impact of a wave of amplitude 1 cm (a daily gain improvement of 20 grams per day) passing through our test population (pig barn) and the variation in the test population is viewed as a wave with amplitude of 1km (days to 120 kg varies from 135-230) you get the idea. There is so much variation already within the population that it would take a large number of data points (pens of pigs) to sort out the effect of the smaller wave.

5) Data collection or the 'people factor'. We could write chapters on examples of tests that never had a chance of answering the original question. The greatest is kindly referred to as planting and harvest disease – known distractions that will occur during the course of the test need to be dealt with in advance. Getting stockpeople on side, arranging additional help to collect information (using summer students in July – is the result valid in January?), not fudging data when it is lost (the pigs ate my homework!), having a backup plan when people unexpectedly leave, having the right measurement tools (is the scale accurate enough to pick up the difference anticipated?) and intervention procedures operating well and checked regularly to ensure they continue to operate as expected over the trial period, all the feed is made and tested prior to the start of the test (remove batch mixing error and eliminates out-of-feed incidents). There are the whole list of other factors such as ventilation error or power failure, out of water events, feeders adjustable to provide uniform access in all pens and avoid waste, what to do if there is a disease outbreak during the test period, effect of weather and changing seasons on feed intake or dunging patterns, stable parity distribution within the breeding herd, pigs jumping from one pen to another …

One sidebar to the people factor is "when you start to measure something, it generally begins to improve" (Krueger, 2009). For example, when daily feeder and waterer checks are consistently made and acted on, the results of all groups will likely improve because the 'normal' out-of-feed events (typically 10% of all feeders in the barn) do not occur during the test period.

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How to Avoid Common Pitfalls when setting up your on-farm trial

1) Do the math first. How many groups of pigs will it take to have confidence (sufficient power in the statistical test) that the difference I am trying to measure can be assessed from my trial design? This can be the subject of a graduate course but if you have the patience and interest some free software on line can help such as www.stat.uiowa.edu/power/index.html, www.winepiscope, www.youtube.com/watch?v=PbODigCZql8

2) Calculate the likely financial benefit of a successful trial. Will it be sufficient to justify the work and cost of conducting the trial? Most businesses will want a 3:1 return on new investment because they realize that biological systems don't always behave as predicted all the time, so can I expect a $3 return from a $1 intervention?

3) Get the people involved. Everyone that plays a role needs to be aware of the cost and the large risk of failure to complete the trial as designed.

4) Use a checklist like the one attached to plan your successful trial implementation.

The Bottom Line

There are many sources of new ideas and technologies awaiting pork producers. Assessing their economic value and appropriateness for your farm should begin with taking the easy route first and looking for third-party verifiable test results that give you confidence the results are repeatable and sufficient to provide a positive economic return under current economic circumstances.

If reliable information does not exist but you believe the potential economic benefit is too great to ignore, and you have adequate resources to design and implement an on-farm test then use the *Designing your on farm trial - A checklist for success* trial checklist to increase your chances for success.

References

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