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Use of Process Control Charts in Production Diagnostics

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Statistical process control , or SPC, is a central component to the application of Deming's concept of total quality management and continual process improvement. Shewhart and Deming first advanced these concepts in the United States between the 1920's to 1940's. While they saw some application in the military during the Second World War, the concepts on process control did not receive wide attention in postwar industrial production (1). These processes did meet with acceptance in Japan during the 1950's and 1960's, and served as a key part of the program that led to world class quality production.

SPC Methods

Process control seeks to provide managers and advisors with predictive information about the output of a production system. This may be a cigarette lighter manufacturing process, or the weekly output of pigs from a farrowing unit. Manufacturing, chemical and biologic processes may all be evaluated with SPC methods.

The key definition, which confuses veterinarians and producers, is the term being in "statistical control". This has nothing to do with control as we normally see it. It does not refer to whether or not processes are complied to or whether management's instructions are followed. It does refer to the output of the production unit being measured. Being in statistical control implies that a process is predictable with normal limits, based on three sigma, or deviation, units.

It should be noted that a system in control is predictable – and no more. SPC cannot make comments about the appropriateness of a system or its output. It is the responsibility of management to interpret process control charts and align the output of the system (the voice of the process) with desired targets (the voice of the customer).

When a system is out of control, the output of that system is not predictable. That is, points fall outside of the three sigma limits calculated from system specific data. These may be defined as good (i.e. lower feed conversion) or bad (higher mortality), though in either case the point is out of control.

Out of control points can be followed up with diagnostics based on process flow diagrams, also know as fishbone charts. These charts identify the significant control points for a given process. When out of control points are detected, each possible critical control point is reviewed for its impact on the detected result.

Case One Low Farrowing Rate

This farm presented the consulting veterinarian with a problem of low farrowing rate in July of 1996. Data was provided and plotted in a control chart that revealed the actual change in farrowing rate occurred in June of 1995. An additional earlier signal in the moving range of farrowing rate was detected several months earlier, in December of 1995. Corrective action based on control chart data should have been taken over one year earlier if control charting process and SPC had been utilized.

Case Two High Salmonella Seroprevalence

A production trial evaluated the effect a live avirulent vaccine to reduce the level of Salmonella contamination ofcarcasses at slaughter. Control limits based on vaccinated pigs were generated. Signals were seen in unvaccinated pigs (samples 1 – 9) demonstrating a significant difference in seroprevalence between the two groups.

A similar use for charting of production group monitoring could be applied to this chart. When a significantly higher seroprevalence is detected, intervention action based on critical control points for Salmonella would be implemented. Pen fecal samples, feed sampling, culture of pigs from affected groups, etc, would be rational steps to take to investigate the elevated results from the Salmonella monitoring procedure.

Discussion

SPC is a management process to monitor the output of a system to determine how predictably it is performing. When out of control points are detected, appropriate actions can be taken to correct the problem. As important, energy is not wasted responding to the normal variation produced by a system. This saves management time and energy, and focuses efforts on areas most likely to improve the process.

Summary Points

- SPC charting has implications to biologic as well as mechanical production systems.
- Both pork production and veterinary medical processes can be monitored, and corrective action taken, based on chart outputs.
- To continually improve pork production and health, SPC methods will play a key role.

References

(1) DJ Wheeler. *Understanding Variation – The Key to Managing Chaos*, SPC Press, Knoxville, TN.

(2) WA Shewhart. *Statistical Method from the Viewpoint of Quality Control.* Dover Publications, New York, NY.

(3) WW Sherkenbach. *Deming's Road to Continual Improvement.* SPC Press, Knoxville, TN.

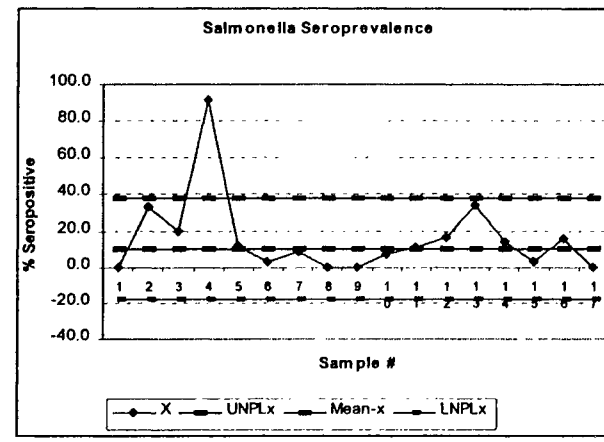

Chart 1 – Farrowing Rate

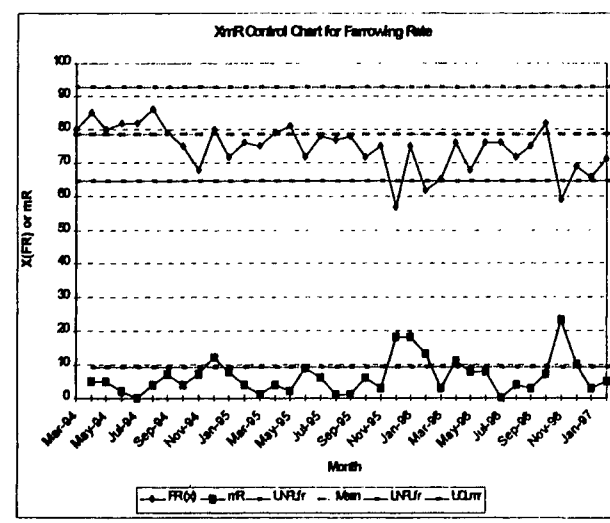

Chart 2 – Salmonella Seroprevalence