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Effect on Fecal Bacteriology and Sow Herd Performance Before and After *Bacillus subtilis*, PB6 Use[1]

Abstract

A trial was conducted at a sow farm in west central Illinois to evaluate the efficacy of *Bacillus subtilis,* PB6 against *Clostridial* disease. This sow farm had a history of *Clostridial* disease as noted by scouring pigs in the farrowing house from previous diagnoses. The bacteriology and sow performance data were collected and analyzed using a before and after *Bacillus subtilis,* PB6 trial design. *Bacillus subtilis,* PB6 was used at 100,000 CFU/ton of feed in both lactation and gestation feeds. Ten sows and ten gilts in both lactation and gestation were randomly selected to collect fecal samples. Fresh fecal samples were collected for bacteriology from the same animals in the before and after fecal collections. The feeding period of *Bacillus subtilis,* PB6 for the bacteriology data collection was a 16-day period. *Clostridium* bacteria plate counts in all forty animals before and after *Bacillus subtilis,* PB6 feeding were 4.2 log and 3.4 log CFU/g respectively. There were no differences in *Clostridial* counts for sows versus gilts. Differences in lactation versus gestation *Clostridial* counts were observed with the response being driven primarily by the average daily feed intake. Feed budgets allowed lactation animals to consume 16 lbs./ day while gestation was 6 lbs./day. *Bacillus* spore counts in all forty animals before and after *Bacillus subtilis,* PB6 feeding were 4.8 log and 5.2 log CFU/g, respectively. There were no differences in *Bacillus* spore counts for sows versus gilts and no differences in lactation versus gestation animals. Feed samples collected to determine the *Bacillus* spore counts were all in the 5.0 log CFU/g range. Performance measures were evaluated 16 weeks before and after *Bacillus subtilis,* PB6 feeding. Numerically improved herd performance metrics were: weekly number of pigs weaned per sow, non-productive sow days and pigs weaned/mated female/yr.

Introduction

There are two species of pathogenic *Clostridium* bacteria associated with enteric disease in farrowing house piglets, *Clostridium perfringens* and *Clostridium difficile*. A proprietary strain of *Bacillus subtilis, PB6*, the active ingredient in CLOSTAT®, has been shown via *in vitro* testing to inhibit the growth of these two *Clostridium* species.[2] Hanson et. al demonstrated that the application of *Bacillus subtilis*, PB6 during gestation and lactation to sows and post-farrowing to piglets had a positive effect on piglet performance during the pre-weaning period.[3] Further work was recently done in a commercial setting to evaluate the effect of *Bacillus subtilis*, PB6 on sow and gilt fecal bacteriology and sow herd performance. The sow farm had evidence of *Clostridium* enteric disease in their farrowing house piglets. Due to experimental design limitations at the farm, a before and after study design was used to evaluate the impact of *Bacillus subtilis*, PB6 on *Clostridium* disease in the sow herd.

Materials and Methods

Animals, facilities and diets

Ten sows and gilts were randomly selected from two farrowing rooms, and ten sows and gilts were randomly selected from one gestation room. Farrowing pens provided *ad libitum* access to feed and water. The farrowing rooms were mechanically ventilated and had wire mesh flooring. Gestation pens were in a tunnel-ventilated gestation room with concrete slat flooring. Animals in gestation were provided 6 lbs. of feed daily and *ad libitum* access to water. Animals in lactation were provided 16 lbs. of feed daily and *ad libitum* access to water. Room temperatures were set at normal production indices. Mash feed was fed for both gestation and lactation diets.

Treatments

Prior to April 24, 2017, all feeds were manufactured and delivered to the farm without *Bacillus subtilis*, PB6 in the feed for both lactation and gestation diets. Animals were fed *Bacillus subtilis*, PB6 at the target rate of 110,000 CFU/g in diets starting on April 24, 2017. *Bacillus subtilis*, PB6 at 110,000 CFU/g of feed was fed to all animals at the farm continuously for 16 weeks.

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Data collection

Ten sows and gilts in farrowing and gestation (n = 40) were randomly selected by the herd manager for collection of fresh fecal samples. These animals were individually tagged, and fresh fecal samples were collected from every animal on trial initiation (April 24, 2017) and shipped on ice for laboratory testing. Sixteen days later (May 10, 2017), the fresh fecal sample collection was repeated on the same animals. Three of the 40 animals were removed from the herd, therefore 37 samples were collected on May 10. Diet samples were collected and analyzed for *Bacillus subtilis*, PB6 spore count after trial initiation and were confirmed to have 110,000 CFU/g of feed.

Data Analysis

The fecal bacteriology and sow and gilt performance data was analyzed using Excel. Numerical summary data are presented below.

Results and Discussion

Numerical reductions in *Clostridium* spp bacterial counts were observed comparing before versus after 16 days (Table 1) of *Bacillus subtilis*, PB6 application in gestation and lactation diets. Numerical increases in *Bacillus subtilis*, PB6 spore counts were noted before versus after feeding *Bacillus subtilis*, PB6 for 16 days (Table 2). Increases of *Bacillus subtilis* were diminished due to treated feeds being consumed prior to establishing a baseline for *Bacillus subtilis* levels in this field trial. The reduction of *Clostridium* spp bacterial counts were greater in farrowing compared to gestation due to increases in average daily feed intake — thus allowing the animals to consume additional PB6.

Table 1. *Clostridium* fecal bacteriology (log CFU/g) before and during 16 days of *Bacillus subtilis,* PB6 application.

Clostridium counts		Average before *Bacillus subtilis,* PB6 application	Average during *Bacillus subtilis,* PB6 application	Reduction in counts
Farrowing	sows	4.3	3.0	1.3
	gilts	4.1	3.2	0.9
	all	4.2	3.1	1.1
Gestation	sows	4.2	3.6	0.6
	gilts	4.1	3.5	0.6
	all	4.2	3.6	0.6
All animals		4.2	3.4	0.8

Table 2. *Bacillus* fecal bacteriology (log CFU/g) during 16 days of *Bacillus subtilis,* PB6 application.

Bacillus counts		Average before *Bacillus subtilis,* PB6 application	Average during *Bacillus subtilis,* PB6 application	Increase in counts
Farrowing	sows	4.5	5.0	0.5
	gilts	5.1	4.9	-0.2
	all	4.9	4.9	0.0
Gestation	sows	4.7	5.0	0.3
	gilts	4.5	5.0	0.5
	all	4.6	5.0	0.4
All animals		4.8	5.0	0.2

Observing the entire sow herd beyond the 40 animals that were randomly selected for *Clostridium* and *Bacillus* testing, sow herd performance was numerically improved. Metrics in the number of pigs weaned per week, non-productive sow days and pigs weaned/mated female/yr. as shown in Table 3.

Table 3. Sow Herd Performance. Sixteen weeks before and sixteen weeks with feeding *Bacillus subtilis,* PB6.

	Before *Bacillus subtilis,* PB6 application			During *Bacillus subtilis,* PB6 application			Differences in Averages post application
		16 Weeks			16 Weeks		
Items	Average	Low	High	Average	Low	High	
Pigs weaned from sows weaned	627.25	529.00	693.00	647.50	520.00	795.00	+20.25
Pigs weaned/sow weaned	10.42	8.10	11.64	10.72	8.39	12.05	+0.30
Avg non-productive sow days	67.28	61.80	79.90	58.64	40.40	68.20	-8.64
Pigs weaned/mated female/year	22.84	17.90	25.85	24.34	19.09	28.09	+1.50

Conclusion

Reductions in *Clostridium* spp bacterial counts were observed comparing before versus after 16 days of *Bacillus subtilis*, PB6 application in gestation and lactation diets, while increases in *Bacillus subtilis*, PB6 spore counts were noted before versus after feeding *Bacillus subtilis*, PB6 (all numerical differences). The addition of *Bacillus subtilis,* PB6 numerically improved sow herd performance metrics in weekly number of pigs weaned per sow, non-productive sow days and pigs weaned/mated female/yr.

References

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