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This Little Piggy Cried P-E-D-v All the Way Home

Estimating the Impacts of PEDv in North America

Rabobank International

Food & Agribusiness Research and Advisory

Will Sawyer
william.sawyer@rabobank.com
+1 212 916 7991

Pablo Sherwell
pablo.sherwell@rabobank.com
+52 55 52610012

www.rabotransact.com
www.rabobank.com/f&a

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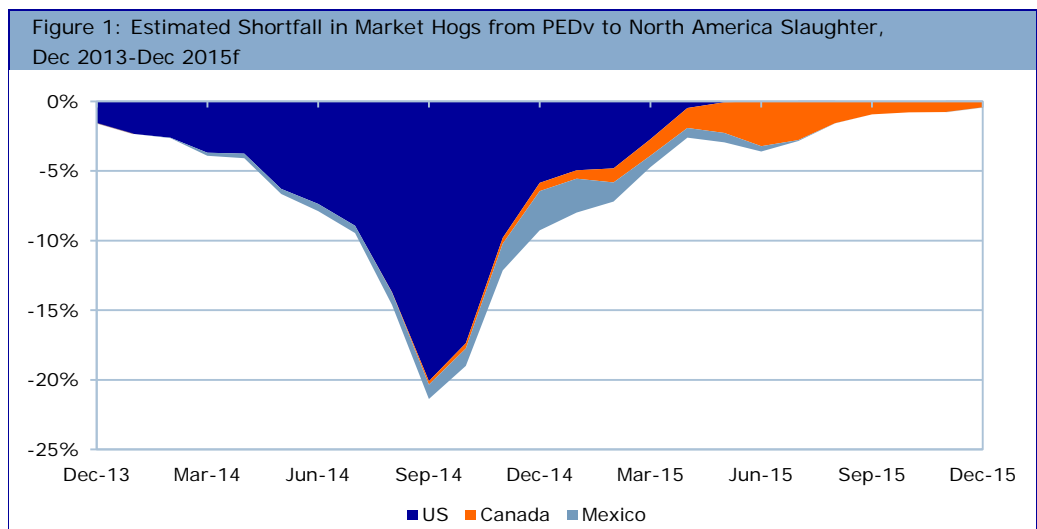
Lessons from PRRS 7

- If PEDv continues to spread through Canada and Mexico as it has in the U.S. over last year, we estimate North American hog slaughter could decline by nearly 18.5 million hogs over 2014 and 2015 or 12.5% relative to 2013 levels.
- Overall U.S. pork production is expected to decline 6% to 7% in 2014, the most in 30 years, driven by 11% (12.5 million) fewer hogs as a result of PEDv, offset by producers who were able to increase farrowings at the end of 2013, before the escalation in PEDv cases, about 1.5%, as well as continued higher hog weights of about 3%.
- In 2014, Mexico hog slaughter and pork production are anticipated to decline 7.5 % and 9.7 %, respectively. Even if PEDv outbreaks slow, we expect another decline in 2015.
- U.S. and Mexico chicken producers will be in a rare position in 2014 to profitably increase production to fill the void as pork and beef supplies decline.
- The tight hog supply environment will begin to pressure packer margins this summer as some have already started to eliminate Saturday shifts and have even discussed plans to cut Friday shifts as well.

PEDv a Drag to U.S. Hog Supply and Pork Production

We must first acknowledge that any estimate for the impact of Porcine Epidemic Diarrhea virus (PEDv) is inherently uncertain given the voluntary nature of PEDv reporting and the wide range of success and time in eradicating the virus following an outbreak. We have relied upon the data available where possible, layered with standard industry productivity to formulate our best guess for the impact of the virus on the availability of market hogs.

That being said, we see the outbreak of PEDv causing a significant shortfall in the availability of market hogs in the U.S. this year to the tune of 12.5 million hogs or 11% of annual slaughter. Given the ever-rising number of PEDv cases reported, coupled with a six-month average lifecycle, the months of August through October are likely to be the tightest for processors where slaughter could decline by 15% to 25% against 2013 levels. Our estimate assumes a slowdown in the number of cases of PEDv in April and May as temperatures rise and more of the U.S. breeding herd builds immunity. However, if the virus continues at its current rate, the shortfall to U.S. slaughter in 2014 could be as high as 15 million hogs or 13.5% of annual slaughter.



Source: AASV, Rabobank estimates, 2014

In total, we currently forecast U.S. pork production to decline by 6% to 7% in 2014 with the 11% reduction from PEDv partially offset by a 1.5% rise in hogs from producers without PEDv and a 3% increase in hog slaughter weights driven by lower corn prices. Producers in regions where the outbreak of PEDv took place more recently or those whose herd built up a strong immunity level last fall will help to backfill these losses, which we estimate could add 1.5% to production.

As of the 1 December 2013 *Quarterly Hogs and Pigs* report, many producers had not experienced a significant outbreak of PEDv and increased their inventory of hogs under 50 lbs by 10%. PEDv has broken out in many of these states since then, including Minnesota, Indiana, Pennsylvania and Illinois. As a result, a number of these pigs were lost, depending on their age at the time of the outbreak. We estimate these producers will add about 1.5% to annual hog slaughter in 2014 increasing to 3.5% in 2015 as the pace of PEDv outbreaks slow.

Hog weights have been on the rise as corn futures declined below USD 5 per bushel, allowing producers to put a few extra pounds on their animals quite profitably. As the spread of PEDv has accelerated and the possibility of empty hog barns appears more likely, producers have kept hog weights up in an effort to bring as much pork to market as possible. We expect the 3% year-over-year increase in hog weights to be sustained through the remainder of 2014 but this factor may come under pressure during the summer months if temperatures become unseasonably warm.

Figure 2: Rabobank U.S. Pork Production Forecast

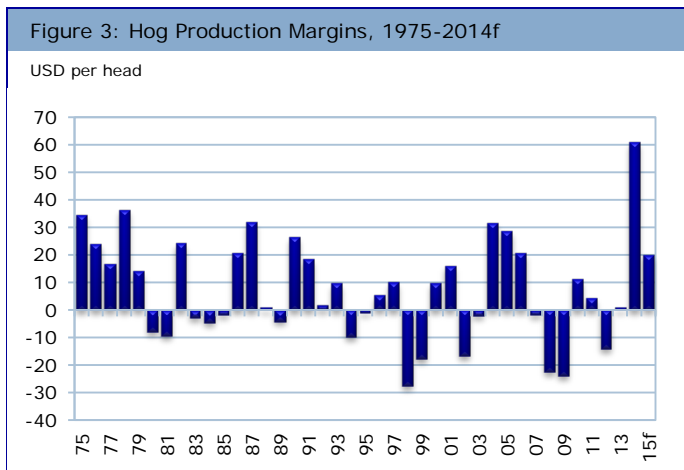
2014 Forecast	2013 Hog Slaughter	Shortfall from PEDv		Increase from Producers w/o PEDv		2014 Hog Slaughter		Increased Hog Weights (dressed)	Pork Production, M lbs		
		Hogs	Percent Change	Hogs	Percent Change	Hogs	Percent Change		2013	2014	Percent Change
January	9,960,300	-284,637	-3%	99,603	1.0%	9,775,266	-1.9%	2.8%	2,066	2,083	0.8%
February	8,594,400	-318,023	-4%	85,944	1.0%	8,362,321	-2.7%	3.0%	1,779	1,783	0.2%
March	9,318,800	-448,876	-5%	93,188	1.0%	8,963,112	-3.8%	3.0%	1,933	1,915	-0.9%
April	9,362,400	-456,882	-5%	140,436	1.5%	9,045,954	-3.4%	3.0%	1,942	1,932	-0.5%
May	9,215,200	-764,309	-8%	138,228	1.5%	8,589,119	-6.8%	3.0%	1,900	1,824	-4.0%
June	8,200,100	-895,223	-11%	123,002	1.5%	7,427,879	-9.4%	3.0%	1,677	1,565	-6.7%
July	9,080,100	-1,085,780	-12%	181,602	2.0%	8,175,922	-10.0%	3.0%	1,841	1,707	-7.3%
August	9,557,200	-1,665,034	-17%	191,144	2.0%	8,083,310	-15.4%	3.0%	1,939	1,689	-12.9%
September	9,030,200	-2,441,446	-27%	180,604	2.0%	6,769,358	-25.0%	3.0%	1,844	1,424	-22.8%
October	10,424,100	-2,110,904	-20%	208,482	2.0%	8,521,678	-18.3%	3.0%	2,170	1,827	-15.8%
November	9,647,900	-1,191,138	-12%	192,958	2.0%	8,649,720	-10.3%	3.0%	2,041	1,885	-7.7%
December	9,735,500	-711,856	-7%	194,710	2.0%	9,218,354	-5.3%	3.0%	2,067	2,015	-2.5%
Annual Total	112,126,200	-12,374,109	-11.0%	1,829,901	1.6%	101,581,992	-9.4%	3.0%	23,197	21,649	-6.7%

Source: AASV, Rabobank estimates, 2014

Profitability During PEDv: a Story of Haves and Have-Nots

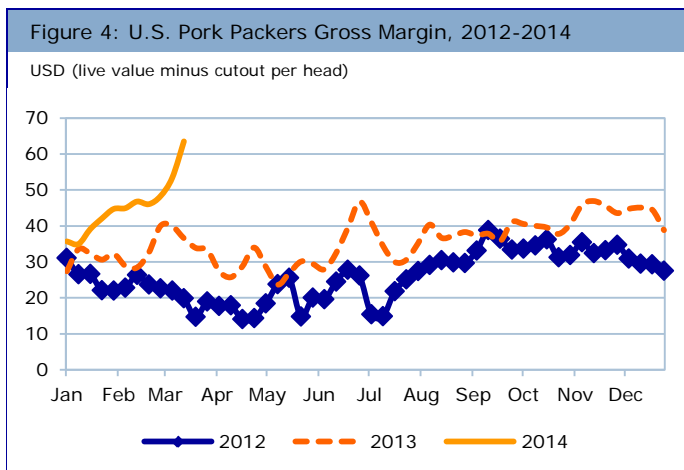
Profit margins in the U.S. pork industry will be more chunky than normal through the supply chain. In summary, 2014 will be a story of “the haves and have-nots” where hog producers who experienced only a mild case of PEDv or not at all could realize margins of over USD 60 per head, the highest calendar year average we have seen in our 40-year record.

Conversely, hog producers who have had difficulty eradicating the virus and keeping it out of their facilities could suffer significant losses as the pain of the high fixed costs of modern hog production compounds prolonged periods of weak productivity.



Source: IA State, Rabobank estimates, 2014

Packers for the year to date have been in a “haves” position as the fear of possible stock-outs have pushed pork cutout prices up far faster than hog prices. The gross margin for packers (live value minus cutout) reached USD 63 per head, up from USD 37 this time last year and USD 35 at the beginning of 2014. Profitability is likely to wane in the spring and summer as hog prices continue to climb, testing pork demand, and hog shortages cause packers to idle plants Saturdays and some Fridays as already suggested.

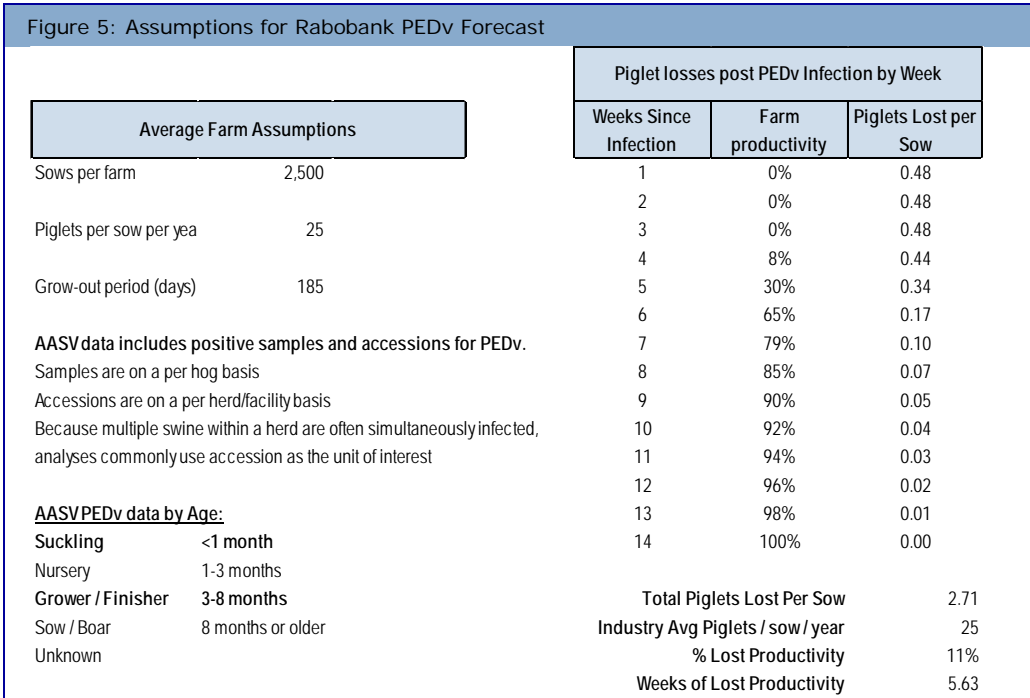


Source: LMIC, 2014

While profitability is quite incongruent along the U.S. pork supply chain, the real winner in the PEDv situation will be the U.S. chicken industry. The USDA forecasts U.S. beef production to decline by nearly 6% in 2014 due to weak profitability in recent years which, when coupled with our estimate of 6% to 7% less pork production, implies an exceptional opportunity for the U.S. chicken industry as the protein of last resort. U.S. chicken production would have to rise by 8% to 9% to offset the shortfall from beef and pork, but a limited breeder flock and continued high demand for fertilized eggs from Mexico will keep supply growth constrained. As a result, we expect chicken prices and margins climb this spring and summer yielding a very favorable year for the U.S. chicken industry.

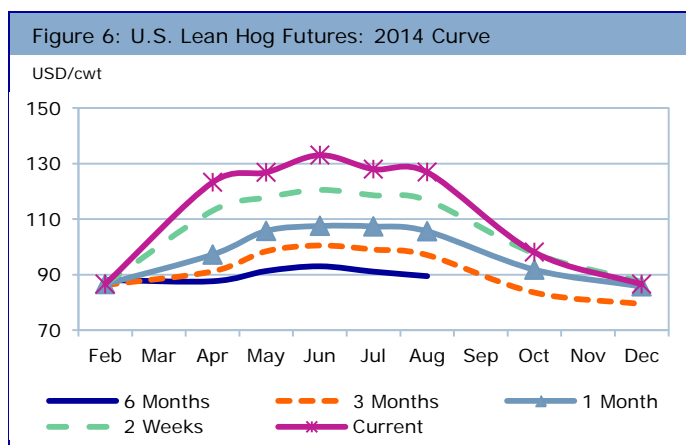
Methodology for PEDv Forecast

We have based on our analysis on positive PEDv outbreaks or cases at the suckling and sow/boar level as provided by the American Association of Swine Veterinarians (AASV). With the highest level of mortality taking place in pre-weaned piglets, we have not included PEDv cases at the nursery or grower/finisher level, which include pigs older than one month. For each outbreak we assume each farm has 2,500 sows on average, each sow producing 25 piglets per year. Accession data provided by the AASV does not differentiate between large and small facilities, which would undoubtedly shift the timing and magnitude of the market impact.



Source: AASV, Rabobank estimates, 2014

The variable with the widest range in the analysis is the amount of time it takes for a farm to return to full productivity following an outbreak of PEDv. There are cases where farms have been able to eradicate the virus within a month while others have taken more than six months. In our analysis, we assume that each farm has zero productivity in the three weeks following the outbreak after which productivity slowly improves as more sows develop immunity to the virus, with the farm reaching pre-outbreak levels of productivity after fourteen weeks. During the first weeks following the outbreak, some litters could have close to 100% mortality but this improves as more sows become immune to the virus. This immunity is then passed on to future litters. Over the course of the 14-week period, each farm would realize 2.7 piglets of lost production per sow or 11% of annual average productivity.



Source: Bloomberg, 2014

PEDv Has Changed the Sentiment in Mexican Pork Industry

After first showing up in the U.S. last April, PEDv made its way to Mexico at the end of the second quarter of 2013. Information on the spread of the virus through Mexico has been quite limited, but with anecdotal information we estimate that to date nearly 30% of the Mexican sow herd has been exposed. If we assume that the virus will continue to expand in Mexico as in the U.S., we estimate a decline in hog slaughter of 7.5% in 2014 and another 6% in 2015 as a result. The lower slaughter weights of around 2.5% we have seen in 2014 thus far are likely to continue implying a 9.7% drop in 2014 pork production. Given the

dynamics of PEDv and the biological cycle of hogs, we expect slaughter rates to diminish mostly during Q4 of 2014 and Q1 of 2015.

In 2014, Mexican meat production is expected at 1.146 million tonnes, down from 1.270 million tonnes in 2013. That is the lowest since 2006. Given current conditions and assumption, in 2015, production is expected at 1.125 million tonnes.

PEDv has changed the sentiment of the Mexican industry. During the second quarter of 2013, the majority of Mexican hog producers began moving toward positive margins as hog prices strengthened and feed costs declined. At that time, prospects for 2014 were positive, supported by high hog and pork meat prices, lower feeder costs and stable pork consumption. However, this sentiment vanished as an increasing number of hog farms in northern and central Mexico were hit by PEDv. At the end of last year, there were farms diagnosed with the PEDv in the following states: Aguascalientes, Colima, DF, Guanajuato, Jalisco, State of Mexico, Michoacán, Morelos, Nuevo León, Puebla, Sinaloa, Sonora and Veracruz.

Meat imports are expected to be 933,000 tonnes, up from 780,000 tonnes in 2013, while exports are expected to decline due to contracted production. Exports are anticipated to decline marginally as we believe meat exporters will try to keep supplying their customers. For 2014, exports are anticipated at 100,000 tonnes, down from 110,000 tonnes a year ago.

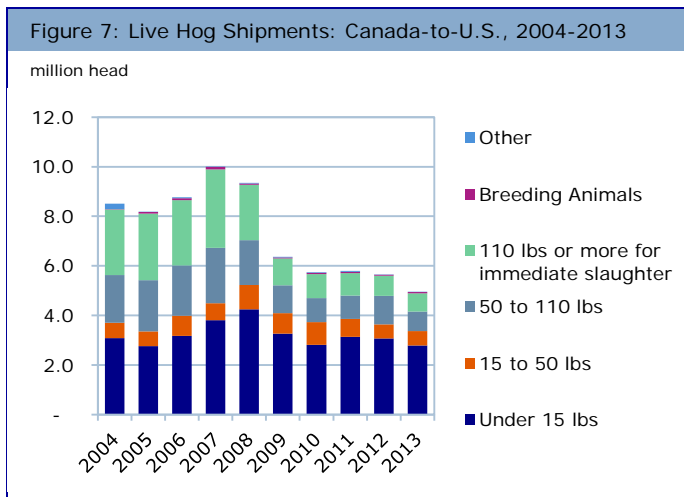
As a result of the hog and pork contraction, we expect hog and pork prices to reach record levels in 2014 and remain strong through 2015. Pork per capita consumption is expected to decline to 16.3 kilograms, down from 16.6 kilograms in 2013. In 2015, we expect per capita consumption at 16.2 kilograms.

PEDv in Canada in Early Stages

In January of this year, Canada confirmed its first case of PEDv in Ontario, more than nine months after the U.S. Ontario has been the epicenter of the PEDv outbreak in Canada with 29 cases reported through the first week of March. Outside of Ontario, the provinces of Manitoba, Quebec and Prince Edward Island have all reported one case of PEDv each. While the Canadian pork industry promptly responded to the first outbreaks of PEDv, if the virus spreads through Canada at a pace similar to what we have seen in the U.S., it will imply a significant shortfall of hogs in 2015. The spread of the virus could be slower, however, as summer approaches, making containment of the virus less problematic.

Soon after the first positive cases of PEDv, the entire Canadian pork supply chain ramped up biosecurity policies to contain the virus and prevent a scenario similar to the U.S. A major source of concern for Canadian producers is the cross-border movement of hogs to the U.S. With hog trailers being a key culprit in the spread of PEDv throughout the U.S., Canada has instituted strict biosecurity policies requiring all trucks from the U.S. that may have come into contact with farms contaminated with PEDv to be thoroughly washed before crossing the border into Canada. While this has kept the virus mostly out of Manitoba for the time being, the risk is still present since PEDv seems to find a way through even most diligent biosecurity measures.

The U.S. would have looked to Canada in the past to help backfill vacant barns and processing capacity. However, since the expansion of Country of Origin Labeling (COOL) requirements first instituted in 2008 and the dramatic strengthening of the Canadian dollar, live hog shipments to the U.S. have declined by half of what they were in 2007 when Canada shipped about 10 million hogs to the U.S. (about one-third feeder pigs, one-third ready-to-be processed and one-third somewhere in-between). COOL regulations, intended to provide U.S. consumers with more information on the origins of their food, has actually imposed a negative bias against meat from Canada and Mexico.



Source: USDA, 2014

As PEDv has spread through the U.S. this winter and feeder pig prices have spiked, Canadian producers have been incentivized to increase shipments of feeders into the U.S. for grow-out; however, shipments have actually declined. In the January trade data, shipments of feeder pigs declined by 8% on last year and total live pig shipments declined by 17%. This may indicate that even with the outsized financial incentive, the hurdle of COOL regulations may prohibit the type of response we would have expected in years past.

What is PEDv?

The outbreak of PEDv has spread rapidly through the U.S. pork industry after being first confirmed in April of 2013. PEDv is a corona virus that causes severe diarrhea and vomiting in pigs of all ages but is most fatal to pre-weaned pigs (less than 3 weeks of age) where mortality can be as high as 100%. Producers are able to develop immunity to the virus in sows through vaccination and back-feeding, which is then passed on to future litters. Productivity following the outbreak of the virus is near zero for a number of weeks but then rebounds as more sows develop immunity to the virus. On average, we estimate it takes 14 weeks for a farm to rebound to pre-outbreak levels with three weeks of zero production. Assuming U.S. average productivity of 25 piglets per sow per year, we estimate the average farm loses 2.7 piglets per sow of annual production following an outbreak of PEDv.

While PEDv has severe ramifications to U.S. hog producers, it does not affect meat quality and food safety. This can have both positive and negative consequences. First, pork consumption is not impacted by the virus itself, which incentivizes producers to rebuild after pork production declines. Second, since the virus is an animal welfare issue and does not affect human beings, producers are not required to notify the Department of Agriculture or any other agency, as is required for many other animal diseases. This reduces the quantity and type of information the industry publicizes, making forecasting the impact of outbreaks of PEDv more challenging.

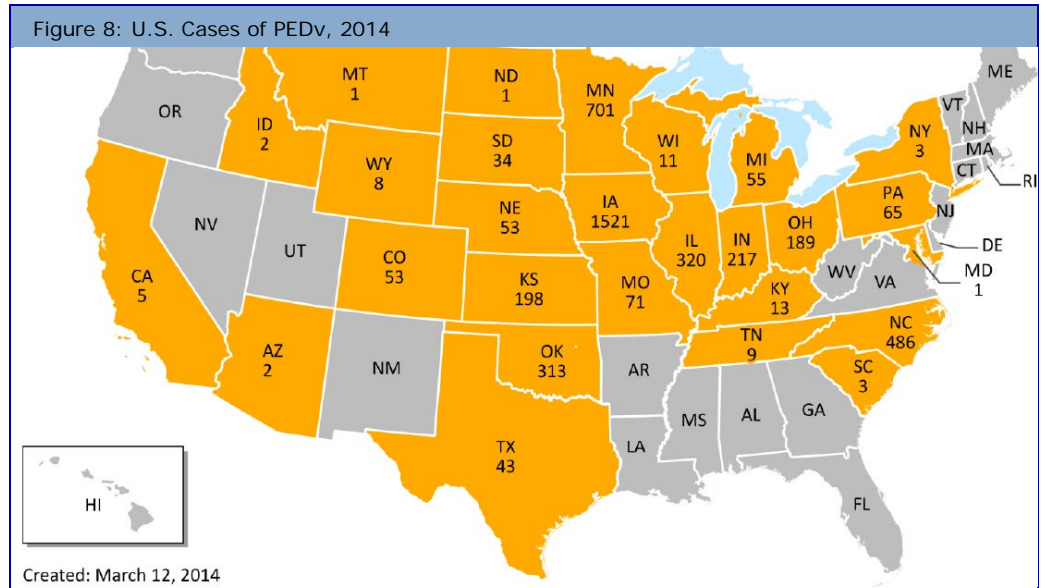
The AASV has worked with many of the U.S.' major pork industry organizations and the USDA to compile as much information as possible. Each week, the AASV releases information on instances of samples and outbreaks that test positive for the virus. Accessions are regarded as farm level cases that have tested positive for the virus, on a state and age class basis. The age classes are broken down into suckling (less than one month), nursery (1 to 3 months), grower/finisher (3 to 8 months) and sow/boar (8 months plus). Since mortality rates from PEDv are highest in newborn pigs, our analysis focuses on accessions at suckling and sow/boar levels.

The Path of PEDv Through the U.S. Hog Herd

The specific origin of PEDv in the U.S. has not been definitively identified but strains of PEDv in the U.S. have indicated a close relationship with PEDv strains in China. What is clear is that once the virus makes it into a region, it can spread quite easily and rapidly throughout an entire hog population. The most common avenue is via livestock and farm equipment

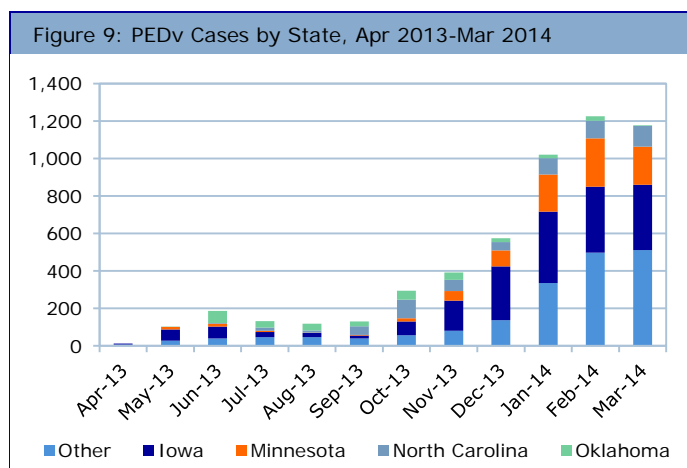
that comes into contact with PEDv-positive hogs or with their feces. Studies have shown that the virus can survive on contaminated trailers at room temperature for up to a week and even on washed trailers if surfaces are not treated to temperatures above 160 degrees. This has made diligent biosecurity practices even more important in preventing the spread of the virus. Since the proper washing and drying of a truck and trailer that have carried infected hogs requires a few hours and hundreds of dollars of expense, sustaining commitment is a costly proposition.

In addition, freezing temperatures actually improve the livability of the virus allowing it to effectively hibernate. In fact, the virus can survive through multiple freeze/thaw cycles and still remain a threat. This factor is the main culprit in the rapid escalation of PEDv cases (outbreaks) in the last three months. Conversely, this is also the reason we expect the pace of PEDv cases to slow as summer approaches.



Source: AASV, 2014

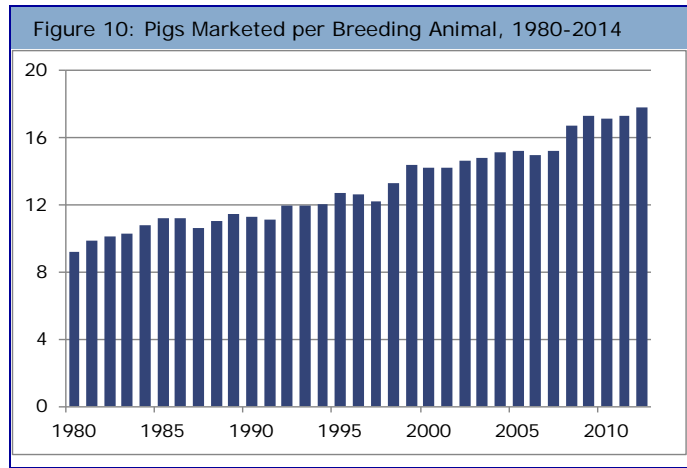
The first cases of PEDv in May and June of last year were primarily focused in Iowa and Oklahoma but soon spread to North Carolina by early September. The weekly rate of outbreaks was relatively steady from May through August but started to climb as temperatures cooled in the Fall from 30 per week in August to 85 at the end of October and to over 300 per week in February. The most recent major outbreaks have been in Illinois and Minnesota where cases of PEDv had been relatively few until November of 2013.



Source: AASV, 2014

Lessons from PRRS

Porcine reproductive and respiratory syndrome (PRRS) is a virus that has been in the U.S. pork industry since the late 1980s. It initially hurt productivity but over time the U.S. pork industry has been able to minimize its impact, allowing pork production to continue to grow. PRRS is a relevant example of the way the U.S. pork industry has improved biosecurity practices to manage disease outbreaks in the past.



Source: USDA, 2014

PRRS is a virus that attacks the defense mechanism in the pig's lungs, which, in turn, makes the animal susceptible to bacterial outbreaks and pneumonia. Over the last 25 years, significant research on the virus has been completed to learn how to better combat the virus and eradicate it from a population affected by PRRS.

Relative to PEDv, the spread of PRRS through the U.S. in the late 1980s was much slower, making it more of a moving target and the impact on pork production much more drawn out. With PEDv having affected 60% of the U.S. sow herd in less than a year by our estimation, we expect the U.S. pork industry to rebound more quickly from the outbreak of PEDv than it was able to do from the spread of PRRS.