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Soy isoflavones may be beneficial to pigs facing health challenges

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IN today's swine industry, nutrition is a powerful way to provide a solid foundation for growing pigs that may face health challenges.

The herd nutritionist formulates diets that ensure that the nutrient requirements of individual animals are met, keeping in mind the growing evidence that the source of those nutrients can directly affect health and productivity. This is especially true when those animals face health challenges, such as infectious diseases.

In 2010, Boyd and others conducted a commercial study comparing graded dietary lysine originating from soybean meal or from crystalline lysine and monitored growth performance and body protein accretion in growing pigs. Unexpectedly, the pigs became naturally infected with porcine reproductive and respiratory syndrome virus (PRRSV). The researchers observed that pigs receiving soybean meal maintained better growth performance than those receiving crystalline lysine at each treatment level.

A 2015 repeat of the accidental experiment yielded similar results: Infected pigs receiving a larger proportion of soybean meal in the diet showed better growth performance and reduced systemic virus circulation (Rochell et al., 2015).

Why? One possibility is isoflavones. Soy isoflavones are naturally occurring compounds with a wide variety of biological activities, including estrogenic, anti-inflammatory and anti-oxidative properties that could be beneficial in disease-challenged pigs.

Previous work has shown that isoflavones reduce viral replication and infectivity, decrease expression of pro-oxidative cellular signaling pathways and influence the production of both pro- and anti-inflammatory cytokines utilized by the immune system (Smith and Dilger, 2018).

While most of these biological actions were demonstrated in the laboratory, not the field, some experiments performed by Dr. Ryan Dilger's laboratory at the University of Illinois at Urbana-Champaign demonstrated that dietary soy isoflavones may provide health benefits in growing pigs facing a respiratory disease challenge.

First, Dilger recreated Boyd's experiment using a controlled PRRSV infection model. Weaned pigs were fed diets differing in soybean meal concentration (17.5% versus 29.0%), which also varied their isoflavone content, and were inoculated with live PRRSV and observed for 14 days. During the post-inoculation period, pigs receiving higher levels of soybean meal exhibited improved average daily gain and decreased serum viral concentrations, indicating a less severe infection, but the reason for the benefit was not identified (Rochell et al., 2015).

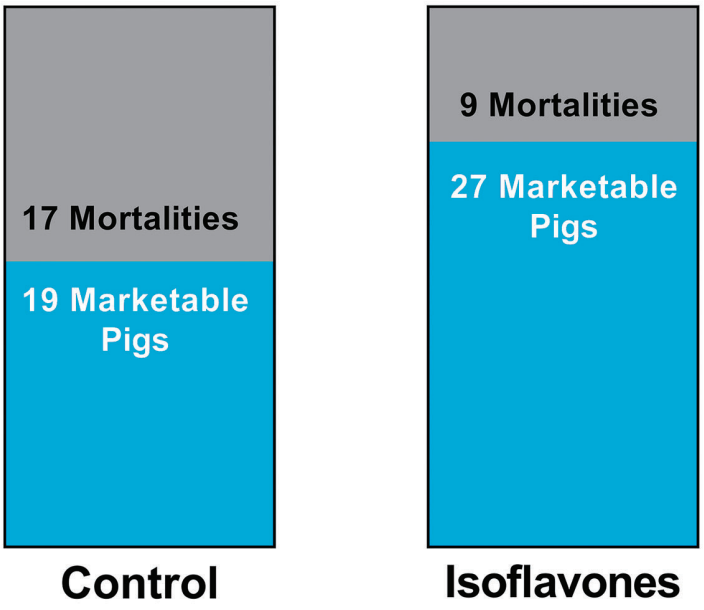
A series of experiments followed. First, 60 weaned pigs were fed diets either devoid of isoflavones (using soy protein concentrate) or containing supplemental isoflavones at levels typically found in commercial grow/finish swine diets. Throughout the 14-day post-PRRSV inoculation period, the pigs receiving dietary isoflavones did not demonstrate improved growth performance, as seen previously, but did exhibit a more robust immune response to PRRSV, including reduced infection-related band neutrophilia (i.e., mobilization of immature neutrophils, an indicator of a severe infection) and improved cytotoxic-to-helper T-cell ratios (Smith et al., 2019).

Next, researchers investigated how isoflavones influenced the long-term response and recovery from PRRSV in 96 growing/finishing pigs. The same model was used, but pigs were observed from weaning to market weight. In this case, the pigs receiving dietary isoflavones demonstrated inconsistent differences in growth performance but increased neutrophil cell counts, increased relative proportions of memory T-cells and decreased time to full PRRSV antigen clearance from oral fluids, again indicating a more robust immune response.

The most notable finding, however, was that PRRSV-infected pigs consuming isoflavones exhibited approximately 50% less mortality than infected pigs not receiving isoflavones: (9 of 36 versus 17 of 36 pigs, respectively (Figure), even though both diets delivered exactly the same concentrations of amino acids (Smith et al., 2020).

Even when considering the small scale of this experiment, a 50% reduction in

Recovery from PRRSV in growing/finishing pigs fed isoflavones



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mortality has significant economic implications. The average carcass value for September 2018, the month these pigs were slaughtered, was $74.34/cwt., and the average live ending weight of infected pigs that did not receive isoflavones was 268 lb. With an average hot carcass weight of 210 lb., the value of each carcass was $156 (Bryan et al., 2020), and the unrealized revenue from an additional eight pigs lost was $1,248.

When the premature loss of an animal from production is so significant, the effect of isoflavones on mortality is of considerable interest.

While the beneficial effects of isoflavones are clear, the biological mechanism that causes these effects is less clear. A follow-up experiment collected fecal samples from pigs in the aforementioned long-term PRRSV infection model study. The microbiome composition of these samples was examined to look for alterations in the colonic bacterial profiles. While PRRSV infection resulted in significant changes to the host microbiota, dietary isoflavones at industry-standard levels alone did not (Smith et al., 2020).

In conclusion, while it is clear that dietary isoflavones from soy improve outcomes for pigs facing health challenges, more information is needed to determine the specific biological mechanism(s) of action and how farmers can use dietary isoflavones in the diets of growing pigs to increase their health and productivity.

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