



Established For the Members, By the Members Working Together, the Possibilities are Endless!

Iron Shots for Piglets

By Debra Allen

There have been many studies done on the impact of iron supplementation on piglets in confinement. However, many people believe that piglets raised with access to soil, unlike confinement operations, can consume enough dirt to satisfy their iron needs.

I have spent months asking questions of soil scientists, Purdue University, and veterinarians about this subject, and I am writing this article to educate kunekune pig owners about why iron supplementation is something that enhances piglet health and their ability to thrive.

Background

Man has known that iron plays an important role in health and disease for some considerable time (Loosli, 1978). In fact, Bryan (1931) stated that documented therapeutic uses of iron date back as far as 1500 BC. However, it was only in Boussingault (1872) that iron was recognized as a vital animal nutrient. Braasch (1891) was credited with being the first to describe anemia in nursing pigs that were being reared in confinement in Germany. However, he did not equate the anemia with iron deficiency but instead with management. The first to link anemia in nursing pigs with iron deficiency were McGowan and Chrichton (1924). The first to realize this in the United States were Hart et al. (1929), who showed that anemia could be prevented by orally supplementing with ferrous or ferric sulfate. This was after Doyle et al. (1927) had unsuccessfully proposed that baby pig anemia was associated with reduced exposure to sunlight.

Research into the bioavailability of iron in feedstuffs is limited because anemia is of little significance in other farm species. Iron deficiency is primarily associated with nursing pigs being reared in confinement or animals dependent on milk-based diets. This limits, for practical purposes, the importance of anemia to the baby or nursing pigs. Several factors compound this susceptibility to anemia: deficient iron stores at birth, particularly low levels of iron in sow's milk, and very rapid growth rates compared to other species (Underwood, 1981). Piglets normally quadruple their birth weight by the time they are three-weeks-of age. In addition, as mentioned earlier, sow's milk is a very poor source of iron, containing only 1 to 3 parts per million (Venn et al., 1947).

The newborn pig contains approximately 50 milligrams of iron at birth, mainly in the form of hemoglobin (Venn et al., 1947). The neonatal pig has been determined to have a requirement of 7 to 16 milligrams of iron per day for average growth (Venn et al., 1947). Another way this can be expressed is a need for 21 milligrams of iron per kilogram of weight gain (Braude et al., 1962). Due to the minimal concentration of iron in sow's milk (1 milligram per liter), neonatal pigs reared in confinement require supplemental iron to overcome the susceptibility to anemia (Brady et al., 1978). Pigs not supplemented with iron while dependent on sow's milk quickly develop iron-deficient anemia (Venn et al., 1947). Maximum hemoglobin levels were produced in neonates at 14 days of age when supplemented with either 100 or 150 milligrams of iron dextran at birth (Wahlstrom & Juhl, 1960). The maximum growth rate was acquired through supplementation of 100 milligrams in injectable iron dextran to pigs weaned at three weeks of age (Zimmerman et al., 1959).

I hear the chorus! "But these are studies in CAFO or confinement operations! It is not comparable to kunekune pigs who have access to the outside soil."

Recent studies

There have been two studies recently (one on an outdoor pig farm in England (1800 sows) and a 2019 study on an organic pig farm in Europe where sows have outdoor access. Both show that iron supplementation significantly improves weaning weight and blood parameters (measurements of anemia). The 2019 study suggests that 2-3 doses have even greater benefits.

Summary of 2010 study: (A total of 9897 piglets were born alive in litters to be iron treated, and 9365 piglets were untreated.)

"The improvement in weaning weight is mediated through improved blood parameters in iron-treated piglets. Improved weaning weight is strongly

correlated with post-weaning performance, and on this unit, iron treatment was estimated to provide an ROI (return on investment) in excess of 10:1."

Summary of 2019 study: (288 piglets)

"To summarize our observations, a single iron injection was insufficient to ensure adequate iron supply and unimpaired growth in suckling piglets on our experimental farm. Considering that a single iron injection is a usual practice on organic pig farms, an inadequate iron supply for suckling piglets is a problem that requires attention. Based on the differences in iron status and growth between the piglets receiving iron once or two, or three times, additional iron supplementation seems highly recommendable. One option is a second (or third) injection, as in our study."

There are a couple of other considerations. One is weaning times. Some studies mentioned that confinement pigs are often weaned before four weeks. In addition, these piglets consume iron in their feed so that they can maintain their iron levels now. Kunekunes and other heritage breeds often only wean piglets at 6-7 weeks of age. This delay in conversion to pig feed only contributes to prolonged anemia in this breed.

Iron in Soil. Is It Enough?

As a pharmacist, I am acutely aware of the many types of iron found and know very few are water soluble and bioavailable to humans or animals. The vast majority of iron in nature is bio-unavailable or insoluble salt forms. Plants can absorb this and convert it into forms mammals can use. I've seen all sorts of things on these pig Facebook pages: use rusty pans (rust is the most insoluble form of iron), born on dirt, they will get it (wrong, very little bioavailable iron in the dirt, plus as very young piglets they do not eat enough even to count), etc.

I continue to see statements about putting dirt in farrowing quarters, "they get enough dirt just being outside," etc.

I wanted to know more about the truth about iron content in the soil.

So here is what I found out:

1. Iron is the fourth most abundant element on earth, mostly in the form of ferromagnesium silicates.
2. Soils typically contain 1-5% iron or 20,000-100,000 lb/acre in the plow layer.

3. Most of the iron found in soil is in the form of iron oxides or hydroxides or in mineral form, all of which are not readily available for plant use. (Or animal)
4. The iron oxides and hydroxides in soil are responsible for soil's yellowish and reddish colors.

However, I wanted to know how much usable or water-soluble iron is present compared to iron in forms where ingestion by piglets would have little to no effect.

Here are two charts that show the number of different types of iron in soil samples:

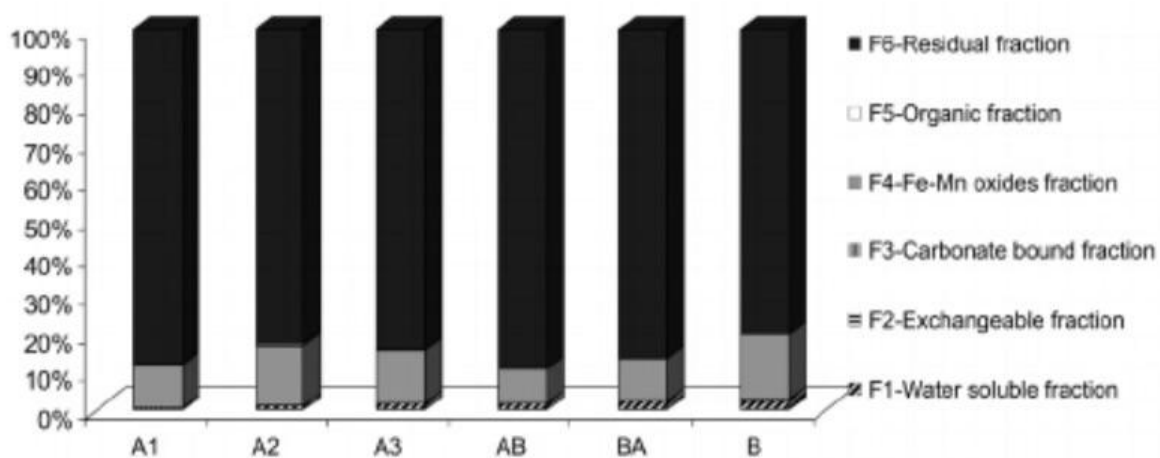


Figure 3. Percentage distribution of iron in soil chemical fractions.

Table 4. Content of iron ($\text{mg kg}^{-1} \pm \text{SD}^{\text{a}}$) extracted in each fraction of soil samples

Fraction	Soil profile					
	A1	A2	A3	AB	BA	B
Water soluble	15.08 $\pm$ 0.64	112.37 $\pm$ 1.19	170.79 $\pm$ 1.42	292.98 $\pm$ 69.32	272.37 $\pm$ 47.55	192.31 $\pm$ 0.93
Exchangeable	2.38 $\pm$ 0.15	< 0.12*	0.42 $\pm$ 0.10	2.89 $\pm$ 0.11	2.68 $\pm$ 0.02	2.10 $\pm$ 0.07
Carbonate	31.68 $\pm$ 0.70	21.65 $\pm$ 0.72	18.19 $\pm$ 0.46	10.17 $\pm$ 0.21	8.02 $\pm$ 0.65	4.86 $\pm$ 0.39
Fe-Mn oxide	1265.39 $\pm$ 227.55	1818.12 $\pm$ 345.53	1497.66 $\pm$ 131.49	1749.72 $\pm$ 8.19	1599.41 $\pm$ 32.23	1376.43 $\pm$ 57.17
Organic	34.12 $\pm$ 2.47	46.03 $\pm$ 13.08	21.25 $\pm$ 0.64	19.07 $\pm$ 1.03	5.79 $\pm$ 0.25	2.68 $\pm$ 0.06
Residual	9847.76 $\pm$ 671.20	9507.49 $\pm$ 968.56	9241.05 $\pm$ 662.06	17391.25 $\pm$ 2444.06	12123.86 $\pm$ 1458.76	6384.52 $\pm$ 815.11
Sum of all fractions	11196.42	11505.66	10949.37	19466.08	14012.14	7962.89
Non-residual / (%)	12.05	17.37	15.60	10.66	13.48	19.82
Residual / (%)	87.95	82.63	84.40	89.34	86.52	80.18

^aSD = standard deviation (n = 3); *LOD (limit of detection) / (mg L^{-1}).

You might have to enlarge the second to read it, but it is very important to really understand what it is saying. From the six types of soil samples, the water-soluble iron content varies from 15.08 to 292.98. This measurement is in mg of iron/kg of soil. In other words, a piglet must consume a kilogram of soil to obtain those amounts of iron in mg. A kilogram is 2.2 pounds! There is no way a three-day-old piglet consumes any appreciable amount of dirt. Even at the highest level, a piglet would have to consume 0.73 lb of dirt to receive approximately 100 mg of iron, which is what most people suggest as a dose of iron dextran at three days of age.

Anemia and the signs

The first signs of iron-deficient anemia are often roughness of haircoat and loss of pigmentation or color of mucous membranes. The skin can become wrinkled, and the pigs emit a general listlessness characterized by drooping of the head and ears combined with a loss of appetite. Iron-deficient anemia was shown to reduce weight gain in affected pigs as early as the 1930s (Moe et al., 1935). In severe cases, pigs may be characterized or identified by labored breathing, increased heart and respiratory rates, and even systolic murmurs due to reduced blood viscosity. **The largest, fastest-growing pigs are susceptible to sudden death from anoxia. (I have seen Facebook posts about the biggest piglet dying unexpectedly and wondered)** Affected pigs have a higher prevalence of subcutaneous edema in the neck, shoulder and limb areas (Conrad et al., 1980). Osborne and Davis (1968) noted that anemic pigs showed higher susceptibility to infectious diseases. This coincides with later research by Nalder et al. (1972), which showed that dietary iron level was directly related to antibody production in weanling rats. **Furthermore, Luke and Gordon (1950) showed evidence that anemic pigs were more susceptible to pneumonia, influenza, and disorders of the GI tract.**

I know this article reads like a college research paper, and I apologize to some extent, but there comes the point when facts must prevail. Therefore, I included copious sources of information.

I still hear the chorus: "how about wild pigs?". My response is, first, they have high morbidity and mortality as young animals and wild pigs wean early and start consuming protein sources, which have the highest levels of usable iron. Worms, grubs, carrion, frogs, etc., have appreciably more iron than soil. "I have never given iron, and my pigs are fine." There is a difference between survival and an animal thriving. Unless you can verify that you've done blood tests to prove your animals were not anemic at any time before weaning, then you can't prove they were "fine." And anyone who has had a piglet develop pneumonia may compare the cost of an iron shot to the cost of treatment of a sick piglet. In six years, I have never had a piglet develop pneumonia. Knock on wood.

Yes, it could be because we also have a vaccination protocol, which protects piglets from some forms of pneumonia. But I give iron shots their due in part of my piglet protocol.

Ultimately, everyone makes their own decisions on how to raise their herds. I have given iron shots on Day 3 since I started raising kunekunes, based on a recommendation from my mentor. I can personally vouch that there is a marked increase in activity levels of the piglets the day after the shot. Every single litter. In 6 years. I've never had a toxicity reaction using a dose of 100 mg, nor had an injection site reaction or infection. I use the Z-track injection method to prevent leakage of the injection back out of the needle track. This is when you pull the skin to the side with a finger, make the injection, and release the skin before pulling out the needle. The skin moves over to cover the hole. Google it. I also use an alcohol wipe to clean the piglet's neck before injection and use a new sterile needle for each animal.

The low cost and low risk of an iron injection and the high cost of poor outcomes reinforce my decision to continue giving my piglets iron. It is inexpensive insurance to help the piglets thrive.