

DH Volkmann (2011) Bull management for optimal reproductive performance.

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“As yet unpublished, but well documented observations on several cases dealt with by the author have revealed that several pyrethroids (very commonly used insecticides) can have devastating effects on semen quality of bulls and rams. Aerial sprays as well as pour-on formulations have been implicated in the development of severe secondary sperm defects and very poor sperm motility in exposed breeding animals. Several very informative research papers published in recent years have reported that many pyrethroids act as endocrine disruptors (Kim et al., 2005; Perry et al., 2007; Sun et al., 2007; Wang et al., 2007; Zhang et al., 2008). In laboratory animals the mechanism of action has been shown to be the inhibition of the enzyme responsible for the conversion of testosterone to dihydrotestosterone, an important driver hormone for accessory sex gland function (in bulls these glands include the seminal vesicles, ampulli, bulbo-urethral glands and the prostate), as well as the epididymedes. While we cannot tell which of the accessory sex organs are affected, the observation of a massive increase in secondary sperm abnormalities fits well with disruption of either epididymal or seminal vesicular functions. The toxic effects have been observed within a few days after the first exposure of bulls and rams to the insecticides and lasted for as long as the pyrethroid exposure continued. After the last exposure the sperm quality and motility of the vast majority of bulls and rams recovered to normal, but only after two to four weeks. The author advises that all pyrethroid treatment be discontinued or avoided no later than 4 weeks before the onset of the breeding season. It is noteworthy that many clients routinely bring their bulls to their veterinarians for a breeding soundness examination 2-4 weeks before the beginning of a breeding season and request that “if they pass, they must get their shots, fly tags and they must be poured”. In accordance with the above-mentioned concerns, no life virus vaccines or any type of pyrethroid insecticides should be administered this late before the onset of a breeding season. “

(End quote)

Here is a brief description of the cases I referred to above:

Case 1: The barns of a bull stud standing some 50 bulls were sprayed against flies by a commercial contractor. Spraying happened without due notice to the stud operator and for that reason feed and water troughs were not emptied/covered and the animals were not moved from their stalls at the time of spraying. The active ingredient of the spray was bifenthrin, a synthetic derivative of native pyrethrin (with much longer residual activity than the native compound). Within days of the application of the insecticide ejaculate volume, sperm motility and the freezability of semen declined sharply. Sentinel animals were used to demonstrate the presence of bifenthrin in semen, blood and urine for about 10 days. Semen quality returned to normal about 4 weeks after exposure. Environmental heat, technician errors, inappropriate preparation of semen extenders and contamination of glass ware were ruled out as causes of the sharp increase in especially distal midpiece reflexes. We also showed that direct exposure of sperm to bifenthrin did not affect motility or morphology at all.

Case 2: A healthy bull was admitted to an academic hospital for semen freezing. The first ejaculate was collected on the day of arrival and was frozen successfully. The second and third ejaculates, collected 2 and 4 days after admission, contained over 30 % distal midpiece reflexes. Ejaculate volume could not be measured as semen was collected by electro-ejaculation. This incident happened about 7 years after Case 1. It took several days before I recognized that this may also have been caused by pyrethrin. Our barns are sprayed by an automated overhead spray system that discharges native pyrethrin four times daily to control flies during the warm months of the year. There is a spray nozzle above each large animal stall, i.e. the feed and water, as well as the animal will be contaminated.

Prompted by my suspicion, we borrowed 4 healthy rams. Two were housed in a stall exposed to the aerial spray and two were in a stall with no overhead nozzle. Within one day of exposure we saw an obvious decline in the % progressively motile sperm and an increase in sperm with midpiece reflexes and detached heads in the exposed animals. The unexposed animals continued to produce normal semen. We then used a syringe

to “pour” the aerial spray compound directly onto the skin of the two control rams and saw their semen quality deteriorate as well. All rams had normal semen 6 weeks after their last exposures to pyrethrin. To date, we have not analyzed any urine, semen or serum for the presence of the pyrethrin.

Case 3: In preparation for his annual production sale a seed stock breeder called us to perform BSEs on about 50 young bulls (15-24 months old). We stopped the exercise after about 20 bulls, because only 3 of them had acceptable semen quality. When I prompted the client, he told us that he had “poured” his animals against ectoparasites (lice, I believe) two weeks before we did the BSEs. The product contained a pyrethroid. A sample of the bulls were retested almost 4 weeks after they had been exposed, but semen quality was still too poor for the majority to pass the BSE. A sample of the group was then tested a third time almost 8 weeks after the initial exposure and these bulls all had normal semen.

I totally appreciate that these experiences do not constitute controlled studies. The evidence generated in lab animals over the last 10 years or so (some references listed below), however, demonstrates rather convincingly that pyrethroids are potent endocrine disruptors and do cause malfunctioning in DHT dependent organs. Obviously I would have done the controlled studies in bulls, dogs and stallions (and people?) a long time ago if I had the opportunity to have done so. The owner of the bull stud (Case 1) sued the spray company. It took about 8 years for the case to reach “court ready” status, but it was settled out of court earlier this year (the plaintiff was paid compensation for loss of production, all legal fees and cost of experts and consultants, but I do not know the amount involved).

Pyrethroids are everywhere and not all of them are equally potent as endocrine disruptors. It will take a long time and huge resources to test each compound and formulation for its effects on reproductive organ function. Think of fly tags in cattle, collars and topical treatments in dogs, aerial sprays and countless products for use “in house and home”. I currently discourage all clients to use any pyrethroid product on a male animal intended for breeding unless the package insert clearly states that it has

been tested to be safe for use in male animals intended for breeding. I have, however, not seen any such statements for any pyrethroid containing products I looked at.

Some references (there are many more):

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