PCBs in Laying Hens

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Polychlorinated biphenyls (PCBs) are environmental pollutants of industrial origin which exert adverse biological effects in fish, birds and mammals, and produce residue contamination in agricultural products. The very extensive use of PCBs in industry has resulted in the appearance of these compounds in wildlife and in agricultural products. The compounds are persistent and are accumulated in animal tissues.

The recent contamination of poultry in 12 states is just one example of the hazards PCBs create. Many potential problems are still unrealized and not appreciated at this time because of the relatively small amount of research on PCBs in the past.

Accidental feeding of contaminated feed by commercial chicken breeders has resulted in decreased hatchability in some cases. There have been only a few controlled studies on the effects of PCBs on reproduction in chickens.

In controlled studies in our laboratory six different polychlorinated biphenyls, a polychlorinated triphenyl and a polybrominated biphenyl were fed to White Leghorn hens. Changes in eggshell characteristics, reproductive traits and residues in eggs and body fat were followed during a 9 week feeding period and a subsequent 6 week period to measure the clearance rate of PCBs from tissues when hens were fed an uncontaminated feed.

There were no effects of feeding polychlorinated bi- or triphenyls or a polybrominated biphenly on feed consumption, body weight, mortality, egg weight, eggshell thickness or fertility.

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Decreases in egg production occurred after feeding 20 ppm of PCB (Aroclors 1232, 1242, 1248 and 1254) or a polybrominated biphenyl (PBB) manufactured by Michigan Chemical. PBB has just been introduced into the environment as a flame retardant in automobile seats.

The most characteristic defect we found after feeding PCBs to White Leghorn chickens was a failure to hatch. Hatchability dropped to 10% with PCBs containing 42 and 48% chlorine. PCBs containing 32 and 54% chlorine caused hatchability decreases of 50 and 70% respectively. The majority of the hatchability failures occurred during the last two days of incubation. Many of the chicks were able to pip and partially break the shell, but were unable to break the shell completely.

In addition to the hatchability failure, a large number of the embryos suffered teratogenic abnormalities. On gross examination 34% of the dead embryos were abnormal. Subcutaneous edema and edemal cysts were found in half of the abnormal embryos. Other teratogenic feature were small bodies, skinny legs, rotated ankles, short or crossed beaks and cleft palates.

Most of the chicks that hatched appeared normal and no deaths after hatching could be attributed to treatment. However, these chicks did not grow as well as control chicks with 4 week body weight gains significantly less.

The detrimental effects of PCBs on hatchability could be reversed by feeding a diet containing no PCBs. Two weeks after the birds were fed a diet containing no PCBs, hatchability improved, and after 6 weeks on clean feed, hatchability had returned to 83% of the control. Growth of the chicks that hatched from these eggs also improved.