Environmental Assessment of Long-Term Poultry Manure Application: Phase 3

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Introduction
This study is an extension of a 20-year manure management study evaluating the impact of spring manure fertilization on soil health, water quality, and crop yields. Phase 3 of the study began with poultry manure application in fall 2017, with the first year of yield and water quality data collected in 2018, and the final year collected in 2020. This 3-year study was conducted on research plots located at the ISU Ag Engineering/Agronomy Research Farm, Boone, Iowa.

Materials and Methods
Phase 3 was initiated in the fall of 2017 with manure application for the upcoming 2018 growing season and concluded in the fall of 2020. Treatments included fall poultry manure applied at the crop recommended N-application rate of 200 lb/acre (PM), a half application rate of 100 lb/acre (PM0.5), and UAN applied at 200 lb/acre (UAN). Manure was applied in the fall and chisel plow incorporated. Sample collection and analysis included manure characteristics, soil nutrients and health, tile drainage nutrients, and bacteria analysis. Manure was analyzed in bulk before application and at the plot level at the time of application to estimate nutrient application rates. Drainage samples were collected and flow rates manually measured at a minimum of once/week throughout the drainage season at each plot. Finally, soil samples were collected periodically to evaluate nutrient levels.

Results and Discussion
This report summarizes the third and final year of data collection for this project. 2020 was a unique year with drought conditions and a windstorm categorized as a derecho on August 10, damaging crops and requiring an early harvest. Overall, the poultry manure treated plots (PM and PM0.5) had good yields despite the challenging growing season conditions, while the UAN treated plots had an appreciable yield drop compared with previous years (Table 1). The UAN plots were treated with supplemental nutrients in fall 2017, which may have contributed to the higher 2018 yields, and also in the spring of 2020. Drainage NO_x-N concentrations were highest with the PM treatment and lowest with PM0.5 (data not shown). This study provided valuable insight into the impact of fall manure application on nutrient transport as well as the potential benefits of poultry manure on more consistent crop yields with varying weather conditions. Additional research will continue at newly established research plots in 2021.

Acknowledgements

Table 1. Comparison of corn yields for 2018, 2019, and 2020 with the Boone County average yields.

	Corn yields (bu/ac)		
	2018	2019	2020
PM0.5	197.0	174.4	177.5
PM	227.5	211.2	193.6
UAN	224.4	172.8	141.4
Boone[*] County	193.7	194.8	161.6

[*]Source: Ag Decision Maker File A1-14. https://www.extension.iastate.edu/agdm/crops/pdf/a1-14.pdf.