Manure in Nova Scotia's Poultry Industries

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INTRODUCTION

Manure is an often-undervalued resource that is rich in nutrients. The nutritive value of a manure source can vary greatly by animal species, diet, bedding material, housing, management and more. Poultry manure is an excellent source of nitrogen, phosphorus and potassium as well as various micronutrients. However, manure characteristics can be variable between the various poultry sources and may even have surprisingly high levels of particular nutrients. Understanding these variabilities can assist in optimizing on-farm nutrients, minimizing environmental impacts and making economical decisions when it comes to crop fertility needs. Through the On-Farm Climate Action Fund (OFCAF), efficient use of manure is a recognized practice under the nitrogen management beneficial management practice (BMP). This demonstration was funded under the OFCAF program to assist in better understanding nitrogen management associated with poultry manure.

In fall 2025, 17 manure samples were collected, representing the commodities, housing types and bedding materials common to Nova Scotia's poultry industries. The analyses of these samples can be broken down by various factors to suggest the impact of each on the overall nutrient content of the manure. Comparisons are made on a dry matter basis unless otherwise stated. Samples are representative of practices in Nova Scotia's poultry industries but, due to the low sample numbers, are meant as a demonstration of differences only. Extensive replication of sampling would be required to confirm trends between sample types.

More information on the parameters and units found on a typical manure analysis can be found in Perennia's **How to Interpret a Manure Analysis Report factsheet**.

Figure 1. Layer manure in coverall storage. Photo: Heather McLean, Perennia.

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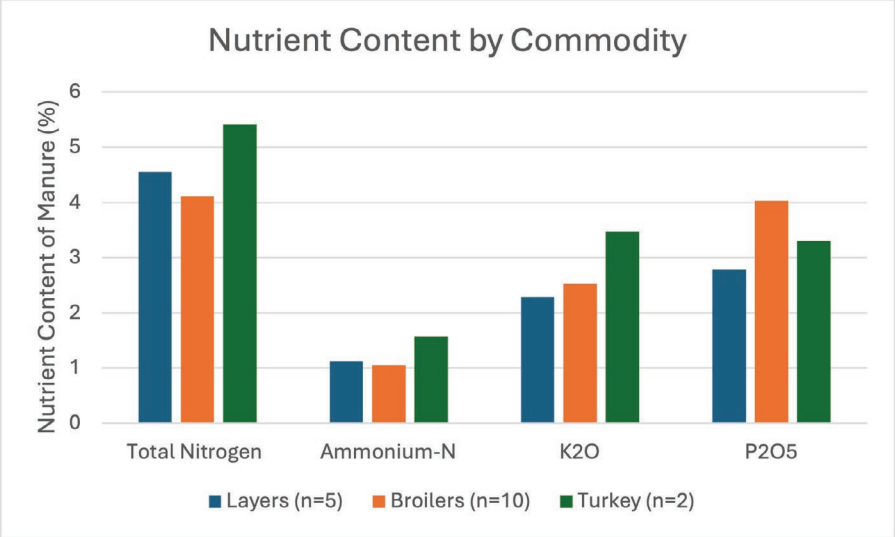
COMMODITY TYPE

Manure analysis results were separated by commodity type – layers, broilers and turkey – and compared on a dry matter basis. Total nitrogen, ammonium-nitrogen (ammonium-N) and potassium were similar for layers and broilers when averaged across samples, while turkey contained slightly higher total nitrogen, ammonium-N and potassium. Phosphorus was variable across the three sample types, with layer manure containing the lowest amount, followed by turkey, and broiler manure having the highest phosphorus content.



Book values suggest that the ammonium-N content in solid layer manure is typically around 46% of the total nitrogen, while broiler manure is around 6% (OMAFA Pub. 611). Based on the samples collected for this demonstration, ammonium-N content was 24% for layers and 23% for broilers, which are both significantly different than the predicted book values. Since ammonium-N is most subject to losses, utilizing book values with a 20% plus difference between predicted and actual values could make a huge difference when calculating nutrients that would be available to the crop and ultimately result in over- or under-application of crop nutrients.

Diet may have an impact on variability in manure nutrient content between commodities. Layer diets would have a lower percentage of protein content than the broilers or turkey, especially in the early weeks of broiler and turkey production, which could impact the manure nitrogen levels. There are also differences in the housing systems between commodities which impact the make-up of the manure and bedding amounts. For example, meat birds would be on bedding in open housing, while layers in housing systems would have no bedding, so output would be almost 100% manure. This would result in a difference in manure content and could influence nutrient concentration. Free run layers and breeders would have much less bedding as compared to the meat birds because of less floor space with bedding and raised slats and nests. There are also differences in how often the manure is cleaned out of the barn since the free run layer system and breeders would accumulate a year's worth of manure/litter, whereas the broiler and turkey systems would be cleaned out after each cycle.

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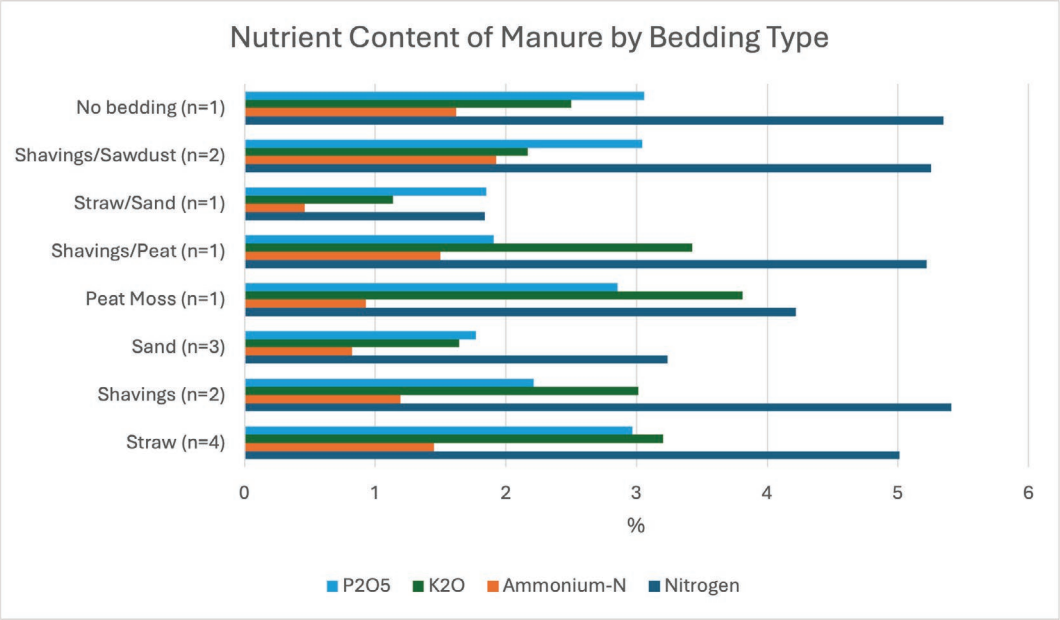
BEDDING

Bedding materials have the potential to significantly impact nutrient retention and later plant nutrient availability from a manure. Bedding materials that are more absorbent will do a better job of holding nutrients, particularly ammonium. Nutrient content varied greatly by bedding type. The straw/sand combination had the lowest overall nutrient content, with particularly low nitrogen in comparison to the other samples. The ammonium-nitrogen content of the straw/sand sample was 0.46%, while all other samples ranged between 0.8–1.9%. Sand is not very absorbent to water, which correlates to the lower values for water soluble nutrients like ammonium-N and potassium. The shavings/sawdust combination had the highest ammonium-N content at 1.92%. The more absorbent bedding materials are able to retain nutrients that could otherwise be lost more quickly to leaching or volatilization. A more absorbent bedding material may result in more nutrient capture that could be beneficial to crops when applied to the field.



While the no-bedding samples would not have had a significant carbon component, other content would include feathers, wasted feed and potentially broken eggs. Interestingly, the calcium content of the no-bedding samples was 6.41% compared to 1.73% on average for other bedding types combined. Layer diets contain significantly higher levels of calcium as compared to broiler and turkey diets and thus excrete more leading to higher calcium being seen in the layer manure. Also, both eggshells and feathers in the manure would be additional sources of calcium, which could add to the higher levels in those samples.

Figure 2. Samples of turkey manure with straw bedding (L) and layer manure with no bedding (R). Photos: Heather McLean, Perennia.

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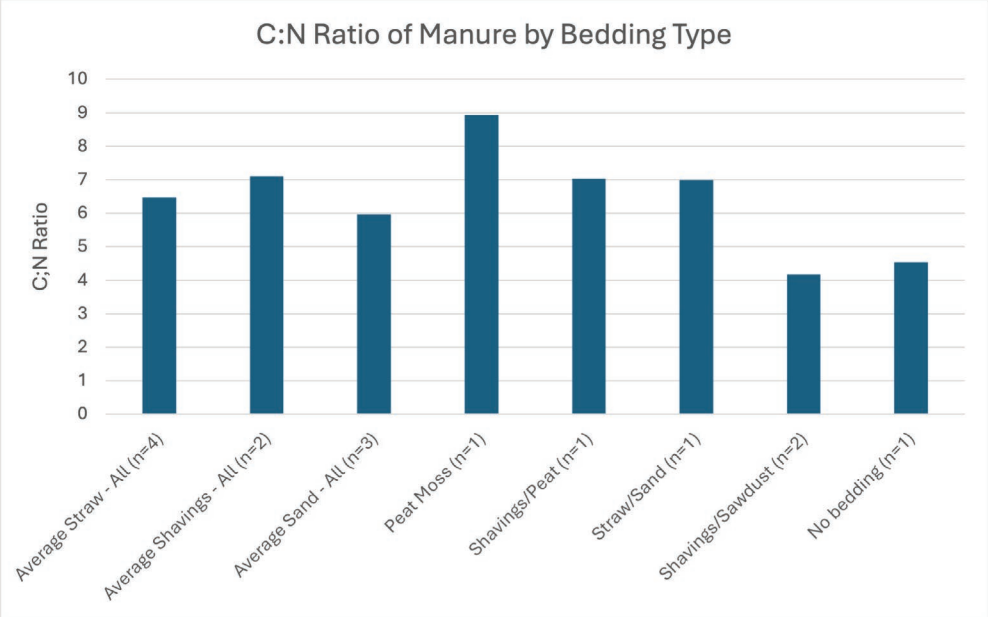
The carbon to nitrogen (C:N) ratio of a manure is important because it impacts the availability of nitrogen for plant uptake. Microorganisms in the soil use carbon rich materials as a food source. When those are available in abundance, the microorganisms multiply to be able to take advantage of the additional food supply. This also increases their nitrogen use so when the C:N ratio is high, there is insufficient nitrogen to meet their needs and they will have to draw on soil nitrogen, reducing availability to plants. In general, a C:N ratio less than 25:1 will result in nitrogen mineralization, making it plant available. Bedding type can have a significant impact on the C:N ratio of a manure, particularly when it has not been composted. The peat moss sample had the highest C:N ratio at almost 9:1 while the shavings/sawdust sample has the lowest at slightly over 4:1. All of the samples were under the 25:1 threshold for nitrogen mineralization. The downside to these low (<15:1) C:N ratios is that nitrogen could be released too quickly, which could increase the potential for losses via leaching. To reduce the risk of losses via leaching, manure should be applied close to the time when crops will be able to take up nitrogen.



FRESH VS AGED

In general, a "fresh" manure could be expected to have higher nitrogen content than a manure that has been "aged" for six months or more. While a higher nitrogen content could be a benefit, it also comes with increased risk of loss and damage to the plants it is being applied to. This can be managed through application rate and placement. An aged manure sample would be expected to have lower ammonium-N content, however, that was not what was seen in the collected samples. A distinction should be made between "aged" and composted manure, where composted manure has been actively managed to reach specific temperatures and moisture levels for efficient decomposition. During decomposition, nitrogen is converted into ammonium, which is subsequently lost through volatilization. There were increased levels of ammonium-N in the aged layer (3.13%) and aged broiler (1.37%) samples over the fresh layer (0.72%) and fresh broiler (0.82%) samples. This increase in ammonium-N could be attributed to heightened decomposition in the undisturbed centre of the pile, resulting in less opportunity for losses through volatilization. The resulting high ammonium-N levels may cause increased plant damage if being applied directly to plants, which could outweigh the potential benefit of more available nitrogen. Since ammonium-N is the most volatile form, chances are that most of it will be lost before it can be taken up by plants anyway. Depending on the housing system, poultry manure is often cleaned out at intervals that may not correspond to immediate field application of manure. In this case, proper composting would be recommended so that increased ammonium-N levels can be avoided, ensuring the nutrient stability and plant safety of the resulting composted material. If proper composting is not possible, it would be beneficial to ensure the manure pile is well-mixed so that the applied product is as uniform as possible, so hot spots of high ammonium-N are reduced.

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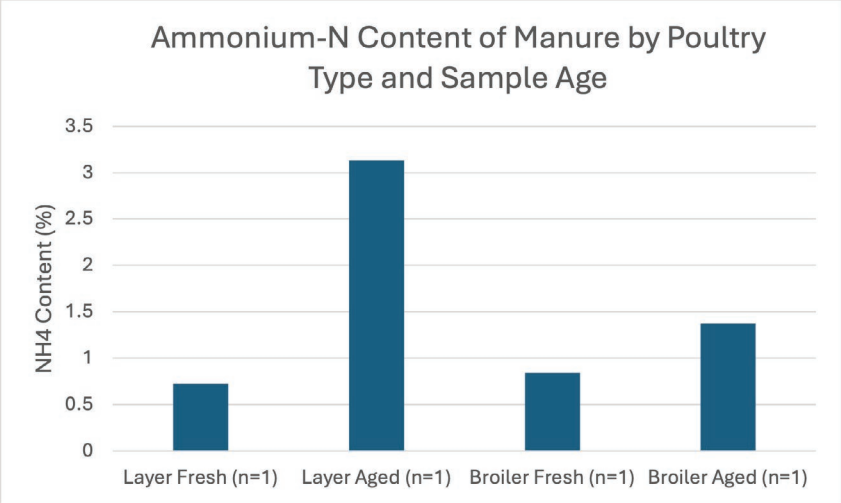
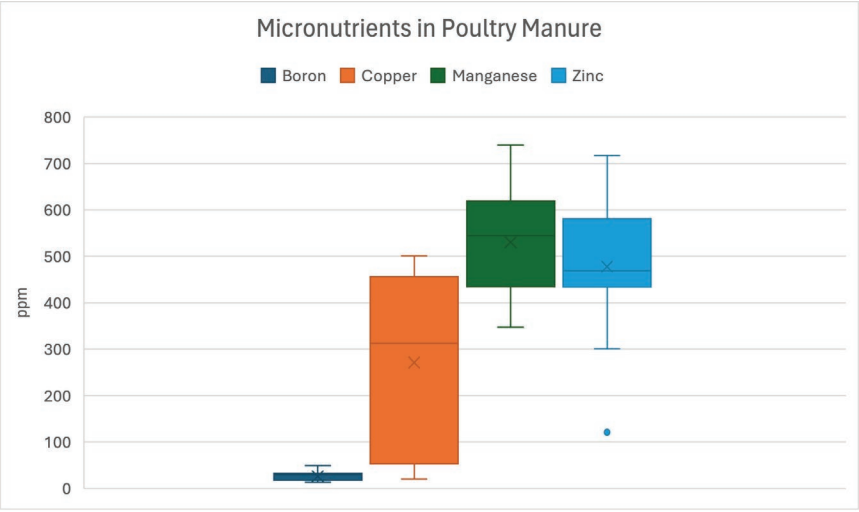


MICRONUTRIENTS

Manure can be an excellent source of micronutrients, which are needed in small amounts by plants. However, both the balance of these nutrients in the soil and their availability at certain pH levels compared to other nutrients could cause toxicities in plants. It is important to pay attention to high levels of micronutrients in manure, like copper and iron, so that they do not get built up to harmful levels in the soil. Micronutrient content was highly variable across all samples. It would be recommended to consider micronutrient content of manure in comparison to the nutrient levels, pH and texture of the soil to which it will be applied to ensure there are not dangerous buildups of any given nutrient.

Copper levels were significantly higher across all samples than book values of 30ppm (layers) to 50ppm (broilers) (OMAFA Pub. 611). When broken down into categories, broilers (391ppm) had almost eight times the copper content compared to the book values, while layers (46ppm) had only 1.5 times the published value. Both zinc (478ppm) and manganese (530ppm) levels were higher than the book values (230–380ppm and 220–350ppm respectively), though not as significant as copper.

Poultry diets (particularly broiler diets) may contain copper levels that exceed the birds' nutritional requirements to optimize gut health and improve growth performance and feed conversion, but this can lead to increased excretion as well. It is important to be aware of the potential of this as it can have an impact on manure levels and therefore soil levels and plant health, and even on the animals feeding on those plants (for example, sheep may be negatively impacted if fed forage that is fertilized by poultry manure with high copper levels).



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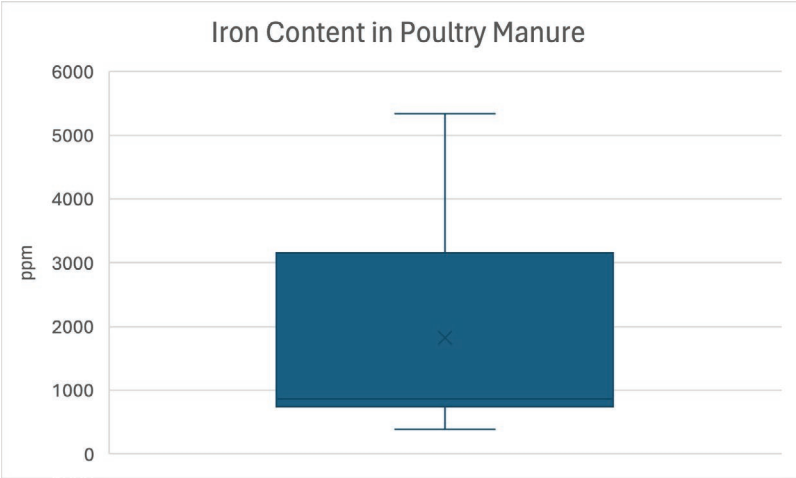

CONCLUSION

There was a lot of variability in manure characteristics and nutrient content across samples from the Nova Scotia poultry industries. Obtaining a manure analysis before application is essential to ensure that nutrients are properly accounted for, appropriate rates and placement are used, and crop and livestock safety is maintained.

REFERENCES

OMAFA Soil Fertility Handbook Pub. 611 **https://files.ontario.ca/omafra-soil-fertility-handbook-en-2022-10-13.pdf**

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