Putting Research into Action!

Partners prove best management practices can help handle nitrogen

There's more evidence that properly managed manure resources can help producers meet their crops' nitrogen needs and reduce leaching.

Partners in Nitrogen-Use Efficiency

Researchers taking part in the Partners In Nitrogen-Use Efficiency (PINUE) project, coordinated by the Ontario Farm Environmental Coalition (OFEC), evaluated what happened when five Waterloo-area farms (beef, cash crop, pork and two dairy farms) used best management practices (BMPs) to reduce nitrogen (N) leaching to groundwater.

Best Management Practices

Selected BMPs were evaluated, based on their practicality, effectiveness and affordability. Whole-farm nitrogen budgets — inputs such as fertilizers and manure from off-farm sources, as well as outputs that included livestock produce and ammonia loss — were studied for each farm, to detect any nitrogen-use inefficiencies.

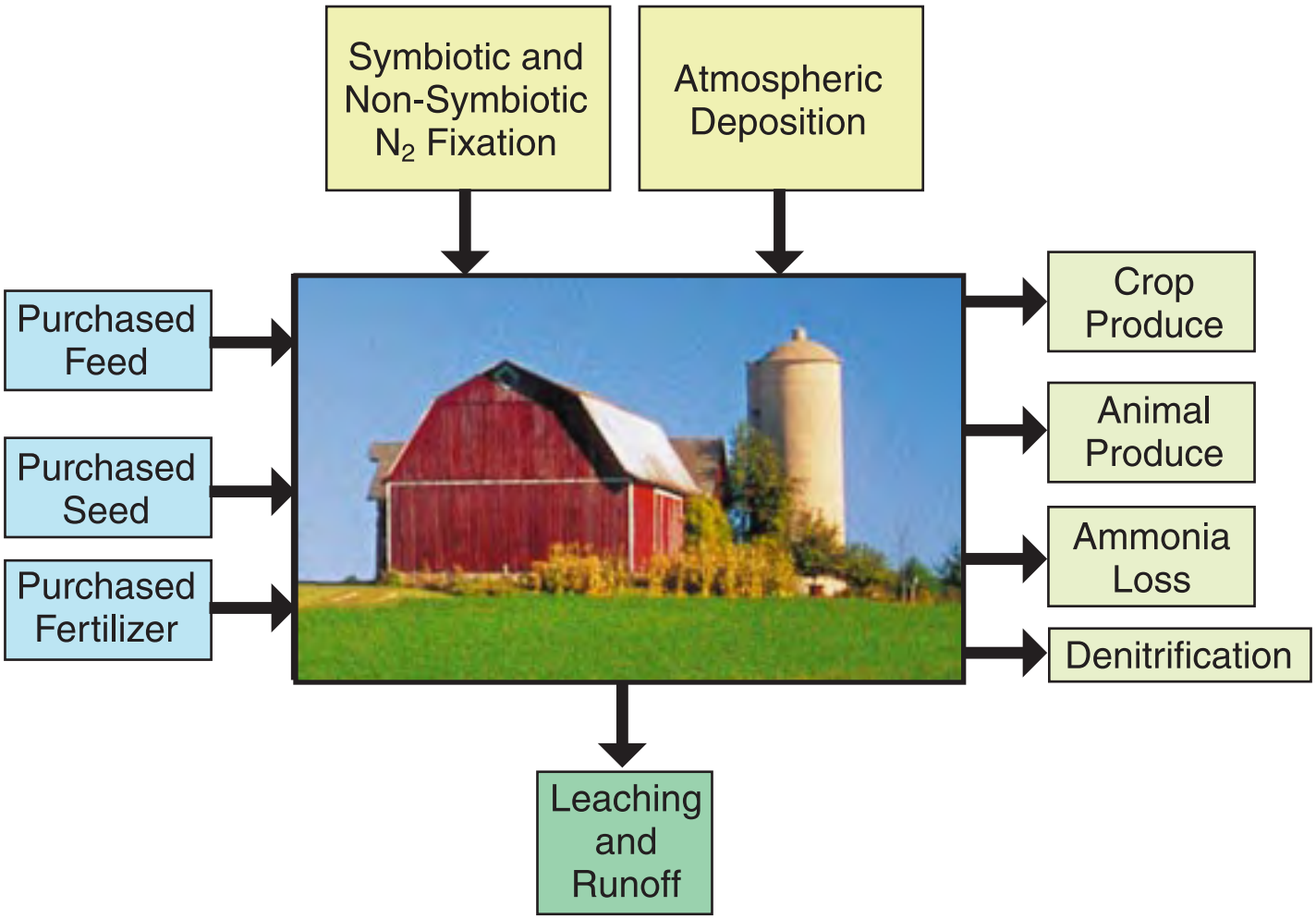
Crop Yields

The researchers believed that cutting crops' N fertilizer inputs would maintain suitable yields while reducing environmental N loss through leaching (especially) and denitrification. They were right: Results comparing BMP rates, zero N and the farmers' usual application rates showed that lower N inputs did not reduce crop yields. Where there is a higher application rate and the nitrogen is not used by the plant there is potential to impact the environment.

Sampling Methods

As well, the researchers tested seven commonly used sampling methods. Their findings? There's room for improvement. Each of the methods had inherent assumptions, limited spatial coverage through the fields and specific technical problems which could skew leaching estimates. Their favourite method was the zero tension lysimeter. *(see inside back cover)*

Whole Farm Nitrogen Balance



Balance = Inputs - Outputs

Nutrient Management

Nitrogen inputs, internal fluxes and outputs measured

Nitrogen Inputs	Internal Nitrogen Fluxes	Nitrogen Outputs
• Seeds • Livestock feed • Replacement livestock • Manure from off-farm • Fertilizers • Symbiotic fixation • Non-symbiotic fixation • Wet and dry deposition	• N added to soil storage pool • Mineralization of organic N • Manure transfers between barn, storage and fields • Transfer of crop produce between field and storage • Transfer of fertilizer to fields	• Livestock produce - milk - surplus livestock • Crop produce • Ammonia volatilization from manure • Denitrification in fields • Leaching from fields

Best Management Practices

Best management practices (BMPs) are practical, affordable approaches to conserving soil, water and other natural resources in rural areas. This research focused specifically on assessing the effectiveness of various nitrogen-use efficiency BMPs.

The BMPs studied were either farmstead BMPs, or field BMPs. Farmstead BMPs include optimizing feed conversion and minimizing nitrogen losses through suitable manure storage handling systems. Currently, Ontario recommends farmers have the capacity to store 240 days worth of manure. This recommendation may be reduced to 200 days, if a suitable nutrient management plan is in place. A similar storage recommendation is in place for barnyard runoff, milkhouse washwater and manure leachate collected.

Field BMPs were identified by completing a nutrient budget (nutrient management plan) for each of the five farms involved in the PINUE study. Balancing nitrogen needs was a particular focus. In general, the nutrient budgeting exercise found that most farms were not giving full credit to the nitrogen available in the applied manure.

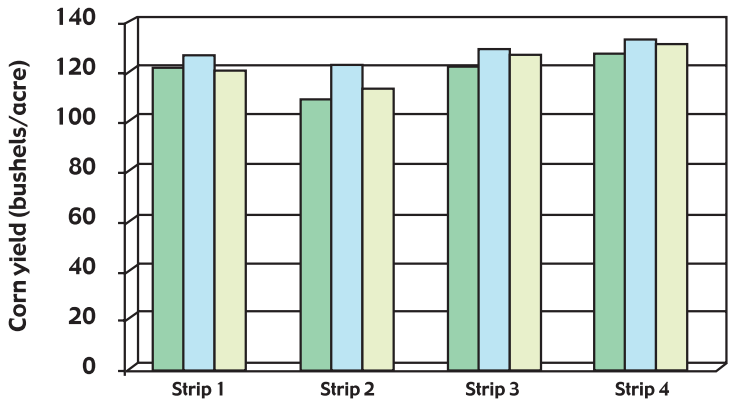
Nitrogen leaching is a major concern of the agricultural industry. But what's the best method to measure the problem? Researchers compared seven approaches, with these observations:

Technique	Advantages	Disadvantages
Solution Samplers/ Water Balance	• Calculated annual surplus water compared well with results from 30-year Environment Canada results and published papers	• Lack of spatial coverage through field • Limited number of samples and large variability in leaching estimates
Solution Samplers/ Tensiometers	• Direction of seasonal fluxes was directly related to topographic position	• Limited spatial coverage • Large variation in estimates of water movement/recharge
Zero Tension Lysimeter	• Larger sampling area, reducing spatial variability • Directly measured nitrogen concentration and volume leached	• Sample depth of 30 cm, still within root zone, may not accurately represent nitrogen available for leaching
Shallow Monitoring Wells	• Good method for measuring nitrogen fluxes reaching groundwater table • Frequency and magnitude of recharge events was greatest in late winter to early summer	• Changes in atmospheric pressure and lateral groundwater flow may produce false recharge events • Cost of installing shallow groundwater monitoring wells
Soil Cores	• Inexpensive to collect and analyse	• Not a direct measure of nitrogen leached from soil profile
Tile Monitoring	• Good spatial coverage	• Uncertainty of capture zone size
LEACHN Model	• Indication of nitrogen leached under different management practices	• Large amount of input data • Estimations may not reflect field situation

For this study, the zero tension lysimeter was found to be the most reliable, interpretable and cost-effective method.

Using nutrient management planning software to determine the application rate of nitrogen is effective in maintaining crop needs, without providing excess nitrogen that could leach into the groundwater.

Corn yields for different nitrogen treatments



Nutrient Management Plan (NMP)
0 lbs/acre Commercial Nitrogen + Manure

Pre-side dress nitrogen test (PSNT)
50 lbs/acre Commercial Nitrogen + Manure

Normal
100 lbs/acre Commercial Nitrogen + Manure

Strips 1-4 were planted in a sandy-loam soil on the same farm.

A detailed handbook outlining specifics on best management practices applied to the farms taking part in the study can be obtained by contacting:

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Other partners in the PINUE project included the Ontario Ministry of Agriculture and Food, the Ontario Ministry of Natural Resources, the Regional Municipality of Waterloo, the Universities of Guelph and Waterloo, the Ontario Federation of Agriculture and the Ontario Farm Environmental Coalition.

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