# On-farm research into liquid manure in minimum tillage systems

by Jeff Quinn

Despite the dismal 1995 growing season, with its' late, cool spring and late summer drought, corn in REAP - Canada's southern Ontario project assessing liquid manure application in no-till corn production systems still responded well to manure nitrogen as opposed to commercial nitrogen.

Gary Chipps, REAP's project cooperator on light-textured soils, operates a dairy farm near Courtland with his brother Keith and father Lloyd.

Chipps likes to keep things simple and problem-free. In fact, his creative ingenuity in overhauling his liquid manure spreader to perform to these standards won him a $1,000 award in the Environmental Farm Plan Contest last year.

By using "tanker tillage", Chipps is now able to incorporate liquid dairy manure evenly on no-till crop stubble in one field pass without excessive horsepower requirements. His problem in the past was that the high amount of straw in the liquid dairy manure kept plugging the distribution hoses that came with his tanker.

**Conserved nitrogen**

Now, the manure is simply splashed off a distribution plate and coats the crop residue in a spread width matching his four-row planter. The wide sweeps mounted on the back of the tanker immediately mix the manure and coated residue into the aerobic zone of the soil. There are no distribution hoses to plug and Chipps figures the manure nitrogen is more efficiently conserved when mixed with the high carbon residues rather than being left in concentrated bands.

"It builds the soils oils and protects the environment. If you can smell it you are losing nitrogen and wasting money," he says.

The sweeps still leave a 30% residue cover in corn following corn. The loosened soil, however, required the trash whippers on the planter to be elevated to avoid furrowing. Also, an additional two sets of 2" fluted coulters will soon be mounted between the tanker sweeps to improve incorporation of the centre two corn rows not trampled at harvest.

New projects are always in the works as needs are perceived. Currently, Chipps is devising an inter-row cultivation guidance system for his soybeans. He hopes it will hold its line better against root stalks of the previous corn crop. Commercially available cultivators seem to have trouble doing this in his sandy soil.

For Chipps, nitrogen availability over the whole growing season is a key concern for their low capacity sandy soils. The full yield potential of their corn appears to be better expressed when some of the nitrogen requirements are sidedressed rather than applied as preplant manure alone or in combination with starter nitrogen. Applying 35 to 40 lbs/acre in conjunction with inter-row cultivation will be a possible future area of experimentation on the Chipps farm.

John Van Dorp, another on-farm cooperator in REAP's liquid manure management project, is a believer and promoter of biologically-friendly practices to maximize the soil life factor expression in cropping programs.

Van Dorp farms near Woodstock on a medium textured Guelph loam. His program begins in the hog barns where he daily adds reactive limestone powder (300 mesh) to neutralize manure acids and stimulate greater microbial activity.

"The barns smell much fresher because the calcium helps to reduce ammonia losses and the pit manure no longer forms a crust with lots of bubbling activity," says Van Dorp.

Van Dorp prefers to spread the manure as close to the time of crop utilization as possible. He has an Aerway tillage implement mounted on the back of his tanker to incorporate any crop residues and it tills the ground immediately before the liquid manure is sprayed from the overhead tanker applicator. By using scraps of 2 X 4 wood and a bit of sheet metal, Van Dorp was able to narrow the spread pattern to the working width of the Aerway.

"The liquid manure soaks immediately into the loose soil and helps break down the residues to build stable organic matter in my soil. Also, the Aerway unit eliminates the tanker tracks and reduces the axle load so compaction isn't a problem," says Van Dorp.

To further enhance the "sheet composting" of liquid manure with crop residues, Van Dorp also broadcasts enzyme catalysts and paramagnetic rock powders.

Van Dorp's manure storage capacity is only adequate for seven months, so he is forced to apply manure on corn stover in the fall. To reduce the usual 50% nitrogen losses he is preparing to plant winter rye to capture the mineralized nutrients. In the spring, he will spray it with *Roundup* before no tilling soybeans. The efficient assimilation of crop residues back into the soil is an important issue when growing crops in 20" rows.

"There's very little room to move large volumes of residue between narrow rows when clearing trash over the seed rows," says Van Dorp with a wry grin.

Actually, in 1995 because of the cool spring, Van Dorp also made a disking pass before planting in his minimum till sites. He did this in order to speed up the soil warming. After planting his ground cover was still 33%.

## Relying on applied manure only

Van Dorp credits the REAP research on his farm for giving him confidence to eliminate sidedress nitrogen and rely solely on spring applied manure. He now counts on 5,000 gallons of manure per acre to supply all his corn crop nutrient needs. Only liquid fish is applied with the planter for seed support. For the past two years, this treatment has given the best yields with minimal leftover nitrogen after the growing season.

Maximizing the efficient use of on-farm resources has dramatically improved the bottom line in his crop production and freed capital for farm improvements, says Van Dorp.

"Knowing exactly what's going on the soil is the key to responsible manure management and environmental protection as opposed to restrictions on animal units per farm alone," he figures.

Andre Soetemans, is the third cooperator involved in REAP Canada's southern Ontario manure project. He farms on heavy clay near Forest, Ontario. A pioneer in no-till corn production on these challenging soils, Soetemans admits there is still lots to learn and he welcomes the assistance of on-farm researchers to provide more detailed information for his own farm situation.

Soetemans likes the time and equipment savings of no-till cropping, but is concerned about the delayed maturity (up to 5 points in moisture at harvest) and yield depressions when impatience leads to planting before soil conditions are just right. Clay soils are notoriously unforgiving so Soetemans is considering "no-till plus one" where a single pass with a "C-tine' vibrashank cultivator might speed up soil warming and create a looser seedbed.

"If it makes money, I will do it," says Soetemans. But cautions that he "will make changes only when reliable evidence proves its superiority."

For instance, Soetemans is perhaps considering the move to narrower rows or perhaps twin-rowing from his current 36 inch spacing. He figures it would take at least a six bu/acre advantage to justify the renovations to his equipment. For now, he prefers to invest most of his time and capital into his farrow-to-finish operation, so saving on fertilizer by using manure to better advantage is a worthy goal.

Compaction and denitrification losses are also prime areas of concern for Soetemans. So, the idea of the REAP experiment on his farm was to use commercial nitrogen in the starter package to help jump start the corn's early development, followed by sidedressing manure at the four to six leaf stage when soil conditions could better stand tanker traffic. Manure was simply gravity-flowed onto the soil surface between corn rows from a 5" manifold with 2" openings four rows at a time. Inner-tubing formed flexible downspouts to reduce splashing onto the corn plants.

## More even flow

For some unexplained reason, the manure distribution was much more even under gravity flow opposed to it being distributed under pressure with a pump. The reduced flow rates meant slower working speeds to get the 4,000 gal/acre application rate,

especially as the tank was nearly empty. This approach was a "baling twine and wire" solution to get by and obviously impractical for widespread adoption by other growers. Nonetheless, where the surface applied manure was subsequently covered using a heavy duty inter-row cultivator, the corn yielded better than commercial nitrogen sidedressed at the same time. This suggests that manure could effectively replace commercial sources of nitrogen at sidedress application on high bulk density soils provided a starter fertilizer was used.

As expected, manure left uncovered not only did not supply adequate nitrogen to finish the corn crop, but also tended to support secondary flushes of weeds!

Perhaps an inter-row cultivation for weed control prior to manure sidedress would improve manure assimilation while conserving soil moisture by forming a loose mulch of soil. The ultimate solution will involve some form of tanker-mounted tillage equipment, to save on field passes. What is currently available is inadequate for high bulk density soils.

"It's got to be effective before it will be widely accepted," figures Soetemans.

Richard Yantzi is a large custom operator with a farrow-to-finish operation near Tavistock and is involved in the REAP - Canada southwestern Ontario manure project.

Yantzi is a committed no-tiller with eight years experience on the variable but predominantly silt loam soils in his region. He credits REAP's on-farm research with giving him the confidence to give more credit to the fertilizer value of the manure and cut back on purchased nitrogen.

"With the high fertilizer prices this spring, it is a great incentive to move to greater self-sufficiency using resources already on the farm," says Yantzi.

"The carry over factor of manure nitrogen from previous years' applications is also surprisingly significant," he says based on the results of the nitrogen response trials grown in conjunction with the manure studies.

Yantzi is very impressed with the benefits of tillage at the time of manure utilization.

"I was so impressed with the 1994 corn response to the tanker-mounted Aerway unit that I treated 85 acres of wheat stubble the same way," he says. "The wheat stubble is digested by the fall and so far the 1995 no till corn looks terrific."

Oilseed radish planted after the wheat stubble was manured and reached heights of 30 to 40 inches. Yantzi also observed that the Aerwayed ground planted much easier because it dried more quickly following the manure application.

**Patience a virtue**

Yantzi did caution that it is important to get adequate down pressure on the Aerway to do a proper job of soil loosening and that "patience is a virtue to stay off soils that are not ready even if the calendar says it's time."

The tanker used in the REAP study was loaned from Husky Farm Equipment of Alma. It could be fitted with the Aerway and an adjustable distribution plate for broadcast treatments or with an inter-row distribution and delivery system complete with hydraulic controlled metering and heavy duty disks for incorporation. High profile "diamond-foot" radial tires minimized compaction from the tanker. It performed more than adequately on the silt-loam soils, but the down pressure loading on both the Aerway unit preplant and incorporation disks sidedress will have to be increased for proper action on heavier soils.

Preserving and enhancing productive resources is a prime motivator for Yantzi when planning changes in his farming strategies. Recently, an upper Thames River Conservation Authority study on his farm revealed acceptable soil losses of 3 tonnes/acre or less under no-till production.

With regards to manure management, Yantzi says, "It is important to limit volumes applied at any one time to 3,000 to 4,000 gallons/acre up to a maximum of 6,000 gallons/acre. Some form of pretillage is crucial to interrupt macropores and reduce the risk of tile and groundwater contamination."

Yantzi also favours the idea of incorporating cover crops into the rotation to protect and improve the soil.