Not all manure is created equal

Be it liquid manure from a hog or dairy farm, solid manure from a cattle feedlot or litter from a poultry operation, there can be dramatic differences in the quality of nutrients in the manure, its beneficial characteristics for soil and crops and its impact on neighbours and the environment.

Unfortunately, still today, the most common form of manure management practiced at farms in western Canada often involves "no treatment" at all. For instance: take your typical modern dairy farm: automatic scrappers push manure from the alleys in a free stall barn into an interim storage pit from which the slurry is subsequently pumped to a storage lagoon and eventually spread back on the farm's fields. If left untreated, an anaerobic process becomes established in this stored slurry which can lead to a problem situation: floating layers and/or solidified sedimentation layers in the slurry tank or lagoon; a need for extensive agitation before applying the slurry; an acrid, pungent smell in the area of barns and pits; gas emissions during stirring and application of the slurry; potential burning and scorching of crops after application and many other problems. Often despite the farmer's best efforts, the slurry fails to produce the desired fertilizing effect. This leads to the application of additional fertilizers and other crop protection measures.

The underlying problem – putrefaction

Typically, slurry will become a problematic waste product when conversion takes place by means of putrefaction processes. This involves decay under anaerobic conditions, i.e. in the absence of oxygen. Anaerobic conversion of slurry leads to the development of malodorous gases, including hydrogen sulphide and ammonia, and odourless methane gas. Also problematic, the odour carriers in manure – *indole* and *skatole* (3-methylindole) – attract harmful insects. These insects lay their eggs in the slurry, and the subsequent larvae are contained in the slurry which is applied to the crops, leading to crop damage and the need to apply pesticides. Furthermore, the valuable substance ammonium nitrogen is lost in the anaerobic slurry, because ammonium is converted into ammonia (off gases by volatilization) and is no longer available for plants.

Oxygen through aeration

The conventional method of introducing oxygen into the slurry involves mechanical aeration by means of agitators or compressors. However, this technical method becomes problematic when dealing with large quantities of slurry which cannot be stirred effectively every day. Floating layers then quickly form, further sealing off the slurry from the oxygen supply and thus strengthening the anaerobic environment. The capital cost and annual energy costs of lagoon agitation can also be considerable.

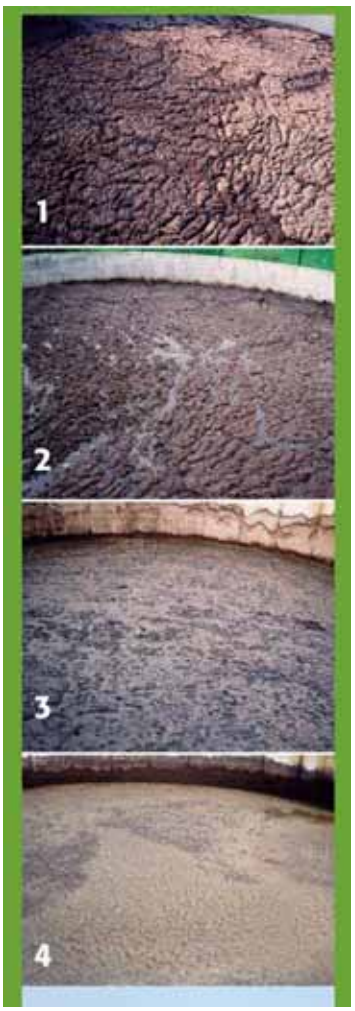
The natural solution – decomposition

But there is another way! The simple and natural solution to turn slurry into a valuable organic fertilizer involves activating those decomposition processes in the slurry, which only take place with oxygen. The decomposition processes involve mould fungi, yeasts and other microorganisms and include several biological processes which are absolutely vital to maintaining a state of equilibrium in nature. Mould fungi very quickly bind any ammonia which is present in the first stage of the

rotting/decomposition process to form ammonium nitrogen, which is subsequently available to plants as a slow release source of nitrogen. The harmful and unpleasant biogases are also largely eliminated, providing for a noticeable difference in the pit/lagoon or storage tank (e.g. SlurryStore®) and during application. A healthy, decomposed slurry thus constitutes an important element of a closed substance cycle management system which benefits the soil, plants, animals and humans alike.

Activating sludge

The best solution is a simple method which activates the aerobic bacteria, while avoiding the need for agitation (or external energy) and other factors detrimental to the environment. Penergetic g (a product from Switzerland, now available in Canada, through Penergetic Canada), possesses the specific active properties of oxygen and reactivates the life processes in slurry. The putrefactive bacteria die and the oxygen which is present in the slurry is aerobically activated. An oxygen-producing and breathing biomass quickly results. The micro algae which develop change the colour of the slurry to dark green and the work performed by the bacteria renders the slurry homogeneous. In the course of time, existing floating layers and sedimentation layers dissolve. As a natural side-effect of these processes, the smell is diminished and a more nutrient rich valuable organic fertilizer results. Using the decomposed (or rotted) slurry produced in this manner enables the quantity of commercial fertilizer used to be reduced.



This information was recently presented at the Pacific Agriculture Show in Abbotsford, B.C, by Derek Pratt of Penergetic Canada, in a seminar titled: Sustainable Manure Management. Pratt pointed out the striking differences in the quality and effects of anaerobic and aerobic manure (see comparison in table below). It was also noted that while farming areas in Europe and elsewhere in the world have long ago recognized the environmental and agronomic advantages to be gained from aerobic manure treatment, too often farmers in Canada still seem content to allow manure to loose much of its nutrient quality, create odours and potential pathogenic or insect problems and be more prone to impact on ground and surface water quality.

By drawing upon the experience of dairy farmers in Europe, it was pointed out that when dairy liquid and dry manures are broken down via an aerobic process (instead of the more common and less desirable anaerobic process) a number of positive benefits are achieved – including a dramatic reduction in the unpleasant ammonia and carbon monoxide odours often assumed as inevitable in conjunction with livestock rearing. Owing to higher population density, stricter government regulations and a longer history of agricultural use, farmers in Western Europe have been confronted with the need to develop appropriate means of manure handling sooner than has been the case in western Canada.

New developments in manure management technology from Europe enable liquid and solid animal wastes to be processed effectively, economically and in an environmentally-responsible manner,

without the requirement for expensive capital expenditures or equipment. It was pointed out how the "aerobic approach" to manure management is increasingly gaining favour around the world and how some of the leading livestock rearing U.S. states have initiated a shift from anaerobic to aerobic methods of processing animal wastes. Seminar presenter, Derek Pratt of Penergetic Canada stated: "Over 10,000 dairy farms in Europe have adopted an aerobic approach to manure management as the benefits speak for themselves".

The implications of this sustainable approach to manure management were overviewed in terms of overcoming the main "nuisance" implications commonly associated with animal manure – e.g. odour, pathogens, and land, air and water pollution, while at the same time producing a better nutrient rich end product to apply back on the fields. Also discussed were the important agronomic benefits of this approach, the resulting benefits for animal and worker health, methods of composting and field application of manure.

Easy to apply

This approach to liquid manure management is uncomplicated to administer. The product is easy to apply – it is simply mixing with water (5 grams/cow/week) and applied directly into the effluent channel or alley in the barn (or poured through slatted flooring), where it is scraped (or carried) to the in-barn holding tank/pit and ultimately transferred to the storage lagoon. It starts working right away, improving the atmosphere in the barn. For situations where slurry is already in the main storage lagoon, the product is simply mixed well with water and applying directly into the lagoon where it goes to work.

Decomposition and putrefaction - the great adversaries	
Putrefaction (anaerobic) - untreated	**Decomposition (aerobic) - treated**
Leads to the formation of: Hydrogen sulphide, Hydrogen chloride, Hydrocarbon, Phosphorus hydride, Ammonia (NH_4) N losses! Result: Toxins (poisons), which promote diseases	The following substances are formed / made available: Plant-available trace elements, such as zinc, copper, magnesium, manganese, molybdenum and many others Nitric oxide (NO_3) N bound to form fungal protein (slow-flowing source of N) Result: Antibiotics, inhibitors that prevent diseases
Livestock exposed to risk of viruses	Destruction of viruses
Anaerobic bacteria do not produce any vitamins	Mould fungi produce vitamins and enzymes
Putrefaction leads to zinc deficiency; zinc deficiency leads to viral infections	Mould fungi break down large quantities of zinc (important in building up protein)
Putrefaction leads to pest infestation	Decomposition processes are essential for healthy plants. Humans are part of this "soil-plant-animal-man" chain!
Acrid, pungent putrescent odours	Low-odour to odourless
Formation of floating crust and sediment layers in slurry	Slurry remains liquid and homogeneous
Formation of strong root toxins	No substances to inhibit root growth
Danger of scorching during application	No scorching of plants during application
Promotes growth of woody top grass = inferior fodder	Promotes growth of ground-covering bottom grass = nourishing fodder
Relatively high quantities of fertilizer are required, mineral fertilizer also needs to be used	Small quantities of slurry per ha. due to high fertilizing capacity, no or reduced mineral fertilizer required
Pollutants in dissolved form = danger for the groundwater	Nutrients in bound form = no risk to the groundwater

Source: Erhard Hennig, The Secrets of Fertile Soil [English edition of "Geheimnisse der fruchtbaren Böden", Germany

Economical

At a cost of just two cents (2¢) a day per cow, it is also inexpensive. Plus with no capital equipments or operational modifications required, a savings on energy use and the generation of a higher quality end product, it was shown how the "Penergetic approach" is a cost effective solution able to fit into any farmer's budget.

Sustainable approaches to managing solid manure were also discussed. Whereas, it is common practice to simply pile solid manure (e.g. soiled livestock bedding and spent poultry litter) and allow it to breakdown on its own, Pratt discussed how a second product, penergetic k can be used to accelerate the breakdown of solid manures. Once again by stimulating an aerobic process it helps to produce a rich humic compost more rapidly, without foul (anaerobic) odours, free of pathogens and instead populated with beneficial fungi which support soil fertility. This product can also be used directly on bedding in stalls or poultry litter to reduce problems of ammonia smell, help to contain potential pathogenic problems and start to decompose the stall bedding or litter and any excrement.

Livestock are inefficient at extracting nutrients from feedstuffs - typically 75-90% of major nutrients fed to livestock pass directly through the animal into the manure. In a closed cycle, where much of these nutrients are often raised right on the farm and with today's prices for synthetic fertilizers, the extent to which these nutrients can be returned to the soil and made available to subsequent crops will depend to a large degree on the way the manure is stored and handled.

Also discussed were the advantages of manure composting and key considerations in developing an effective composting system. Pratt pointed out that well composted manure slowly releases its nutrients into the soil, enhancing the soil microbiological life and soil texture; whereas, the highly-soluble nutrients in raw (or in-adequately treated manure) are quickly leached away and can damage both the soil biology and crop.

While focusing somewhat on the agricultural community in the Fraser Valley, which has perhaps the highest concentration of intensive dairy and poultry operations in the country, this presentation provided thoughtful information that should prove useful to farmers with livestock or poultry, anywhere in western Canada, who are interested in an economical, agronomically-sound and environmentally appropriate means of transforming what is often considered to be *a problematic waste into a valuable organic fertilizer*.