Recent studies assess challenges to marketing and user uptake of organic recycled nutrient products.

Four recent studies, based on surveys of professionals and farmers in different European countries, assess the challenges to marketing of digestates, barriers to farmer uptake of composts and expectations of organic farmers. These studies indicate that relatively few publications to date address recycled nutrient use with a market approach, rather than from the position of the producer of the products.

Dahlin et al. (2015) assess biogas digestate marketing, based on a survey of digestate marketing information online and on 21 in-depth interviews (June ? December 2014) with companies marketing digestate, based in Germany, Switzerland, Austria, Netherlands and France, selected after identification of 48 websites commercialising digestate. Interviews included biogas plant operators, agricultural contractors, soil and organic fertiliser manufacturers, brokers and technology suppliers.

Based on a literature search, the authors note that marketing issues have largely been ignored in publications on digestate management to date (see e.g. Schüsseler 2009). The authors underline that digestate marketing is complicated because digestates are very variable, depending on the input materials and treatment processes. Dry matter content, nitrogen, phosphorus and potassium content can vary widely. Digestate treatment can reduce volume and facilitate transport to areas with nutrient demand. Such digestate upgrading processes include solid-liquid separation, evaporation ? drying and membrane separation (more information in Vaneeckhaute et al. 2016 and Drosg et al. 2015, see ESPP News n°4). In some cases, regulation or subsidies can drive processing, e.g. the German renewable energy heat incentive bonus includes digestate drying and the German bio-waste ordinance obliges treatment of digestate used on grassland if feedstock includes household wastes. Nonetheless, the authors estimate that only c. 3% of digestate produced in Europe is currently being upgraded.

They note that although upgrading increases the sale price of digestate, this may not be sufficient to cover the processing costs if digestate is sold to mainstream agriculture. Markets such as horticulture, private gardeners and soil manufacturing (inc. substitution of peat) can however offer higher prices (see Probert et al. 2005 concerning compost sales to landscape contractors and retailers). Today c. 17% of digestate processed to solid forms is sold to such markets (BGK 2015).

Key issues for digestate marketing

- digestate marketing is often driven by difficulties to dispose locally of digestate, because of local / regional nutrient surpluses or because the digestate plant operator itself does not control farmland
- new business niches: e.g. agricultural contractors or organic fertiliser manufacturers can act as value-chain intermediates finding customers and suitable applications for digestates
- certain digestates can be used in specific markets: organic farming, chicken litter (dried fibre fraction), horticulture, home gardening
- marketing mix: digestate production and processing can be adapted to produce digestates corresponding to different market demands, including with different nutrient balances, or with different physical properties for spreading or transport (e.g. pelletising increases bulk density, so reducing transport costs). Some digestate producers offer a catalogue of different digestates (up to 24 for one producer) and organic fertiliser manufacturers process to even wider specifications (up to 200)
- digestate quality is key to marketing, including hygienisation (pathogen limits), nutrient content, contaminants and foreign materials (glass, stones). Quality control systems, for both feedstock and output digestate, are important
- quantities produced will define possible markets and require appropriate product packaging
- distribution channels

Indicative figures on digestate sale prices are given, which depend strongly on whether it is sold in bulk or in small-scale retail-type ?on the shelf?, as well as on the degree of processing. The authors note that farmers often understand the interest of digestate in bringing organic carbon to the soil and also calculate the economy in mineral fertiliser costs related to digestate nutrient content. However, local excesses of digestate availability enable farmers to negotiate down prices. Farmers are noted to be sceptical concerning digestate containing household wastes as input materials, although this can also be a price bargaining strategy.

The authors conclude that there is a need for better understanding by companies marketing digestates of what are users? concerns and preferences, and a better education of potential users concerning both the safety and the benefits of digestate. The authors advise that specific digestate marketing competence is developed and used, rather than marketing being attempted by actors whose core competence is digester plant operation. This can be facilitated by cooperation of

producers to develop brands or labels, share marketing costs, and provide a range of specialist digestate products for different target markets. The authors note that new players, such as agricultural contractors, digestate upgrading/processing technology providers or franchise marketers, are entering the market and can provide such marketing competence. Marketing can also use the positive arguments that digestate enables renewable energy production and nutrient stewardship.

Barriers to compost use

Viaene et al. (2016, partly FP7 CATCH-C project) investigated barriers in Flanders, Belgium, to on-farm composting and to agricultural use of composts, based on interviews of 86 stakeholders (including 21 farmers) and questionnaire returns from 83 farms (all in conservation areas or organic). Nearly all the farmers use inorganic fertilisers and slurry/manure, and most also plough in straw (mainly maize grain straw, incorporation of cereal straw is less common).

The authors also note that some 40 companies produce compost at a commercial scale in Flanders (c. 360 000 t/y, containing c. 3 000 tN) but that only around 5% of this is used in agriculture, most goes to parks and gardens.

Identified barriers to on-farm composting are:

- shortage of woody biomass, resulting from subsidies to green energy (combustion, anaerobic digestion biogas)
- licencing obligations if farmers wish to use off-farm materials in composting, whereas this is necessary to achieve viable scale and appropriate input material mixtures
- investment costs for equipment for aeration of compost and for monitoring
- lack of knowledge
- costs or perceived (anticipated) costs and so profitability

Barriers to use of composts by farmers:

- regulatory complexity and overlap, e.g. Manure Decree (Nitrates Directive and phosphorus limitations), soil organic matter (CAP Mid Term Review, greenhouse emissions mitigation)
- competition with regional manure supply surplus
- transport regulations
- real or perceived issues with compost quality: respondent farmers believe that compost

composition is variable (e.g. unpredictable availability of nitrogen to crops) and that all compost poses risks of weed seeds and diseases (lack of confidence in compost sanitisation)
- lack of experience and knowledge concerning compost use

The authors note that compost quality, availability and price have been identified as barriers by previous authors (Rahmani et al 2004 in Florida, Walker et al 2006 in Illinois).

Denmark farmers? attitudes to organic nutrient sources

Case et al. (2016) obtained questionnaire returns from 448 Danish farmers (representative of farms > 10ha using nitrogen fertilisers). Whilst only 35% had livestock, 72% indicated using at least one form of organic fertiliser, mostly manures received from neighbouring farms. 80% indicated that three years from now they expect to use the same amount of organic fertiliser as today, but nearly half indicated that they would be interested to use a form of organic fertiliser not currently available to them (most interest for unprocessed manure, then processed manure, and lastly sewage sludge or municipal bio-wastes).

Farmers? motivations for using organic fertilisers were (1) improvement of soil structure by organic content (2) low cost (particularly manure) and (3) availability nearby. The most important barriers to organic fertiliser use indicated by the farmers were (1) odour nuisance (2) uncertainty of nutrient content (3) difficulty in planning for application (supply and nutrient availability) and (4) cost of specific equipment needed for handling.

Organic farmers and secondary P sources

Løes et al. (NORSØK, , Improve-P project) collected 213 questionnaires at stakeholder workshops held in seven countries to discuss the use of secondary phosphorus sources in organic farming. Nearly 40% of questionnaires were from farmers.

The authors note that the following are the principal phosphorus sources currently authorised under the EU Organic Farming Regulation: animal manure, including after processing (if not from factory farming), digested or composted source-separated household organic wastes and green waste from recreational areas, certain animal by-products (meat and bone meal, fish meal). Rock phosphate (soft, ground) is also authorised, but is not readily plant available in most soils. Some other materials are authorised under certain conditions but are generally available only in certain local situations, such as seaweeds, stillage extracts, freshwater dredge sediments.

Conventional animal manure is an important P input to organic farming. The respondents were

concerned about residues of pesticides and pharmaceuticals, but the majority accepted manure from cattle (75% accepted), sheep (73%) and horses (72%). Results varied in different countries, and the acceptance for conventional manure was clearly lowest in Germany. Manure from poultry or pigs were on average accepted by c. 55%,and 31% found manure from fur animals to be acceptable.

Appropriately treated park and recreation green waste achieved the highest acceptance (>90%) along with source-separated municipal food waste (85%) and (non animal) food industry residues (77%) and catering food waste (71%). More than 60% of respondents also considered acceptable the use of human urine and human sewage in organic farming, with a general order of preference precipitates (69%) > urine > sewage sludge > sewage sludge incineration ash (56%). Meat and bone meal ash was also acceptable to over 70% of respondents, but with comments that this often comes from non-organic / intensive production or should be applied under specific safety conditions (e.g. injected into the soil). Phosphate rock was considered acceptable to only 50% of respondents, with concerns expressed concerning the country of origin.

The authors note that farmers were generally somewhat more sceptical than farm advisors and scientists or other stakeholders, concerning use of secondary phosphorus sources in organic farming.

Environmental impacts of compost nutrients and carbon

In previous papers, Vandecasteele, D?Hose and Vanden Nest et al. showed that long term amendment (4, 8 or 16 year) of farmland with plant-based compost improved soil quality and did not increase phosphorus / nitrogen leaching, even when such compost was used in addition to manure application. Phosphorus in soils amended with manures was more readily available and prone to leaching.

References

?Biogas digestate marketing: Qualitative insights into the supply side?, Resources, Conservation and Recycling 104 (2015) 152?161 http://dx.doi.org/10.1016/j.resconrec.2015.08.013 J. Dahlin (a,b), C. Herbes (b), M. Nelles (a,c). a = Faculty of Agricultural and Environmental Sciences, University of Rostock, Justus-von-Liebig-Weg 6, 18059 Rostock, Germany. b = Faculty of Business Administration, Nuertingen-Geislingen University, Neckarsteige 6-10, 72622 Nuertingen, Germany. c = DBFZ Deutsches Biomasseforschungszentrum gemeinnützige GmbH, Torgauer Str. 116, 04347 Leipzig, Germany. Johannes.Dahlin@hfwu.de

?Opportunities and barriers to on-farm composting and compost application: A case study from northwestern Europe?, Waste Management Volume 48, February 2016, Pages 181?192 http://dx.doi.org/10.1016/j.wasman.2015.09.021 J. Viaene (a), J. Van Lancker (b), B. Vandecasteele (a), K. Willekens (a), J. Bijttebier (b), G. Ruysschaert (a), S. De Neve (c), B. Reubens (a) jarinda.viaene@ilvo.vlaanderen.be

?Farmer attitudes and potential barriers to the use of processed organic fertilisers? SLU 19th Nitrogen Workshop, Skara, Sweden, 27-29 June 2016 http://akkonferens.slu.se/nitrogenworkshop/wp-content/uploads/sites/18/2014/05/Nitrogen-Absracts-USB_ny.pdf S. Case (a), Y. Hou (b), M. Oelofse (c), O. Oenema (c), L Stoumann Jensen (a). a = Dept. Plant and Environmental Sciences, University of Copenhagen, Frederiksberg C, Denmark. B = Soil Quality Group, Wageningen University, Wageningen, The Netherlands. c = Alterra, Wageningen University and Research Centre, Wageningen, The Netherlands lsj@plen.ku.dk

?Phosphorus supply to organic agriculture. What does the organic sector think about different phosphorus fertilisers?? NORSØK report vol. 1 / nr. 3 / 2016 http://orgprints.org/30368/1/NORS%C3%98K%20RAPPORT%20nr%203%202016%20P%20FERTILI A-K. Loes, Norwegian Centre for Organic Agriculture, Gunnars veg 6, N-6630 Tingvoll, Norway anne-kristin.loes@norsok.no

Schüsseler, P., 2009. Gärrest für eine Pflanzenbauliche Nutzung ? Stand und F+E Bedarf; Gülzower Fachgespräche. Aktueller Stand bei der Gärrestaufbereitung Band 30, 160?165 http://refhub.elsevier.com/S0921-3449(15)30073-2/sbref0175

Rahmani, M., Hodges, A.W., Kiker, C.F., 2004 ?Compost Users? Attitudes Toward Compost Application In Florida?, Compost Science & Utilization. 12, 55?60 http://dx.doi.org/10.1080/1065657X.2004.10702158

Walker, P., Williams, D., Waliczek, T.M., 2006 ?An analysis of the horticulture industry as a potential value-added market for compost?, Compost Science & Utilization. 14, 23?31. http://dx.doi.org/10.1080/1065657X.2006.10702259

Vanden Nest, T., Ruysschaert, G., Vandecasteele, B., Houot, S., Baken, S., Smolders, E., Cougnon, M., Reheul, D., Merckx, R. 2016. The long term use of farmyard manure and compost: effects on P availability, orthophosphate sorption strength and P leaching. Agriculture,

Ecosystems and Environment 216, 23-33 http://dx.doi.org/10.1016/j.agee.2015.09.009

D?Hose, T., Ruysschaert, G., Viaene, N., Debode, J., Vanden Nest, T., Van Vaerenbergh, J., Cornelis, W., Willekens, K., Vandecasteele, B. Farm compost amendment and non-inversion tillage improve soil quality without increasing the risk for N and P leaching. Agriculture, Ecosystems and Environment 225, 126?139 http://dx.doi.org/10.1016/j.agee.2016.03.035

Return to the **SCOPE In Press** section.