Bulletin de veille Valor PRO N°32

Sabine Houot, Aurélia Michaud, Frédéric Feder, Florent Levavasseur, Matthieu Bravin, Jeanine Martelli

INRAE cirad

Veille sur les Produits Résiduaires Organiques

Bulletin de veille ValOr Pro N°32 - Octobre 2021

SOERE-PRO

L'Observatoire de recherche Produits résiduaires organiques propose les actualités sélectionnées par l'équipe de veille ValOr Pro.
Directrice de la publication : Sabine Houot

Réalisation : Aurélia Michaud, Frederic Feder, Florent Levavasseur, Matthieu Bravin, Jeanine Martelli (DipSO)

Site Web L'Observatoire de recherche Produits résiduaires organiques
https://www6.inrae.fr/valor-pro/

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Colloques, journées, webinaires

Les JRI Biogaz méthanisation 2022 - ATEE

ATEE, 04/11/2021

Les JRI Biogaz méthanisation 2022 auront lieu du 15 au 17 mars 2022 à Lyon.

L'objectif de ces JRI 2022 est de promouvoir les échanges entre les différents acteurs de la filière (industriels, agriculteurs, chercheurs et acteurs du territoire) afin de poursuivre le développement d'une filière adaptée au contexte français. Pour ce faire, les travaux de recherche, retours d'expérience, réflexions seront partagées au travers des présentations, tables rondes et moments d'échange.

Liens : *Accès au document*

Journée Mondiale des Sols – AFES

AFES, 04/11/2021

Journée Mondiale des Sols, Dégradations des sols : quels enjeux territoriaux actuels et futurs ? Du 2 au 7 décembre 2021 dans les Hauts de France, une série d'évènements organisés par l'AFES.

Toutes les informations sur l'édition 2021 seront prochainement mises en ligne *sur cette page*

Liens : *Accès au document*

SERD 2021 - La Semaine Européenne de la Réduction des Déchets

ADEME, 03/11/2021

Édition 2021 de la SERD : du 20 au 28 novembre Coordonnée en France par l'ADEME, la Semaine Européenne de la Réduction des Déchets (SERD) est un « temps fort » de mobilisation au cours de l'année pour mettre en lumière et essaimer les bonnes pratiques de production et de consommation qui vont dans le sens de la prévention des déchets.

Liens : *Accès au document*

Colloque OPL en Savoie : la méthanisation au cœur des débats - CR

Coordination Rurale, 02/11/2021

La treizième édition du colloque de l'OPL (Organisation des producteurs de lait), section Lait de la Coordination Rurale, s'est tenue cette année en Haute-Savoie (74) sur la commune de Marigny-Saint-Marcel. Les échanges de la journée s'articulaient autour de la méthanisation et de la filière laitière en Savoie, thèmes qui ont suscité l'attention des plus de 90 participants présents. À noter la présence de nombreux jeunes et futurs éleveurs qui ont montré un intérêt particulier aux thématiques abordées et ont activement participé aux échanges. L'Institut Solagro a pu présenter la méthanisation sous l'angle de la durabilité et de la transition agroécologique (*voir la présentation*)

Liens : *Accès au document*

Ouvrages Rapports Actes Thèses

Biodéchets : du tri à la source jusqu'à la méthanisation

ESPELIA, 04/11/2021

Biodéchets : du tri à la source jusqu'à la méthanisation - Découvrez le guide réalisé par Espelia, en partenariat avec SOLAGRO et GRDF

Un guide au cœur des sujets de transition énergétique et écologique de nos territoires pour comprendre les enjeux de demain sur les biodéchets et comment assurer leur valorisation organique tout en produisant des énergies renouvelables.

Liens : *Accès au document*

Bilans de fonctionnement méthanisation - Pays de la Loire

AILE, 02/11/2021

Les bilans de fonctionnement sont une obligation réglementaire pour toutes les installations de valorisation de biogaz. En 2020, les premiers bilans de fonctionnement ont été réalisés, pour toute unité de méthanisation en fonctionnement en 2019.

Quelques points à retenir sur le tonnage d'intrants déclaré (unités de méthanisation agricole, industrielle, STEP, centralisée) :

- Les CIVE représentaient 1.4 % du tonnage total des intrants déclarés
- Les cultures dédiées représentaient 2.6 % du tonnage total d'intrants déclarés
- La part d'effluent d'élevage était de 52.4%

Liens : *Accès au document*

Une analyse de filière des dynamiques de revenus de la méthanisation agricole

Agreste, 02/11/2021

Cet article présente les principaux résultats du projet de recherche Métha'revenus, financé par le ministère de l'Agriculture et de l'Alimentation, et commandé en 2019 au laboratoire Ladyss (CNRS). Il adopte une approche institutionnaliste dite « de filière » pour rendre compte

de la dynamique de revenu de la méthanisation agricole en France. Il distingue deux périodes : celle de l'émergence de la méthanisation, à partir des années 2000, et celle du développement de la filière, marqué par une augmentation du nombre des intermédiaires, par une logique d'optimisation du pouvoir méthanogène et une plus grande concurrence entre les acteurs. Les résultats montrent une diversité de manières de dégager un revenu de la méthanisation agricole en France, du fait de l'histoire de la filière. Ils soulignent aussi que cette filière connaît actuellement une logique d'industrialisation et d'extension. Cette dynamique se traduit par une plus grande difficulté, pour certains agriculteurs, à dégager un revenu de cette activité non agricole.

Liens : *Accès au document*

Biodéchets : Objectif 2023 !

ADEME Magazine novembre 2021

La loi du 10 février 2020, relative à la lutte contre le gaspillage et à l'économie circulaire, prévoit de généraliser le tri à la source des biodéchets au 31 décembre 2023. Dans le cadre du Plan de relance économique de la France, l'ADEME dispose d'une enveloppe exceptionnelle, à dépenser avant fin 2022, pour aider les collectivités et les entreprises à développer le tri à la source des biodéchets.

Liens : *Accès au document*

INRAE Publications

Valoriser la méthanisation en agriculture, une incessante question d'équilibres

INRAE, 05/11/2021

La méthanisation produit du méthane, source de revenu pour les agriculteurs, et un digestat qui présente tous les éléments nutritifs utiles aux plantes. Alors qu'une large proportion du carbone alimentant le méthaniseur se transforme en biogaz, le phosphore, l'azote ou encore le potassium restent quant à eux présents dans les digestats, en concentration élevée, et en grande partie sous forme minérale.

Les digestats, à l'issue du procédé de méthanisation, contiennent encore une fraction résiduelle de matière organique qui s'est stabilisée au cours de la fermentation. Ils peuvent donc contribuer à l'entretien des sols en matière organique et constituent ainsi une très bonne alternative au lisier, au fumier ou aux engrais minéraux azotés classiques, dont la synthèse est très énergivore. Les digestats, co-produits de la méthanisation, sont d'autant plus intéressants pour la fertilisation des plantes que l'azote, initialement sous forme organique, s'y retrouve sous une forme minérale directement assimilable par les végétaux.

Si les avantages des digestats semblent donc importants pour l'agriculture, il reste néanmoins de nombreux points d'attention sur lesquels il est primordial de s'attarder afin de s'assurer des bénéfices de leur valorisation en agriculture.

Liens : *Accès au document*

Resultats Decisive

INRAE, Communiqué de presse, 20/10/2021

Valoriser nos biodéchets urbains localement : résultats concluants du projet européen DECISIVE

Les biodéchets, déchets alimentaires et autres déchets naturels biodégradables, représentent un tiers des ordures ménagères des Français. Ces déchets biodégradables constituent pourtant un véritable gisement de ressources valorisables non seulement en énergie pour produire de l'électricité et de la chaleur, mais aussi en produits à forte valeur ajoutée pour les agriculteurs. Alors que d'ici fin 2023 tous les particuliers devront disposer d'une solution pratique de tri à la source de leurs biodéchets,

Le projet européen multidisciplinaire DECISIVE s'est concentré sur le développement de la micro-méthanisation des biodéchets en milieu urbain. Coordonné par INRAE, ce programme lancé en 2016 avec 14 partenaires2 implantés en France, Allemagne, Espagne, Italie, Belgique et Danemark a permis de développer et tester grandeur nature un système de micro-méthanisation efficace de proximité, capable de produire à la fois de l'énergie localement et un biopesticide valorisable dans les champs. Sur le plan environnemental comme socio-économique, les résultats du projet qui prend fin en octobre 2021 permettent d'envisager concrètement le déploiement de ce système circulaire.

Le projet DECISIVE est un projet Horizon 2020 de l'Union européenne (Grant n°689229). www.decisive2020.eu

Liens : *Accès au document*

Dossier Bioénergies : quelle place pour la méthanisation ?

INRAE, 02/11/2021

La méthanisation est utilisée depuis plus de 50 ans pour dépolluer les effluents d'élevage, les boues de station d'épuration urbaines ou encore la fraction organique des effluents d'industries alimentaires. Elle est étudiée à INRAE depuis les débuts et l'institut est aujourd'hui l'un des premiers organismes de recherche au monde pour sa production scientifique sur ce sujet. La méthanisation produit du biogaz (méthane majoritairement) et un résidu, le digestat, qui peut être restitué au sol pour le fertiliser et l'amender. Plus récemment, la perspective de production d'énergie est devenue le moteur de son expansion, ce qui a conduit à développer les techniques pour méthaniser d'autres sources de biomasse, notamment des résidus de culture ou des cultures à vocation énergétique.

Pour atteindre les objectifs de l'accord de Paris sur le climat, le Pacte vert européen et la stratégienationale bas carbone (SNBC) prévoient de réduire nos

consommations d'énergie et d'en diversifier les sources pour réduire notre dépendance aux énergies fossiles.

Le biogaz provenant de la méthanisation est l'une des voies encouragées par les politiques publiques. Le secteur industriel qui doit verdir sa production de gaz place également de fortes attentes sur la méthanisation d'origine agricole….

Liens : *Accès au document*

Réseau SOERE PRO

S. Houot (Inrae) rétablit les vérités quant à l'impact du digestat dans le sol

Agri-mutuel, 02/11/2021

Sabine Houot, directrice de recherches à l'Inrae, tord le cou aux idées reçues sur la méthanisation et ses impacts sur le sol. En effet, les études l'affirment : le digestat a un effet positif sur la vie des sols. « La matière organique est vraiment l'élément qui pilote les sols, souligne Sabine Houot. Les digestats augmentent la vie microbienne des sols. »

- Le digestat favorable au stockage de carbone…
- La ration du méthaniseur a son importance…
- Un fertilisant azoté très intéressant mais très volatil…
- Le digestat et les vers de terre…
-

L'Inrae poursuit ses travaux de recherches sur la méthanisation agricole avec des programmes sur la biologie du sol, ses propriétés physiques et la culture de Cive. Un projet Casdar devrait prochainement voir le jour.

Liens : *Accès au document*

Conséquences de l'introduction de la méthanisation dans une exploitation de polyculture-élevage sur les cycles du carbone et de l'azote. Combinaison de l'expérimentation et de la modélisation à l'échelle de la ferme. – Thèse

Conséquences de l'introduction de la méthanisation dans une exploitation de polyculture-élevage sur les cycles du carbone et de l'azote. Combinaison de l'expérimentation et de la modélisation à l'échelle de la ferme. Par Victor Moinard. Thèse soutenue le 18/11/2021

Résumé : La méthanisation agricole des effluents animaux est une pratique en fort développement en France. Elle produit de l'énergie renouvelable (biogaz). La valorisation des digestats au champ, comme celle des effluents non méthanisés, permet le retour au sol de nutriments et de matière organique, ce qui diminue le besoin en engrais minéraux et entretient les stocks de C des sols. Le traitement et l'épandage de ces produits peut aussi induire l'émission de gaz à effet de serre et de contaminants. La méthanisation agricole influence ces impacts : pour les maitriser, il faut comprendre comment la digestion des effluents avec des déchets importés modifie les cycles du C et du N à l'échelle de la ferme. Cette question a été traitée en s'appuyant sur un cas d'étude à l'INRAE de Nouzilly (Centre – Val de Loire) : une exploitation agricole avec un méthaniseur traitant les effluents de son élevage bovin et divers déchets organiques. Lors de l'essai au champ MétaMétha, nous avons comparé les flux d'azote au cours d'une rotation culturale fertilisée avec des engrais minéraux, des lisiers et fumiers bovins, ou des digestats issus de ces effluents. Les digestats se substituent bien aux engrais minéraux, mais ils sont sensibles à la volatilisation d'ammoniac (NH3). Les vers de terre peuvent être négativement impactés juste après l'épandage de digestat ou de lisier, mais les effets sont similairement positifs après 2 ans d'apports de matière organique. Nous avons ensuite évalué les modèles STICS et SYS-Metha pour simuler respectivement l'essai au champ et le traitement des digestats. Ces modèles ont été couplés pour simuler les flux de C et N à l'échelle de la ferme. Avec de forts imports de déchets, la méthanisation favorise la substitution des engrais minéraux, le stockage de C dans les sols, mais aussi les émissions de NH3. Ce travail permet de mieux évaluer les conséquences de l'introduction d'un méthaniseur dans une exploitation agricole et ainsi d'optimiser la filière.

Études à long terme de l'effet d'apports répétés de matière organique sur des parcelles agricoles - Formation

Aurélia Michaud INRAE ; Formation FORMACOOP (pour des gestionnaires de plateformes de compostage) - 21/10/2021.

Quantifying and simulating carbon and nitrogen mineralization from diverse exogenous organic matters

Levavasseur F., Lashermes G., Mary B., Morvan T., Nicolardot B., Parnaudeau V., Thuriès L., Houot S.. Quantifying and simulating carbon and nitrogen mineralization from diverse exogenous organic matters. 2021. *Soil Use and Management* : 15 p..

DOI: *10.1111/sum.12745*

Abstract : The potential contributions of exogenous organic matters (EOMs) to soil organic C and mineral N supply depend on their C and N mineralization, which can be assessed in laboratory incubations. Such incubations are essential to calibrate decomposition models, because not all EOMs can be tested in the field. However, EOM incubations are resource-intensive. Therefore, easily measurable EOM characteristics that can be useful to predict EOM behaviour are needed. We quantified C and N mineralization during the incubation of 663 EOMs from five groups (animal manures, composts, sewage sludges, digestates and others). This represents one of the largest and diversified set of EOM incubations. The C and N mineralization varied widely

between and within EOM subgroups. We simulated C and N mineralization with a simple generic decomposition model. Three calibration methods were compared. Individual EOM calibration of the model yielded good model performances, while the use of a unique parameter set per EOM subgroup decreased the model performance, and the use of two EOM characteristics to estimate model parameters gave an intermediate model performance (average RMSE-C values of 32, 99 and 65 mg C g-1 added C and average RMSE-N values of 50, 126 and 110 mg N g-1 added N, respectively). Because of the EOM variability, individual EOM calibration based on incubation remains the recommended method for predicting most accurately the C and N mineralization of EOMs. However, the two alternative calibration methods are sufficient for the simulation of EOMs without incubation data to obtain reasonable model performances.

Short- and long-term impacts of anaerobic digestate spreading on earthworms in cropped soils

Moinard, V., Redondi, C., Etievant, V., Savoie, A., Duchene, D., Pelosi, C., . . . Capowiez, Y. (2021). Short- and long-term impacts of anaerobic digestate spreading on earthworms in cropped soils. Applied Soil Ecology, 168, 14.

DOI : *10.1016/j.apsoil.2021.104149*

Anaerobic digestion is increasingly used in Europe to treat organic substrates and produce biogas as a renewable energy source. The residual matter (digestate) is used in agriculture as an organic fertilizer. The study aims at assessing the impact of digestate application in the field on earthworms from the short term (few hours) to the long term (two years), and at investigating under laboratory conditions the role of ammonia and earthworm behavior on digestate toxicity in the short term. First, we studied earthworm communities in fields fertilized with digestates, cattle effluents, or chemical fertilizers for two years. Earthworm abundance was assessed before and after the fertilization event of the third year. Earthworm mortality at the soil surface was also assessed immediately after fertilization. Next, the toxicity of digestate or ammonia solutions on Aporrectodea caliginosa and Lumbricus terrestris was measured in microcosms (110 cm(3)) to better understand the short-term toxicity (two weeks). Finally, we spread digestate (40-80 t ha(-1)) on soil columns (5300 cm(3)) and used X-ray tomography after two weeks to assess the burrowing behavior of earthworms in the cores. Earthworm abundance was 150% higher in the fields treated for two years with digestates or cattle effluents compared to the field treated with chemical fertilizers. 0.5 to 2% of adult earthworms died at the soil surface a few hours after liquid digestate and cattle slurry spreading (18 to 24 t ha(-1)). The digestate (10% to 20% (fresh digestate/dry soil)) and ammonia were also lethal to earthworms in the microcosms within two weeks. In contrast, no mortality occurred inside soil columns two weeks after digestate spreading; A. caliginosa avoided the soil surface with high digestate inputs. This case study highlighted the potential short-term toxicity of digestate (a few hours), which evolved towards a neutral to positive impact in the field in the longer term (from two weeks to two years). Further research is needed to understand the impact of diverse solid and liquid digestates on soil macrofauna in different soils.

Target and Nontarget Screening of PFAS in Biosolids, Composts, and Other Organic Waste Products for Land Application in France

Gabriel Munoz, Aurélia Marcelline Michaud, Min Liu, Sung Vo Duy, Denis Montenach, Camille Resseguier, Françoise Watteau, Valérie Sappin-Didier, Frédéric Feder, Thierry Morvan, Sabine Houot, Mélanie Desrosiers, Jinxia Liu, and Sébastien Sauvé. Environ. Sci. Technol. October 20, 2021

DOI : *10.1021/acs.est.1c03697*

Zwitterionic, cationic, and anionic per- and polyfluoroalkyl substances (PFAS) are increasingly reported in terrestrial and aquatic environments, but their inputs to agricultural lands are not fully understood. Here, we characterized PFAS in 47 organic waste products (OWP) applied in agricultural fields of France, including historical and recent materials. Overall, 160 PFAS from 42 classes were detected from target screening and homologue-based nontarget screening. Target PFAS were low in agriculture-derived wastes such as pig slurry, poultry manure, or dairy cattle manure (median Σ46PFAS: 0.66 μg/kg dry matter). Higher PFAS levels were reported in urban and industrial wastes, paper mill sludge, sewage sludge, or residual household waste composts (median Σ46PFAS: 220 μg/kg). Historical municipal biosolids and composts (1976–1998) were dominated by perfluorooctanesulfonate (PFOS), N-ethyl perfluorooctanesulfonamido acetic acid (EtFOSAA), and cationic and zwitterionic electrochemical fluorination precursors to PFOS. Contemporaneous urban OWP (2009–2017) were rather dominated by zwitterionic fluorotelomers, which represented on average 55% of Σ160PFAS (max: 97%). The fluorotelomer sulfonamidopropyl betaines (X:2 FTSA-PrB, median: 110 μg/kg, max: 1300 μg/kg) were the emerging class with the highest occurrence and prevalence in contemporary urban OWP. They were also detected as early as 1985. The study informs for the first time that urban sludges and composts can be a significant repository of zwitterionic and cationic PFAS.

Effects of Fertilisation Using Organic Waste Products with Mineral Complementation on Sugarcane Yields and Soil Properties in a 4 Year Field Experiment.

Feder, F. (2021). Effects of Fertilisation Using Organic Waste Products with Mineral Complementation on

Sugarcane Yields and Soil Properties in a 4 Year Field Experiment. Agriculture-Basel, 11(10).

DOI : 10.3390/agriculture11100985

Sugarcane cultivation is suitable for the exploitation of organic waste products. However, minimum complementary mineral input is necessary for optimal fertilisation. Control mineral fertilisation treatments with mulch (MCM) or without mulch (MC) were compared with two organic waste treatments, a pig slurry with mulch (PSM) and without mulch (PS), and a sugarcane vinasse with mulch (SVM) and without mulch (SV) on a Nitisol in French Reunion Island. The sugarcane yields obtained with the different treatments differed each year. However, no trend was observed and no significant and recurrent effect of the presence of mulch or of the different treatments was identified over the course of the 4 year experiment. Soil pHw and pH KCl measured in the different treatments increased from year 3 in with the treatments including organic waste products (PS, PSM, SV and SVM) but remained constant with the treatments including only mineral fertilisation (MC and MCM). With the exception of PS and PSM, which were significantly higher in year 4, soil organic carbon content was not modified by the treatments. Soil cation exchange capacity increased only slightly with the PS and PSM treatments from year 3 on. The differences in yields and soil properties can be explained by the nature of the organic waste products, the accumulation of nutrients after several applications, and the specific characteristics of the sugarcane crop. The improvement in soil properties from the third year on was not reflected in the yield of sugarcane because it was too weak, and the crop explores a much larger volume of soil.

Short- and long-term impacts of anaerobic digestate spreading on earthworms in cropped soils

Moinard, V., Redondi, C., Etievant, V., Savoie, A., Duchene, D., Pelosi, C., . . . Capowiez, Y. (2021). Short- and long-term impacts of anaerobic digestate spreading on earthworms in cropped soils. Applied Soil Ecology, 168, 14.

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Anaerobic digestion is increasingly used in Europe to treat organic substrates and produce biogas as a renewable energy source. The residual matter (digestate) is used in agriculture as an organic fertilizer. The study aims at assessing the impact of digestate application in the field on earthworms from the short term (few hours) to the long term (two years), and at investigating under laboratory conditions the role of ammonia and earthworm behavior on digestate toxicity in the short term. First, we studied earthworm communities in fields fertilized with digestates, cattle effluents, or chemical fertilizers for two years. Earthworm abundance was assessed before and after the fertilization event of the third year. Earthworm mortality at the soil surface was also assessed immediately after fertilization. Next, the toxicity of digestate or ammonia solutions on Aporrectodea caliginosa and Lumbricus terrestris was measured in microcosms (110 cm(3)) to better understand the short-term toxicity (two weeks). Finally, we spread digestate (40-80 t ha(-1)) on soil columns (5300 cm(3)) and used X-ray tomography after two weeks to assess the burrowing behavior of earthworms in the cores. Earthworm abundance was 150% higher in the fields treated for two years with digestates or cattle effluents compared to the field treated with chemical fertilizers. 0.5 to 2% of adult earthworms died at the soil surface a few hours after liquid digestate and cattle slurry spreading (18 to 24 t ha(-1)). The digestate (10% to 20% (fresh digestate/dry soil)) and ammonia were also lethal to earthworms in the microcosms within two weeks. In contrast, no mortality occurred inside soil columns two weeks after digestate spreading; A. caliginosa avoided the soil surface with high digestate inputs. This case study highlighted the potential short-term toxicity of digestate (a few hours), which evolved towards a neutral to positive impact in the field in the longer term (from two weeks to two years). Further research is needed to understand the impact of diverse solid and liquid digestates on soil macrofauna in different soils.

Les PRO dans la presse

Méthanisation. Des opposants manifestent : "C'est l'industrialisation du procédé qui nous pose problème."

France 3 Régions, Bretagne, 15/11/2021

Ce vendredi 29 octobre à la mairie de Betton, des élus de Bretagne et de Loire-Atlantique se sont réunis pour échanger sur la méthanisation ; exemples des éléments et questions abordés : "C'est l'industrialisation de la méthanisation qui nous pose problème", "qu'est-ce qu'on met dans le méthaniseur ?", "Des imprudences sur des installations ont déjà conduit à plusieurs pollutions" et "la culture de fourrage uniquement destiné à "alimenter" les unités de méthanisation fait également grincer des dents".

Liens : *Accès au document*

Méthanisation : le filon risque de se tarir pour les agriculteurs

Terres et Territoires, 15/11/2021

Un article d'un laboratoire du CNRS (Ladyss) alerte sur l'évolution de la filière de la méthanisation, avec une industrialisation de la filière aux dépends des agriculteurs. L'auteur souligne notamment 2 éléments : le renforcement de la concurrence entre agriculteurs et industriels, et, le risque de transformer « une grande partie des agriculteurs en simples fournisseurs de substrats ». Il recommande également de maintenir une méthanisation agricole diversifiée, alors que la cogénération est progressivement délaissée pour l'injection qui est plus coûteuse en investissements et en maintenance. Liens : *Accès au document*

A Mulhouse, les bus carburent aux eaux usées

France Info, 15/11/2021

Un des moyens de lutter contre le réchauffement climatique est de favoriser les transports en commun.

A Mulhouse, 22 bus roulent au biogaz depuis début 2021. Ce carburant est produit à partir des eaux usées des 280 000 habitants. Celles-ci sont traitées et les boues sont réutilisées et transformées en énergie (biogaz) dans l'unité de méthanisation. Ces bus au biogaz rejetteraient 75% de moins de gaz à effet de serre, mais le coût serait 30% plus cher à l'achat qu'un bus au diesel.

Liens : *Accès au document*

Yvelines. Carrières-sous-Poissy : l'unité de méthanisation des biodéchets alimentaires est opérationnelle

Actu.fr, 15/11/2021

La première unité de valorisation par méthanisation des biodéchets alimentaires créée en France est installée à Carrières-sous-Poissy dans les Yvelines. L'enjeu est clair, d'ici 2025, jeter les déchets alimentaires dans les ordures ménagères sera interdit, avec deux solutions qui seront autorisées : le compostage ou la méthanisation. « Sur le périmètre du syndicat ValoSeine, nous avons quantifié la présence de 39 % de biodéchets dans les ordures ménagères résiduelles collectées". Les 4 000 tonnes de biodéchets alimentaires traités par an représentent 4 000 m3 de digestat.

Liens : *Accès au document*

Veille Presse agricole

Les revenus de la méthanisation agricole menacés par une industrialisation croissante

Réussir, 02/11/2021

Pascal Grouiez, auteur d'une étude du laboratoire Ladyss pour le CNRS, estime qu'une prise de pouvoir des acteurs non agricoles est en train de s'exercer sur la filière.... La fluctuation des prix observée sur le marché des biomasses et des biodéchets, et la concurrence des industriels des biodéchets méthaniseurs conduiraient les agriculteurs-méthaniseurs français à augmenter l'usage de cultures intermédiaires à vocation énergétique ; dans un second temps, les céréaliers pourraient revendiquer le retrait du plafond de 15 % de cultures dédiées dans le tonnage total des intrants, pour répondre aux tensions sur le marché des substrats ».[...]

Liens : *Accès au document*

Réduire les coûts en misant sur le recyclage

La France Agricole, 22/10/2021

« De toute part, les disponibilités en engrais minéraux et de synthèse s'annoncent limitées pour la saison prochaine (fermeture d'usines de fabrication d'engrais azotés liées à la flambée des prix du gaz notamment) », alerte l'Afaïa (1) dans un communiqué du 18 octobre 2021.

Le syndicat encourage à favoriser « les fertilisants d'origine recyclée » et appelle au soutien des pouvoirs publics, « en mettant en place des règles simples et claires en matière d'innocuité et de valeur agronomique, de façon à garantir la qualité des produits tout au long des cycles ». L'objectif étant pour les agriculteurs d'augmenter leur autonomie vis-à-vis d'intrants minéraux « majoritairement importés ».

Liens : *Accès au document*

La profession agricole agit pour la qualité de l'air

La France Agricole, 29/10/2021

Parmi les polluants responsables de la dégradation de l'air, l'agriculture est en tête pour l'ammoniac. La Bretagne est la première région émettrice française (17 %) avec l'am–mo–niac provenant des bâtiments d'élevage, du stockage des déjections et de la fertilisation organique et minérale des sols.

Des essais en station expérimentale :

En 2017, le ministère de l'Écologie a fixé un objectif de réduction de 13 % des émissions en 2030 par rapport à 2005. Les chambres d'agriculture y travaillent au travers des essais menés dans les stations expérimentales. Le 14 octobre 2021, ces travaux ont été présentés à la station porcine de Crécom, à Saint-Nicolas-du-Pélem (Côtes-d'Armor) … Liens : *Accès au document*

Valoriser la ressource ligneuse

Entraid, 03/11/2021

Valoriser un maximum de déchets verts ainsi que les résidus de taille de haies. C'est avec cet objectif que la fdcuma du Rhône et la communauté de communes des Monts du Lyonnais ont organisé une démonstration. La Cuma du Rançonnet à Amplepluis recevait un broyeur de marque Hantsch. « La qualité recherché est un bon défibrage de la matière » indique Alexandre Gonin, président de la Cuma. Le broyat obtenu servira de substitut à la paille pour les litières. Il sera ensuite épandu dans les parcelles afin d'augmenter les taux de matière organique. En plus des apports agronomiques, cette solution permet de répondre à l'interdiction de bruler les résidus de taille de haies. A terme, l'installation d'une ou plusieurs plateformes de broyage sera portée par des cuma du département.

Liens : *Accès au document*

Reliquat azoté et apports organiques

Aurea, 29/10/2021

Depuis quelques semaines, de fortes tensions sur le marché des engrais azotés sont présentes. Dans ce contexte, il apparait nécessaire de piloter au plus juste vos apports en fonction de vos objectifs de rendement. Pour répondre à cela, le bilan prévisionnel d'azote (récolte = état initial + entrée – sortie) devient indispensable.

Dans l'équation du bilan, les entrées représentent toutes les fournitures d'azote par le sol ou par les apports que vous pouvez faire sur votre parcelle, qu'ils soient d'origine minéral ou organique… AUREA vous accompagne dans la mesure des valeurs fertilisantes de vos produits organiques. Vous pourrez ainsi adapter vos apports (dose, composition, origine…) et les compléter si besoin par des engrais minéraux si votre cahier des charges technique et réglementaire le permet…

Liens : *Accès au document*

Comment s'organiser avec un Holmer Terra Variant ?

Entraid, 28/10/2021

La Loire, la Haute-Loire et le Cantal ont accueilli des démonstrations dynamiques d'un automoteur d'épandage de lisier du 12 au 19 octobre dernier. L'appareil était un Holmer Terra Variant. Il disposait d'une cuve de 16.000l et d'une puissance de 435ch. Pour les démonstrations de ces chantiers d'épandage de lisier, une rampe à patins Bomech de 15m équipait l'automoteur…

Liens : *Accès au document*

La transition agroécologique expliquée à Barbara Pompili

L'Agriculteur de l'Asine, 28/10/2021

« On ne réussira pas la transition écologique sans l'agriculture (…) Les agriculteurs sont une partie de la solution. On ne peut pas faire sans eux », a déclaré la ministre de la Transition écologique, Barbara Pompili, visiblement convaincue. Il est vrai que la ferme de Pierre Lhopiteau est un exemple de vertu agroécologique avec les panneaux photovoltaïques installés sur les toits de ses hangars, son unité de compostage qu'il valorise à d'autres agriculteurs « à la fois bio et conventionnels », a-t-il précisé.

Liens : *Accès au document*

Quand les contrats rassurent tout le monde !

Wikiagri, 26/10/2021

Alors qu'elle conserve un service purement agricole pour ses clients fidèles et traditionnels, un contrat industriel apporte de la sérénité à l'ETA Lefèvre. Fin août, au petit matin, le rendez-vous avec Bruno Lefèvre est fixé au champ. Son ETA est installée à Beauvois-en-Vermandois (Aisne). Sa spécialité ? L'épandage de digestat issu des méthaniseurs.

[…] Avec l'arrivée d'un tracteur et de son imposante citerne, puis d'un deuxième et d'un troisième avant que le premier, vidé de son chargement, ne reparte, je perçois l'impor- tante logistique de ce chantier. Sur le champ, Bruno Lefèvre m'en explique la complexité. La partie essentielle ne s'avère finalement pas l'application mais l'organisation nécessaire à l'approvisionnement en digestat. En effet, la citerne du Terragator contient 15 m3 alors que celle des citernes d'approvisionnement monte à 33 m3. Cela demande donc une rotation importante compte tenu de l'éloignement du méthaniseur, situé à 1 heure de route. Il ne faut pas moins de trois citernes pour équilibrer l'ap- provisionnement et l'épandage.

Liens : *Accès au document*

Frcuma AuRA: 6 démo avec un automoteur d'épandage de lisier

Entraid, 13/10/2021

La frcuma AuRA organise une tournée de démonstration avec un automoteur d'épandage de lisier sur trois départements. Un matériel encore absent des cuma de la région.

Liens : *Accès au document*

« Le projet d'arrêté épandage menace l'élevage paysan »

La France Agricole, 14/10/2021

La Confédération paysanne s'inquiète des conséquences du « projet d'arrêté sur l'épandage », dont la consultation publique s'est achevée le 10 octobre 2021. Elle estime qu'il pénaliserait les exploitations familiales, et notamment les fermes en polyculture-élevage.

Ce projet promet d'harmoniser les réglementations inhérentes à l'épandage, aujourd'hui spécifiques à chaque type d'ICPE, installations classées pour la protection de l'environnement, réparties en quatre catégories selon leurs niveaux de risque.

Liens : *Accès au document*

Le rapport du Sénat, une « caution douteuse », selon Eau et Rivières

Agri-mutuel, 12/10/2021

Le rapport de la mission d'information du Sénat sur la méthanisation publié la semaine dernière est « partial » et « apporte une caution douteuse » à cette pratique industrielle, a estimé mardi l'association Eau et Rivières de Bretagne qui réclame un « moratoire immédiat ».

Estimant que « beaucoup d'affirmations du rapport sont non démontrées, partielles, voire fausses », l'association considère que les avis d'experts indépendants ont été minorés au bénéfice de ceux émanant d'organismes impliqués dans le développement de la méthanisation.

« Loin de prendre appui sur les travaux de ces experts indépendants, les éléments retenus font entre autre la part belle aux avis de GRDF, du SER (syndicat des énergies renouvelables) et de Solagro (société qui propose, selon son site internet, une « expertise innovante au service des transitions énergétique, agroécologique et alimentaire », NDLR), organismes impliqués dans le développement de la méthanisation, ce qui ne manque pas de nous interroger sur les motivations de la mission », écrit l'association.

Liens : *Accès au document*

Veille Scientifique Agro et Impact

Examining the perspectives of using manure from livestock farms as fertilizer to crop fields based on a realistic simulation

Kamilaris, A., & Prenafeta-Boldu, F. X. (2021). Examining the perspectives of using manure from livestock farms as fertilizer to crop fields based on a realistic simulation. Computers and Electronics in Agriculture, 191, 15.

doi:10.1016/j.compag.2021.106486

Intensive livestock production has a negative environmental impact by producing large amounts of animal dejections, which, if not properly managed, can contaminate nearby water bodies with nutrient excess. However, if the animal manure could be transferred efficiently to nearby crops and used as a fertilizer for the plants, pollution/contamination would be mitigated, transforming manure from a waste to a resource. This valorization of manure from waste to a resource falls within the circular economy principles, but the transportation of manure also comes at an environmental and economic cost. It is a single-objective optimization problem regarding finding the best solution for the logistics process of satisfying nutrient crops needs through livestock manure. This paper uses a centralized optimal algorithm (COA) to solve the problem, based on a realistic simulator that considers numerous real-world constraints that related work has not yet addressed. Implementation and evaluation of this method have been carried out based on extensive geolocalized data from Catalonia (Spain), one of the densest European farming regions, as a case study. The findings show that the use of treatment units in pig farms is not profitable, while applying treatment units on selected cow farms for composting manure has its merits, under an intelligent choice of cow farms. Finally, a comparison of our findings with those of two similar studies in Hangzhou, China and Minnesota, USA, are performed.

Eight years organic amendment application alters N2O emission potential by increasing soil O-2 consumption rate

Wei, H. H., Liu, Y., Ju, X. T., & Wu, D. (2022). Eight years organic amendment application alters N2O emission potential by increasing soil O-2 consumption rate. Science of the Total Environment, 806, 9. doi:10.1016/j.scitotenv.2021.150466

Organic amendments are efficient measures that can be employed to increase both nitrogen use efficiency and soil organic carbon (SOC) content. However, the long-term effects of such measures on soil N2O emission and the associated underlying mechanisms are still unclear. Here, we sampled soils that were part of two long-term trials after eight years of different amounts and types of organic amendment addition, and investigated the response of soil N2O emissions to different types of mineral N addition under oxic condition. Further, we selected two soil samples with a large difference in SOC content and investigated the responses of soil CO2, N2O, NO, and N-2 emissions as well as O-2 consumption to NH4+, NO3-, and nitrification inhibitor addition under limited O-2 diffusion condition and anoxic condition. Results showed that long-term organic amendments significantly increased SOC content, while the stimulated effect on N2O and N-2 emissions owing to increased SOC contents was more pronounced with NH4+ addition under limited O-2 diffusion condition than under oxic or anoxic conditions. Further, in all treatments under limited O-2 diffusion condition, soil O-2 concentration and N2O production showed significant inverse relationships, suggesting that O-2 directly regulates N2O production. We speculated that the decrease in O-2 availability with higher SOC contents owing to enhanced soil respiration, instead of the increased supply of electron donors, is primarily responsible for the stimulated N2O emissions. This implied that practices which reduce limited O-2 diffusion conditions might help to minimize the stimulated N2O emissions from increased SOC content.

Manure-induced carbon retention measured from long-term field studies in Canada

Liang, C., Hao, X. Y., Schoenau, J., Ma, B. L., Zhang, T. Q., MacDonald, J. D., . . . Angers, D. (2021). Manure-induced carbon retention measured from long-term field studies in Canada. Agriculture Ecosystems & Environment, 321, 11.

doi:10.1016/j.agee.2021.107619

Accurate estimates of manure-induced carbon retention coefficients (MCR) in soil are required when assessing carbon (C) storage and the C footprint in agricultural production systems. Eight field studies using various types and rates of manure applications on different crop rotations with durations varying from 10 to 74 years were used to quantify MCRs across diverse climatic conditions in Canada. The rate of solid cattle and swine manure had no impact on MCR which averaged 26%, whereas the MCR for liquid manure, including swine and cattle liquid manures, was much

smaller, at only 5%. Under semi-arid conditions, irrigation had no impact on MCR. Compared to stockpiled manures, composted manure had a higher MCR (similar to 36%), due to the additional stabilization of C during the composting process. The MCRs can be effectively stratified based on the type of manure affecting soil organic C differently, and the approach has potential application in regional and national estimates of soil C storage in Canada and elsewhere.

Organic amendments affect soil organic carbon sequestration and fractions in fields with long-term contrasting nitrogen applications

Li, X. S., Zhu, W. L., Xu, F. Y., Du, J. L., Tian, X. H., Shi, J. L., & Wei, G. H. (2021). Organic amendments affect soil organic carbon sequestration and fractions in fields with long-term contrasting nitrogen applications. Agriculture Ecosystems & Environment, 322, 12. doi:10.1016/j.agee.2021.107643

Organic amendments are widely used to both manage soil organic C (SOC) and improve soil fertility in agroecosystems. However, crop production and the mechanisms of SOC sequestration following organic amendment may be affected by long-term differential N fertilizations, hence driving the dynamics in SOC fractions in cultivated fields. Our 3-yr (2016-2019) field experiment evaluated the responses of SOC sequestration and SOC fractions to organic amendments in soils with long-term contrasting N applications in a winter wheat monoculture system. We compared wheat straw return (St) and farmyard manure application (Fm) in soils with either long-term (2002-2019) N absence (-N) or normal N application (+N). Both St and Fm increased SOC stocks in the 0-20-cm layer, but Fm increased it more than St did. However, St exhibited a greater SOC sequestration rate in +N soils than that in -N soils, whereas Fm exhibited both a lower SOC sequestration rate and efficiency in +N soils than in -N soils. SOC increased across all fractions in all soils after both St and Fm. However, compared with -N soils, +N soils exhibited a lower SOC increase, specifically in the very labile fraction after St, but in the nonlabile fraction after Fm. St, Fm, and +N all increased the soil C management index (CMI), but only +N increased wheat yield and its sustainable yield index (SYI). Those relationships indicated that both straw and manure amendments were responsible for both SOC sequestration and increasing the CMI, and N input was fundamentally responsible for an increased SYI and associated plant-C input. Consequently, straw return was expected to be more effective at sequestering SOC when applied to soil having had adequate long-term N application, whereas farmyard manure application was likely more effective when applied in N-deficient soil. Our field study findings provide empirical evidence that soil N availability affects SOC sequestration capacities following organic amendments, and that impacts strategies aimed at further increasing soil fertility improvements via organic amendment, especially considering that different agro-ecosystems are subject to different fertilization regimes.

Effect of reduced exposed surface area and enhanced infiltration on ammonia emission from untreated and separated cattle slurry

Pedersen, J., Nyord, T., Feilberg, A., Labouriau, R., Hunt, D., & Bittman, S. (2021). Effect of reduced exposed surface area and enhanced infiltration on ammonia emission from untreated and separated cattle slurry. Biosystems Engineering, 211, 141-151. doi:10.1016/j.biosystemseng.2021.09.003

Ammonia (NH3) loss during field application of liquid manure (slurry) causes loss of nutrients for the crops and contributes to contamination of the environment. The emission can be mitigated by different low-emission application technologies and slurry treatment prior to application. It is assumed that a reduced area for air-slurry interaction will reduce the emission. The NH3 emission mitigation potential of technologies intended to reduce manure-air contact by reducing the exposed surface area (ESA) of the slurry or enhancing slurry infiltration was investigated for cattle slurry applied on grassland. Treatments tested were: 1) removing solids by solid-liquid separation of the slurry, 2) reduced ESA by narrow band application, and 3) application with a sub-surface-deposition (SSD) slurry application (creating aeration slots). For untreated cattle slurry NH3 emission was not reduced by reducing ESA, but application over aeration slots significantly decreased emission. However, reduced ESA by band application reduced emission from separated slurry compared to broadcast applied slurry, but no additional reduction was obtained by using the SSD technique. Lower emission was generally observed from separated slurry compared to untreated slurry for all application methods. This study shows that a reduction in NH3 emission is not necessarily obtained solely by reducing the ESA. It is hypothesized that rapid surface drying or crust formation of the untreated slurry in the relatively warm sunny conditions of these trials mitigated NH3 emission, thereby masking the effects of a reduced ESA. (C) 2021 The Author(s). Published by Elsevier Ltd on behalf of IAgrE.

Restoring nutrient circularity in a nutrient-saturated area in Germany requires systemic change

van der Wiel, B. Z., Weijma, J., van Middelaar, C. E., Kleinke, M., Buisman, C. J. N., & Wichern, F. Restoring nutrient circularity in a nutrient-saturated area in Germany requires systemic change. Nutrient Cycling in Agroecosystems, 18.

doi:10.1007/s10705-021-10172-3

Regions with intensive agriculture often encounter environmental problems caused by nutrient excess of agro-food-waste systems that have become increasingly linear over previous decades. In this study,

nitrogen (N), phosphorus (P), potassium (K) and carbon (C) flows in the whole agro-food-waste system of district Cleves in Germany were quantified simultaneously using substance flow analysis. Moreover, nutrient use inefficiency hotspots were identified to establish options to improve nutrient self-sufficiency as a first step towards nutrient circularity. Data on mass flows and nutrient contents was acquired for the year 2016 from stakeholders, statistical databases, literature and modelling. Organic C was included for flows with potential as organic fertilizer. Results show that animal production drives the nutrient flows in the export-oriented district, with feed import, manure application and losses from housing and manure storage accounting for 40, 45 and 60% of all N, P and K flows, respectively. In particular agriculture is responsible for N losses, with 150 kg N lost ha(-1) agricultural land. Crop production surplus and with that soil accumulation of P and K are 515 t and 4100 t respectively. Stoichiometry of N:P:K:C in the different organic materials does not allow direct application and meeting crop requirements without exceeding demand of especially P. Processing of biomass is therefore required. Based on mass, especially manure holds potential for processing into bio-based fertilizers. To improve nutrient cycling and soil C conservation, being an important element for a sustainable agricultural sector, local balances between crop and animal production need to be considered.

From wastewater to fertilizer products: Alternative paths to mitigate phosphorus demand in European countries

Santos, A. F., Almeida, P. V., Alvarenga, P., Gando-Ferreira, L. M., & Quina, M. J. (2021). From wastewater to fertilizer products: Alternative paths to mitigate phosphorus demand in European countries. Chemosphere, 284, 16.

doi:10.1016/j.chemosphere.2021.131258

Phosphorus (P) is a non-renewable resource, irreplaceable for life and food production, and currently considered a Critical Raw Material to the European Union (EU). Due to concerns about the rate of consumption and limited reserves in countries with sensitive geopolitical contexts, it is urgent to recover P from urban and industrial flows. Indeed, the municipal wastewater treatment plants (WWTP) are considered relevant sources with several hot spots, especially sewage sludge with estimated recovery efficiencies of >80%. The most promising recovery strategies are based on thermal treatments (e.g., incineration of sludge) following by wet-chemical or thermochemical leaching, precipitation, and adsorption. The direct application of sludge on soil is no longer a primary route for P reintegration in the value-chain for countries as Switzerland, Germany, and The Netherlands. In fact, Switzerland and Austria paved the way for implementing P recovery legislation, focusing on recovery from raw sewage sludge or ashes. Indeed, industrial technologies with sludge ash as input show high recovery efficiencies (Ashdec (R) and Leachphos (R) with 98 and 79%) and lower environmental impacts, whereas Pearl (R) technology has about 12% recovery efficiency with wastewater as input. After all, struvite emerges as the most recovered product with recent access to the internal market of EU fertilisers and similar growth performance compared to triple-super-phosphate. However, several studies leave open the possibility of introducing loaded adsorbents with P as soil amendments as a new alternative to conventional desorption. Briefly, P recovery should be a compromise between efficiency, environmental impacts, and economic revenues from the final products.

Do soil conservation practices exceed their relevance as a countermeasure to greenhouse gases emissions and increase crop productivity in agriculture

Shakoor, A., Dar, A. A., Arif, M. S., Farooq, T. H., Yasmeen, T., Shahzad, S. M., . . . Ashraf, M. (2022). Do soil conservation practices exceed their relevance as a countermeasure to greenhouse gases emissions and increase crop productivity in agriculture? Science of the Total Environment, 805, 12.

doi:10.1016/j.scitotenv.2021.150337

Globally, agriculture sector is the significant source of greenhouse gases (GHGs) emissions into the atmosphere. To achieve the goal of limiting or mitigating these emissions, a rigorous abatement strategy with an additional focus on improving crop productivity is now imperative. Replacing traditional agriculture with soil conservation-based farming can have numerous ecological benefits. However, most assessments only consider improvements in soil properties and crop productivity, and often preclude the quantitative impact analysis on GHGs emissions. Here, we conducted a meta-analysis to evaluate crop productivity (i.e., biomass, grain, total yield) and GHGs emissions (i.e., CO2, N2O, CH4) for three major soil conservation practices i.e., no-tillage, manures, and biochar. We also examined the yield potential of three major cereal crops (i.e., wheat, rice, maize) and their significance in mitigating GHGs emissions. None of the manures were able to reduce GHGs emissions, with poultry manure being the largest contributor to all GHGs emissions. However, pig-manure had the greatest impact on crop yield while emitting the least CO2 emissions. Use of biochar showed a strong coupling effect between reduction of GHGs (i.e., CH4 by -37%; N2O by -25%; CO2 by -5%) and the increase in crop productivity. In contrast, no-tillage resulted in higher GHGs emissions with only a marginal increase in grain yield. Depending on crop type, all cereal crops showed varied degrees of GHGs mitigation under biochar application, with wheat responding most strongly due to the additional yield increment. The addition of biochar significantly reduced CO2 and N2O emissions under both rainfed and irrigated conditions, although CH4 reductions were identical in both agroecosystems. Interestingly, the use of biochar resulted in a greater yield benefit in rainfed than in irrigated agriculture. Despite significant GHGs emissions, manure application contributed to higher

crop yields, regardless of soil type or agroecosystem. Moreover, no-tillage showed a significant reduction in CH4 and N2O emissions under rainfed and irrigated conditions. Notably , biochar application in coarse while no-till in fine textured soils contributed to N2O mitigation. Most importantly, effectiveness of no-tillage as a countermeasure to GHGs emissions while providing yield benefits is inconsistent. Overall, the decision to use farm manures should be reconsidered due to higher GHGs emissions. We conclude that the use of biochar could be an ideal way to reduce GHGs emissions. However, further understanding of the underlying mechanisms and processes affecting GHGs emissions is needed to better understand the feedback effects in conservation agriculture. (C) 2021 Elsevier B.V. All rights reserved.

Strategies to mitigate ammonia and nitrous oxide losses across the manure management chain for intensive laying hen farms

Rosa, E., Arriaga, H., & Merino, P. (2022). Strategies to mitigate ammonia and nitrous oxide losses across the manure management chain for intensive laying hen farms. Science of the Total Environment, 803, 10. doi:10.1016/j.scitotenv.2021.150017

Circular economy principle aims to achieve sustainable production systems, focusing on the waste valorisation and the reduction of gaseous losses to the atmosphere. Nitrogen (N) compounds in terms of ammonia (NH3) and nitrous oxide (N2O) represent the major losses to the atmosphere of laying hen manure management chain. We present a study aimed to evaluate NH3 and N2O emission and mitigation strategies at housing, storage and land spreading stages. The whole manure management chain was evaluated under different scenarios which combined mitigation strategies of each stage. Two intensive laying hen facilities were involved in the study. Evaluated mitigation strategies were: (i) frequency of manure removal from housing facility, (ii) dried manure storage after passing throughout a manure drying tunnel (MDT) compared to fresh manure storage and (iii) fresh or dried manure incorporation versus surface land application. Increasing the frequency of manure removal from 4 days to 1/3 daily, reduced N losses around 68%. Dried manure storage achieved around 75% reduction in N losses compared to fresh manure storage. Spreading dried manure on grassland surface reduced approximate to 77% NH3 losses in relation to the emission level reached by fresh manure. The reduction was similar when dried manure was incorporated compared to surface application of fresh manure (approximate to 79%). A 40% reduction in N losses was achieved using the MDT compared to no drying strategy. In the whole manure management chain, the combination of strategies that most reduced N losses was: removal frequency of 1/3 daily, dry storage after passing through the MDT and incorporated land application. These strategies reduced N losses between 40 and 60% compared to the 4 days of removal frequency, fresh storage and surface application of fresh manure.

Manure management and soil biodiversity: Towards more sustainable food systems in the EU

Koninger, J., Lugato, E., Panagos, P., Kochupillai, M., Orgiazzi, A., & Briones, M. J. I. (2021). Manure management and soil biodiversity: Towards more sustainable food systems in the EU. Agricultural Systems, 194, 24.

doi:10.1016/j.agsy.2021.103251

CONTEXT: In the European Union (EU-27) and UK, animal farming generated annually more than 1.4 billion tonnes of manure during the period 2016–2019. Of this, more than 90% is directly re-applied to soils as organic fertiliser. Manure promotes plant growth, provides nutritious food to soil organisms, adds genetic and functional diversity to soils and improves the chemical and physical soil properties. However, it can also cause pollution by introducing toxic elements (i.e., heavy metals, antibiotics, pathogens) and contribute to nutrient losses. Soil organisms play an essential role in manure transformation into the soil and the degradation of any potential toxic constitutes; however, manure management practices often neglect soil biodiversity.

OBJECTIVE: In this review, we explored the impact of manure from farmed animals on soil biodiversity by considering factors that determine the effects of manure and vice versa. By evaluating manure's potential to enhance soil biodiversity, but also its environmental risks, we assessed current and future EU policy and legislations with the ultimate aim of providing recommendations that can enable a more sustainable management of farm manures.

METHODS: This review explored the relationship between manure and soil biodiversity by considering 407 published papers and relevant legislative provisions. In addition, we evaluated whether benefits and risks on soil biodiversity are considered in manure management. Thereafter, we analysed the current legislation in the European Union relevant to manure, an important driver for its treatment, application and storage.

RESULTS AND CONCLUSIONS: This review found that coupling manure management with soil biodiversity can mitigate present and future environmental risks. Our analyses showed that manure quality is more important to soil biodiversity than manure quantity and therefore, agricultural practices that protect and promote soil biodiversity with the application of appropriate, high-quality manure or biostimulant preparations based on manure, could accelerate the move towards more sustainable food production systems. Soil biodiversity needs to be appropriately factored in when assessing manure amendments to provide better guidelines on the use of manure and to reduce costs and environmental risks. However, radical changes in current philosophies and practices are needed so that

soil biodiversity can be enhanced by manure management.

SIGNIFICANCE: Manure quality in the EU requires greater attention, calling for more targeted policies. Our proposed approach could be applied by European Union Member States to include soil protection measures in national legislation, and at the EU level, can enable the implementation of strategic goals.

The potential for enhancing soil carbon levels through the use of organic soil amendments in Queensland, Australia

Biala, J., Wilkinson, K., Beverley, H., Singh, S., Joshua, B. J., & De Rosa, D. (2021). The potential for enhancing soil carbon levels through the use of organic soil amendments in Queensland, Australia. Regional Environmental Change, 21(4), 15.

doi:10.1007/s10113-021-01813-y

Application of organic amendments such as livestock manures and compost is commonly listed amongst strategies with potential to sequester soil organic carbon (SOC) in agriculture and contribute to climate change mitigation. However, quantifying this potential is hampered by the paucity of data on amounts and characteristics of organic amendments applied to land, and limited understanding of the carbon dynamics during storage, processing and following land application. The objective of this study was to evaluate this potential for the State of Queensland, Australia, by collating and analysing information on organic amendments and modelling SOC sequestration in illustrative cropping locations. An estimated 2.7 million tonnes (Mt) dry matter (dm) of organic amendments has likely been land applied in Queensland in 2015/16, supplying significant quantities of carbon (C) to the soil. Simulations with Australia's national inventory modelling tool predicted that, in a favourable location, high annual applications of manure and compost (10 t / 15 t fresh matter (fm) per hectare and year (ha(-1) yr(-1)) could result in SOC increases of 0.9% and 0.55%, respectively, per year averaged over 20 years of continuous cropping, exceeding the aspirational goal of the United Nations Framework Convention on Climate Change 4 per 1000 Initiative. In less favourable conditions, C stocks may continue to decline but at a slower rate than without organic amendments. Based on regional analysis and review of current understanding of the dynamics of organic matter in soils, we identified a set of research priorities to enable more accurate assessments of the C sequestration potential to support development of policies and frameworks for use of organic amendments in agricultural soils for climate, food security and waste management benefits.

Recirculating treated sewage sludge for agricultural use: Life cycle assessment for a circular economy

Aleisa, E., Alsulaili, A., & Almuzaini, Y. (2021). Recirculating treated sewage sludge for agricultural use: Life cycle assessment for a circular economy. Waste Management, 135, 79-89. doi:10.1016/j.wasman.2021.08.035

The objective of this study is to assess the environmental value of recirculating nutrients from treated sewage sludge by application to agricultural soils to grow forage as opposed to landfilling and incineration. The methodological choices are aligned to the circular economy framework using life cycle assessment. Consequential modeling and open loop modeling were adopted and adhere to ISO 14044 and International Reference Life Cycle Data System (ILCD) standards. The functional unit is defined in terms of the amounts of nitrogen (N), phosphorus (P) and potassium (K) recirculated from the treated sewage sludge produced annually in Kuwait. The results indicate a reduction in environmental burden with respect to fossil fuel depletion, metal depletion and climate change. A total of 95% of the reduction is realized by avoiding virgin nitrogen production and instead using its recirculated counterpart. Considerable amounts of natural gas, coal, dinitrogen monoxide (nitrous oxide, N2O) and copper are consumed during virgin N fertilizer production.

Manure management and soil biodiversity: Towards more sustainable food systems in the EU

Koninger, J., Lugato, E., Panagos, P., Kochupillai, M., Orgiazzi, A., & Briones, M. J. I. (2021). Manure management and soil biodiversity: Towards more sustainable food systems in the EU. Agricultural Systems, 194. doi:10.1016/j.agsy.2021.103251

CONTEXT : In the European Union (EU-27) and UK, animal farming generated annually more than 1.4 billion tonnes of manure during the period 2016–2019. Of this, more than 90% is directly re-applied to soils as organic fertiliser. Manure promotes plant growth, provides nutritious food to soil organisms, adds genetic and functional diversity to soils and improves the chemical and physical soil properties. However, it can also cause pollution by introducing toxic elements (i.e., heavy metals, antibiotics, pathogens) and contribute to nutrient losses. Soil organisms play an essential role in manure transformation into the soil and the degradation of any potential toxic constitutes; however, manure management practices often neglect soil biodiversity.

OBJECTIVE : In this review, we explored the impact of manure from farmed animals on soil biodiversity by considering factors that determine the effects of manure and vice versa. By evaluating manure's potential to enhance soil biodiversity, but also its environmental risks, we assessed current and future EU policy and legislations with the ultimate aim of providing

recommendations that can enable a more sustainable management of farm manures.

METHODS :This review explored the relationship between manure and soil biodiversity by considering 407 published papers and relevant legislative provisions. In addition, we evaluated whether benefits and risks on soil biodiversity are considered in manure management. Thereafter, we analysed the current legislation in the European Union relevant to manure, an important driver for its treatment, application and storage.

RESULTS AND CONCLUSIONS :This review found that coupling manure management with soil biodiversity can mitigate present and future environmental risks. Our analyses showed that manure quality is more important to soil biodiversity than manure quantity and therefore, agricultural practices that protect and promote soil biodiversity with the application of appropriate, high-quality manure or biostimulant preparations based on manure, could accelerate the move towards more sustainable food production systems. Soil biodiversity needs to be appropriately factored in when assessing manure amendments to provide better guidelines on the use of manure and to reduce costs and environmental risks. However, radical changes in current philosophies and practices are needed so that soil biodiversity can be enhanced by manure management.

SIGNIFICANCE : Manure quality in the EU requires greater attention, calling for more targeted policies. Our proposed approach could be applied by European Union Member States to include soil protection measures in national legislation, and at the EU level, can enable the implementation of strategic goals.

Veille Scientifique Contamination

Environmental impacts of livestock excreta under increasing livestock production and management considerations: Implications for developing countries

Cai, Y., Tang, R., Tian, L., & Chang, S. X. (2021). Environmental impacts of livestock excreta under increasing livestock production and management considerations: Implications for developing countries. Current Opinion in Environmental Science & Health, 24. doi:10.1016/j.coesh.2021.100300

Increased livestock production under increasing global human population and wealth results in increased discharge of livestock excreta, which may cause more greenhouse gas and ammonia emissions. In addition, heavy metals, residual antibiotics, and pathogens contained in excreta may impose biosafety risks in its utilization. Technologies such as anaerobic digestion, composting and pyrolysis of excreta can improve the biosecurity in utilization, while diet manipulation for livestock, amending inhibitors and optimizing manure applications are some of the strategies to use to reduce greenhouse gas and ammonia emissions from excreta application. Novel excreta processing technologies and effective mitigation practices will need to be developed to sustainably manage excreta and minimize the environmental health hazards in the land application of livestock excreta.

Multiple driving factors contribute to the variations of typical antibiotic resistance genes in different parts of soil-lettuce system

Wen, X., Xu, J., Xiang, G., Cao, Z., Yan, Q., Mi, J., . . . Wu, Y. (2021). Multiple driving factors contribute to the variations of typical antibiotic resistance genes in different parts of soil-lettuce system. Ecotoxicology and Environmental Safety, 225. doi:10.1016/j.ecoenv.2021.112815

The application of manure compost may cause the transmission of antibiotic resistance genes (ARGs) in agroecological environment, which poses a global threat to public health. However, the driving factors for the transmission of ARGs from animal manure to agroecological systems remains poorly understood. Here, we explored the spatiotemporal variation in ARG abundance and bacterial community composition as well as relative driving factors in a soil-lettuce system amended with swine manure compost. The results showed that ARGs abundance had different variation trends in soil, lettuce phylloplane and endophyere after the application of swine manure compost. The temporal variations of total ARGs abundance had no significant different in soil and lettuce phylloplane, while lettuce endosphere enriched half of ARGs to the highest level at harvest. There was a significant linear correlation between ARGs and integrase genes (IGs). In contrast to the ARGs variation trend, the alpha diversity of soil and phylloplane bacteria showed increasing trends over planting time, and endosphere bacteria remained stable. Correlation analysis showed no identical ARG-related genera in the three parts, but the shared Proteobacteria, Pseudomonas, Halomonas and Chelativorans, from manure compost dominated ARG profile in the soil-lettuce system. Moreover, redundancy analysis and structural equation modelling showed the variations of ARGs may have resulted from the combination of multiple driving factors in soil-lettuce system. ARGs in soil were more affected by the IGs, antibiotic and heavy metals, and bacterial community structure and IGs were the major influencing factors of ARG profiles in the lettuce. The study provided insight into the multiple driving factors contribute to the variations of typical ARGs in different parts of soil-lettuce system, which was conducive to the risk assessment of ARGs in agroecosystem and the development of effective prevention and control measures for ARGs spread in the environment.

Effect of pig manure-derived sulfadiazine on species distribution and bioactivities of soil ammonia-oxidizing microorganisms after fertilization

Li, J., Yang, H., Qin, K., Wei, L., Xia, X., Zhu, F., . . . Zhao, Q. (2022). Effect of pig manure-derived sulfadiazine on species distribution and bioactivities of soil ammonia-oxidizing microorganisms after fertilization. Journal of Hazardous Materials, 423.

doi:10.1016/j.jhazmat.2021.126994

To evaluate the effect of pig manure-derived sulfadiazine (SDZ) on the species distribution and bioactivities of ammonia-oxidizing microorganisms (AOMs), ammonia-oxidizing bacteria (AOB), ammonia-oxidizing archaea (AOA) and complete ammonia oxidizer (comammox) within the soil were investigated pre- and post-fertilization. Kinetic modeling and linear regression results demonstrated that the DT50 value of different SDZ fractions under initial SDZ concentrations of 50 and 100 mg·kg−1 exhibited the following trend: total SDZ>CaCl2-extractable SDZ>MeOH-extractable SDZ, whereas their inhibiting effect on AOMs showed an opposite trend. qPCR analysis suggested that comammox was the predominant ammonia oxidizer in soils regardless of SDZ addition, accounting for as much as 77.2–94.7% of the total amoA, followed by AOA (5.3–22.5%), whereas AOB (<0.5%) was the lowest. The SDZ exhibited a significant effect on the AOM abundance. Specifically, SDZ exerted the highest inhibitory effect on comammox growth, followed by AOA, whereas negligible for AOB. The community diversity of AOMs within the pig manure-fertilized soils was affected by SDZ, and AOA Nitrososphaera cluster 3 played a key role in potential ammonia oxidation capacity (PAO) maintenance. This study provides new insights into the inhibition mechanisms of pig manure-derived antibiotics on AOMs within the fertilized soil.

Changes in potentially toxic element concentration and potential ecological risk in topsoil caused by sewage sludge application on forestland: A 3-year field trial

Chu, S., Yang, W., Xia, D., Liang, Z., Su, S., Zhao, N., . . . Zeng, S. (2021). Changes in potentially toxic element concentration and potential ecological risk in topsoil caused by sewage sludge application on forestland: A 3-year field trial. Forest Ecology and Management, 500. doi:10.1016/j.foreco.2021.119657

Sewage sludge (SS) application on forest plantation soils as a fertilizer/soil amendment is increasingly becoming a forestry management measure. However, the potential risk of SS-derived potentially toxic elements (PTEs) is still a cause for concern. This research was carried out to evaluate PTEs behavior in SS applied as an amendment for forestland application purposes. Speciation and transformation perspectives on residual effects during a 3-year field experiment were evaluated. Sewage sludge was applied to soils under Eucalyptus urophylla S.T. Blake, Schima superba Gardn. et Champ, and Pinus elliottii Engelm plantations at 30 Mg.ha(-1) (dry weight). We investigated the total concentrations of Cu, Zn, Pb, Cd, and Ni, as well as their concentrations of five fractions: exchangeable (F1), bound to carbonates (F2), Fe-Mn oxides (F3), organic matter (F4), and residual (F5) along with the 0-10 cm of a surface A horizon (topsoil) one day, one, two, and three years after SS application, respectively. Sewage sludge caused significant increase in PTEs total concentrations and proportion of fraction F1 or F2. The mobility index and potential ecological risk confirmed that the risk was linked to the presence of these PTEs, especially for Cd. The total concentration and corresponding ecological risks of PTEs in most cases decreased, suggesting a potential loss of PTEs from the topsoil system. The percentage of all PTEs in fractions F1-F4 decreased and that in F5 increased with time. These results illustrate that the residual and mobility of PTEs in the topsoil during SS utilization was lower than expected and more attention should be paid to the risk of PTEs transferring to other environments.

Transformation of Silver Nanoparticles (AgNPs) during Lime Treatment of Wastewater Sludge and Their Impact on Soil Bacteria

Abdulsada, Z., Kibbee, R., Princz, J., DeRosa, M., & Ormeci, B. (2021). Transformation of Silver Nanoparticles (AgNPs) during Lime Treatment of Wastewater Sludge and Their Impact on Soil Bacteria. Nanomaterials, 11(9). doi:10.3390/nano11092330

This study investigated the impact of lime stabilization on the fate and transformation of AgNPs. It also evaluated the changes in the population and diversity of the five most relevant bacterial phyla in soil after applying lime-stabilized sludge containing AgNPs. The study was performed by spiking an environmentally relevant concentration of AgNPs (2 mg AgNPs/g TS) in sludge, applying lime stabilization to increase pH to above 12 for two hours, and applying lime-treated sludge to soil samples. Transmission electron microscopy (TEM) and energy-dispersive X-ray spectroscopy (EDS) were used to investigate the morphological and compositional changes of AgNPs during lime stabilization. After the application of lime stabilized sludge to the soil, soil samples were periodically analyzed for total genomic DNA and changes in bacterial phyla diversity using quantitative polymerase chain reaction (qPCR). The results showed that lime treatment effectively removed AgNPs from the aqueous phase, and AgNPs were deposited on the lime molecules. The results revealed that AgNPs did not significantly impact the presence and diversity of the assessed phyla in the soil. However, lime stabilized sludge with AgNPs affected the abundance of each phylum over time. No significant effects on the soil total organic carbon (TOC), heterotrophic plate count (HPC), and percentage of the live cells were observed.

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