INRAE cirad

Veille sur les Produits Résiduaires Organiques

Bulletin de veille ValOr Pro N°34 - 2022

SOERE-PRO

L'Observatoire de recherche Produits résiduaires organiques propose les actualités sélectionnées par l'équipe de veille ValOr Pro.
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Site Web L'Observatoire de recherche Produits résiduaires organiques
https://www6.inrae.fr/valor-pro/

Appels à projets et à communications

Lancement d'un appel à projets pour la valorisation des biodéchets

FNCCR.asso.fr, 24/01/2022

L'Agence des économies solidaires, GRDF et la FNCCR lancent un appel à projets en vue de soutenir la valorisation des biodéchets, via la méthanisation, au profit du développement durable des territoires. Cet appel à projets s'adresse ainsi aux collectivités locales ou groupements (régions, départements, syndicats, ...). Les porteurs de projet peuvent déposer leur candidature jusqu'au 25 mars 2022.

Liens : *Accès au document*

Colloques, journées, webinaires

La prise en compte des polluants émergents dans les eaux destinées à la consommation humaine (EDCH) ? - Webinaire

Astee, Le 1/02/2022

La Commission Eau Potable de l'Astee et la Direction générale de la santé (DGS) ont organisé en février 2021 un webinaire sur la Directive eau potable 2020/2184 et ses principaux axes d'évolution (événement disponible en replay ici).

Afin de donner suite à cet événement, un webinaire sur la prise en compte des polluants émergents dans les eaux destinées à la consommation humaine (EDCH) a été organisé le mardi 1er février 2022, de 9h à 11h.

Liens : *Accès au document*

Analyse du cycle de vie du biométhane agricole - "Quels impacts sur l'environnement ? " – Webinaire

Webinaire du 25 janvier 2022. Organisateur : Solagro, INRAE Transfert

INRAE Transfert et Solagro ont souhaité mettre en parallèle leurs travaux sur les impacts environnementaux et agronomiques des nouvelles pratiques agricoles constatées à la mise en place d'un méthaniseur. Ces travaux croisés ont permis de comparer les impacts sur les systèmes agricoles en grandes cultures et en élevage et de préciser les conditions nécessaires à la mise en place d'une méthanisation réussie et des pratiques associées.

Liens : *Accès au document*

Expobiogaz 2021

Atee, 25/01/2022

Expobiogaz, salon national du gaz renouvelable, c'est le rendez-vous de référence en France qui traite l'ensemble des solutions pour la production et la valorisation du gaz renouvelable ...

Liens : *Accès au document*

JRI Biogaz et Méthanisation 2022 à Lyon

Atee, 24/01/2022

La prochaine édition des Journées Recherche Innovation biogaz méthanisation se déroulera à Lyon du 15 au 17 mars 2022. 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 partagés au travers des présentations, tables rondes et moments d'échange. Cet événement est organisé par le Centre Technique national du Biogaz et de la Méthanisation de l'ATEE (CTBM) en partenariat avec l'INSA Lyon.

Liens : *Accès au document*

Journée thématique 2022 - COMIFER

Le COMIFER organise le 12 avril 2022 un webinaire en distanciel sur le thème "Oligo-éléments et contaminants métalliques en agriculture : quelle réponse face aux enjeux agronomiques, sanitaires, environnementaux ?"

Liens : *Accès au document*

Ouvrages Rapports Actes Thèses

MéthaFrance, le portail national d'information grand public sur la méthanisation

Bioenergie-promotion.fr, 24/01/2022

A l'occasion du Groupe National d'échanges sur le biogaz organisé le le 18 janvier 2022 par le Ministère français de la Transition écologique, le Syndicat français des énergies renouvelables lance MéthaFrance, le portail national

d'information grand public dédié à la méthanisation. Dans le cadre d'un mandat confié par les pouvoirs publics, le contenu de ce portail national a été élaboré de manière collective par un comité de pilotage qui réunit de nombreux contributeurs. Le portail MéthaFrance est consultable à ce lien : *www.methafrance.fr*

Liens : *Accès au document*

Restitution des résultats du programme de recherche national sur les CIVE - RECITAL

Aile.asso.fr, 19/01/2022

Dans le cadre de RECITAL, programme de recherche national sur les CIVE, l'association AILE et Arvalis ont restitué à 12 agriculteurs les premiers résultats expérimentaux : le partage des avancées et résultats techniques sur CIVE d'hiver, la restitution des évaluations économiques à l'échelle de la parcelle et de l'unité de méthanisation, et les résultats des évaluations environnementales.

Le support de la présentation technique et le support de la présentation technico-économique et environnementale sont téléchargeables.

Liens : *Accès au document*

La librairie ADEME propose 3 nouveaux guides Méthanisation

Librairie.ademe, 20/01/2022

Trois nouveaux guides Méthanisation sont disponibles au téléchargement gratuit sur la page de la librairie ADEM, Collection *Cahiers des Charges d'aide à la décision.2022*

- Étude territoriale pour développer la méthanisation
- Étude de faisabilité d'une unité de méthanisation
- Assistance à maitrise d'ouvrage (AMO) d'une unité de méthanisation
-

Liens : *Accès au document*

Analyse de la version N°2 Projet Socle Commun des MFSC - RIPSO

Ripso.org, 25/01/2022

Présentée à l'issue de l'AGO 2021 du RISPO à Lyon le 17/12/2021, l'analyse de Jean Luc MARTEL, secrétaire du RISPO sur « la version n°2 du projet socle commun des MFSC, les évolutions constatées et les réactions des professionnels » est mise en ligne avec un accès public. Après avoir exposé les principaux enseignements de l'étude d'impact réalisée par RITTMO pour le Ministère de l'Agriculture, cette note très documentée analyse les réactions des associations et fait le bilan de la réunion du 7/12/2021 entre le Ministère, l'ANSES et les parties prenantes.

Liens : *Accès au document*

INRAE Publications

INRAE et GRDF poursuivent leurs travaux au service d'une méthanisation agricole durable

Inrae.fr, 24/01/2022

Communique de presse - Le 27 février, à l'occasion du Salon international de l'agriculture, Philippe Mauguin, président directeur général d'INRAE et Édouard Sauvage, directeur général de GRDF, ont signé un nouvel accord-cadre visant à favoriser l'insertion de la méthanisation dans les pratiques agro-écologiques. Ce renouvellement de partenariat pour une durée de 5 ans, a notamment pour but d'accompagner la filière agricole dans le développement de cultures intermédiaires multi-services ou à vocation énergétique.

INRAE et GRDF réaffirment leur volonté commune de valoriser le biométhane et d'accompagner les agriculteurs, de la production à l'injection du gaz vert dans le réseau de distribution.

Liens : *Accès au document*

life cycle assessment of agri-food systems – Ouvrage QUAE éditions

life cycle assessment of agri-food systems. An operational guide dedicated to emerging and developing economies. Claudine Basset-Mens, Angel Avadí, Cécile Bessou, Ivonne Acosta-Alba, Yannick Biard, Sandra Payen. Edition Quae, Collection : Savoir faire Janvier 2022. 210 pages.

Abstract: Life Cycle Assessment (LCA) is the internationally recognized method to assess the environmental impacts of products and services. Its application to agri-food systems in developing or emerging contexts is recent and represents many challenges of scientific, partnerial and operational nature. With more than 10 years of scientific and field experience, the CIRAD LCA team has synthesized, with other internationally recognized experts, the best knowledge and approaches available to apply LCA under these conditions. This operational guide is a useful tool for LCA practitioners; it provides best practice recommendations to carry out LCA studies on

agri-food products in developing and emerging contexts.

Liens : *Accès au document*

Réseau SOERE PRO

A robust initialization method for accurate soil organic carbon simulations

Kanari, E., Cécillon, L., Baudin, F., Clivot, H., Ferchaud, F., Houot, S., Levavasseur, F., Mary, B., Soucémarianadin, L., Chenu, C., and Barré, P.: A robust initialization method for accurate soil organic carbon simulations, Biogeosciences, 19, 375–387, DOI : 10.5194/bg-19-375-2022, 2022.

Abstract: Changes in soil organic carbon (SOC) stocks are a major source of uncertainty for the evolution of atmospheric CO2 concentration during the 21st century. They are usually simulated by models dividing SOC into conceptual pools with contrasted turnover times. The lack of reliable methods to initialize these models, by correctly distributing soil carbon amongst their kinetic pools, strongly limits the accuracy of their simulations. Here, we demonstrate that PARTYSOC, a machine-learning model based on Rock-Eval® thermal analysis, optimally partitions the active- and stable-SOC pools of AMG, a simple and well-validated SOC dynamics model, accounting for effects of soil management history. Furthermore, we found that initializing the SOC pool sizes of AMG using machine learning strongly improves its accuracy when reproducing the observed SOC dynamics in nine independent French long-term agricultural experiments. Our results indicate that multi-compartmental models of SOC dynamics combined with a robust initialization can simulate observed SOC stock changes with excellent precision. We recommend exploring their potential before a new generation of models of greater complexity becomes operational. The approach proposed here can be easily implemented on soil monitoring networks, paving the way towards precise predictions of SOC stock changes over the next decades.

Liens : *Accès au document*

A global overview of studies about land management, land-use change, and climate change effects on soil organic carbon

Beillouin, D., Cardinael, R., Berre, D., Boyer, A., Corbeels, M., Fallot, A., . . . Demenois, J. (2022). A global overview of studies about land management, land-use change, and climate change effects on soil organic carbon. Global Change Biology, 28(4), 1690-1702 DOI: *https://doi.org/10.1111/gcb.15998*.

Varying Effects of Organic Waste Products on Yields of Market Garden Crops in a 4-Year Field Experiment under Tropical Conditions

Diallo, F., Legros, S., Diarra, K., & Feder, F. (2022). Varying Effects of Organic Waste Products on Yields of Market Garden Crops in a 4-Year Field Experiment under Tropical Conditions. Agronomy, 12(1), 32.

DOI : 10.3390/agronomy12010032

Abstract: Controlling organic and mineral fertilisation is a major concern in tropical environments. An experiment was conducted on an arenosol in the Dakar region, the main market gardening area of Senegal, to evaluate treatments commonly used by farmers. Seven treatments were repeated three times: A mineral fertilisation (MF) treatment based on N-P2O5-K2O (10-10-20), and three organic treatments at two doses (dried sewage sludge (SS), poultry litter (PL) and a digestate from an anaerobic digestion (AD) of cow manures). Each of the organic treatments were supplemented with a normal dose (1) and a double dose (2) of mineral N and K fertiliser. A lettuce, carrot and tomato rotation was grown in four campaigns (2016–2020) on all of the plots. Yields of all three crops in all of the organic treatments were statistically similar ($p > 0.05$) to the MF in all four campaigns, except for the yield of the lettuce crop under treatment PL-2 in campaigns 2 and 3. The tomato yields were statistically similar under all of the organic treatments in all four campaigns. In contrast, the yields of the lettuce and carrot crops differed statistically from each other and under the different organic treatments in all four campaigns. The yields of all three crops differed in the campaigns with the fertilisation treatment. In each campaign, the yields of each crop were not correlated with the total amounts of N, P and K applied. These differences or similarities in yields are explained by the nature of the organic waste products, the accumulation of nutrients after several applications, the type of crop and interannual differences in temperature.

Liens : *Accès au document*

Prediction of organic matter accessibility and complexity in anaerobic digestates

Fernández-Domínguez, D., Patureau, D., Houot, S., Sertillanges, N., Zennaro, B., & Jimenez, J. (2021). Prediction of organic matter accessibility and complexity in anaerobic digestates. Waste Management, 136, 132-142

DOI: 10.1016/j.wasman.2021.10.004.

Abstract: Further characterization to properly assess the fate of organic matter quality during anaerobic digestion and organic carbon mineralization in soils is required. Organic matter quality based on its accessibility and complexity was employed to successfully classify 28 substrate/digestate pairs through principal components and hierarchical clustering analysis. The two first components explained 58.02% of the variability and four main groups were separated according to the feedstock type. A decrease in the accessibility (16–66%) and an increase in the complexity (34–98%) of the most accessible fractions was noticed. Besides, an increase of non-biodegradable compounds (17–66%) was globally observed after anaerobic digestion. The observed trends in the conversion of organic matter during anaerobic digestion have allowed to fill the gap in the modeling of the anaerobic digestion process chain. Indeed, partial least squares regressions have accurately predicted the organic matter quality of digestates from their inputs (R2 = 0.831, Q2 = 0.593) although the digester operational conditions (temperature and hydraulic retention time) were non-explicative enough. As a novel approach, the predicted digestate quality was used to feed a partial least squares regression model previously developed to predict organic carbon mineralization in soil. The combined models have predicted experimental organic carbon mineralization in soil (R2 = 0.697) with a model quality similar to the model for organic carbon mineralization in soil (R2 = 0.894). This is the first study that has successfully conceived an additional step in the prediction of organic matter fate from raw substrate before anaerobic digestion to soil carbon mineralization.

Thèse - Conséquences de l'introduction de la méthanisation dans une exploitation de polyculture-élevage sur les cycles du carbone et de l'azote.

Moinard, V. (2021). Consequences of the anaerobic co-digestion of cattle effluents in a crop livestock farm on carbon and nitrogen cycles. Combination of experimentation and of modelling at the farm scale

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. Université Paris-Saclay, Retrieved from https://pastel.archives-ouvertes.fr/tel-03485490 Star

Les PRO dans la presse

Nantes : La collecte séparée des déchets alimentaires sera imposée dans toute la métropole

20minutes.fr, 03/01/2022

"Ce n'est pas le sujet le plus sexy qui soit. Mais il concerne l'ensemble des habitants."

Le traitement des ordures ménagères va faire l'objet d'un budget d'investissement important de la part de la métropole Nantaise, avec l'Objectif de recycler 65 % des déchets ménagers et de réduire leur volume de 20 %. Depuis un an, une collecte séparée des épluchures, reste d'assiettes et denrées périmées est expérimentée par 1.650 familles au nord de Nantes. Les habitants sont invités à vider leurs biodéchets dans un point de collecte collectif proche de chez eux pour que ces déchets organiques ne soient plus incinérés mais « valorisés » en compost pour « nourrir le sol et les cultures ». Forte de la réussite de cette démarche et pressée par la *réglementation nationale*, la métropole compte élargir ce dispositif à l'ensemble de la ville de Nantes en 2023-2024, puis à la métropole d'ici à 2026. Les points d'apport volontaire seront multipliés et le compost produit sera utilisé pour enrichir les espaces verts de la métropole et revendu à des « agriculteurs du territoire ».

Liens : *Accès au document*

Déchets : comprendre pourquoi il faut faire mieux en 5 points

Estrepublicain.fr, 03/01/2022

Les habitants du Grand Verdun ont encore des efforts à faire concernant les déchets, avec 5 000 tonnes de déchets tous flux confondus récoltées sur une année, dont 6 800 tonnes d'OMR (ordures ménagères résiduelles) et 5 800 tonnes déposées en déchetterie. Ceci représente 500 kg/an/habitant, dont 245 kg/an/habitant d'OMR, soit une baisse de 4 % depuis 2015. Deux tiers de ce qui est jeté dans les sacs noirs est recyclable. Environ 1 000 tonnes de déchets sont récoltées sur l'année avec le tri sélectif, ce qui représente

36 kg/an/habitant, alors que la moyenne Grand-Est est de 56 kilos. Pour réduire le coût, il faut réduire le poids des OMR qui finissent à l'enfouissement, notamment en excluant les déchets alimentaires (biodéchets) des sacs noirs. Dès janvier 2022, l'Agglo va ainsi tester la collecte des biodéchets en apport volontaire dans des abris bacs mis à disposition qui seront ensuite récoltés par Suez en vue de produire du biogaz.

Liens : *Accès au document*

Méthaniseur XXL : MéthaHerbauges propose d'interdire le passage des poids lourds entre Paulx et La Bénate

Actu.fr, 24/12/2022

Les porteurs du projet de méthaniseur XXL prévu au sud de la Loire-Atlantique ont présenté un plan routier pour interdire la circulation des poids lourds sur la RD 263, entre Paulx et La Bénate. Au cours de cette réunion, les collectifs opposés à l'unité XXL ont rappelé que le Département avait émis un avis défavorable au projet, estimant « incompatible avec les infrastructures routières existantes ». Les porteurs ont également présenté les avantages du méthaniseur XXL traitant près de 500 000 tonnes (le comparant à la construction de dix méthaniseurs de 50 000 tonnes chacun), pour le foncier, pour le réseau gazier, la réduction des émissions de CO2 et l'économie de subventions. Si l'hypothèse de diminuer la taille du méthaniseur ne semble pas envisageable, un projet potentiel pourrait être envisagé au nord-ouest de la Vendée.

Liens : *Accès au document*

Ecologie. Une station-service de gaz naturel inaugurée à Vaux-le-Pénil

Actu.fr, 22/12/2022

Une station-service de GNV (gaz naturel) et de BioGNV (gaz naturel obtenu par méthanisation) vient d'être inaugurée dans la Marne. Ce carburant est de plus en plus employé, notamment pour les poids lourds. Au début, les principaux clients de cette nouvelle station connectée au réseau de gaz naturel seront les bennes à ordures ménagères. "Tout cela entre dans le cadre de la lutte contre le réchauffement climatique et contre tous les phénomènes que le GIEC (Groupe d'experts intergouvernemental sur l'évolution du Climat) a soulevés."

Liens : *Accès au document*

Juridique et règlementaire

Effluents d'élevage utilisables en AB : des restrictions s'appliquent dès le 1er janvier 2021

Arvalis-infos, 21/01/2022

A partir du 1er janvier 2021, certains produits organiques issus d'élevages industriels ne peuvent plus être épandus en France sur des parcelles conduites en agriculture biologique. Ces restrictions font suite à la nouvelle définition d'élevage industriel validée par le comité national de l'AB en octobre 2020. Le point sur les produits concernés et les délais de mise en conformité.

Cette règlementation concerne les fumiers, les fumiers séchés et fientes de volailles, le compost d'excréments d'animaux solides, les excréments d'animaux liquides et le digestat de biogaz contenant des sous-produits animaux codigérés avec des matières animales ou végétales.

Fertilisation en AB : ce que dit la réglementation européenne [...]

Liens : *Accès au document*

Projet de socle commun, de nouveaux critères définis

CA hautsdefrance, 20/01/2022

La version 2 du projet de décret relatif à l'élaboration d'un socle commun a été portée à la connaissance des parties prenantes représentant les acteurs de la filière de valorisation organique. Ces textes visent à définir des critères de qualité agronomique et d'innocuité pour les Matières Fertilisantes et les Supports de Culture (MFSC) épandus en agriculture.
Les catégories de matières et les critères à appliquer [...]
Les impacts de ce projet sur les filières d'épandages [...]
Des groupes de travail doivent être constitués. D'autres textes (Arrêté test éco toxicologique, arrêté efficacité agronomique) ainsi qu'une modification de l'arrêté registre sont prévues courant 2022. Le texte fera l'objet d'une consultation publique et de différentes instances et devra encore avoir le feu vert de l'Europe et du Conseil d'Etat avant d'être publié. De ce fait, une application des nouvelles règles prévue pour 2022 paraît peu probable.

Liens : *Accès au document*

SARL Saffray: Saisir l'opportunité de la méthanisation

Wikiagri.fr, 13/01/2022

C'est en 1946 que l'entreprise de travaux agricoles Saffray a vu le jour à Corps-Nuds, au sud de Rennes, en Ille-et-Vilaine. [...] Côté record, c'est vers l'épandage qu'il faut regarder. « Nous allons recevoir la première tonne à lisier de 35 000 litres en France », annonce fièrement l'entrepreneur. [...] Parmi les tendances du moment, Anthony Saffray mise sur la méthanisation. [...] Pour répondre aux besoins d'épandage de l'unité de méthanisation qui fonctionne sèche, il peut mettre à disposition ses quatre épandeurs de 20 m3 avec une chargeuse 17 tonnes New Holland pour assurer un débit de quinze épandeurs à l'heure.

« Mais la méthanisation a aussi un impact sur les récoltes. Cette activité nous apporte des volumes en ensilage et nous avons équipé deux moissonneuses-batteuses avec des récupé-rateurs de menues-pailles », détaille Anthony Saffray. La culture des couverts végétaux fait également partie des prestations à maîtriser pour répondre à la demande des agriculteurs méthaniseurs.

Liens : *Accès au document*

Quoi de neuf au Salon des ETA?

Entraid.com, 09/01/2022

[...] Le constructeur allemand de tonnes à lisier *Kumm* débarque en France avec sa gamme KTR. Elle se distingue par le choix de pompes à lobes pour le remplissage et a vidange, couplées à une cuve sans mise en pression. Un broyeur en entrée évite les risques de colmatage. Capacité à partir de 16m3, suspension d'essieux pneumatique, DPAE en standard. Kumm propose un grand choix d'équipements arrières: enfouisseur à dents et à disques, rampes à pendillards et à patins. Ce constructeur produit aussi des citernes de transfert de lisier pour tracteurs agricoles et pour camions. [...]

Liens : *Accès au document*

« Combien vaut le fumier ? » à chaque éleveur son prix

Agri-mutuel, 04/01/2022

« Quel prix peut-on demander pour du fumier ? » C'est la question que posait récemment Gaetan sur les réseaux sociaux. Et selon les régions, les réponses sont bien différentes... [...]

Liens : *Accès au document*

Fertilisation, assolement, troupeau… les adaptations de Benoît Rozière (12)

Agri-mutuel, 04/01/2022

Benoît Rozière, éleveur dans l'Aveyron, […] a optimisé la fertilisation (lisier et fumier) : « on le fait en fin d'hiver-début de printemps et assez tôt en automne, afin que la végétation puisse utiliser facilement l'azote disponible. Avant, on avait un compost assez mûr, maintenant on épand plus tôt pour essayer de garder le maximum d'azote utilisable par les plantes », explique l'éleveur. [...] Et pourquoi pas se lancer bientôt dans la méthanisation… »

Liens : *Accès au document*

Vers la réduction des émissions d'ammoniac de l'épandage

Agri-mutuel, 03/01/2022

Mis en place par le gouvernement, un plan d'actions a pour objectif la réduction des émissions de polluants atmosphériques émanant des pratiques d'épandage. A terme, ce plan vise à interdire les matériels les plus polluants. [...] A horizon 2030, ce plan, appelé PMEE, vise la réduction des émissions de NH3.

Il cherche à inciter les acteurs de la filière à opter pour du matériel plus performant tels que les rampes à pendillards ou bien les Injecteurs. Ainsi, grâce à la mise en place de coups de pouce réglementaires et financiers le PMEE poursuit l'objectif de supprimer l'usage de la buse palette, considérée comme trop polluante. [...]

Liens : *Accès au document*

« J'épands près de 40.000 tonnes de vinasse par an »

WikiAgri.fr, 31/12/2021

Sous le hangar de l'exploitation familiale, typique de la région Troyenne sont hivernés les automoteurs de l'entreprise Agri Sol, en attendant la prochaine saison. Managée par Francis Berthelin, elle s'est spécialisée dans l'épandage de vinasse, un fertilisant issu de l'industrie betteravière, sous-produit de la distillation de la mélasse contenant notamment du sulfate d'ammoniac et de potassium. [...]

Liens : *Accès au document*

Quel avenir pour les différents modèles économiques de la méthanisation ?

Agri-mutuel, 29/12/2022

Le secteur de la méthanisation se caractérise par une grande diversité des types d'unités qui ont vu le jour à des périodes différentes et répondent à des enjeux divers. Entre aspirations sociétales, diversification agricole, production d'énergie verte, elles ne répondent pas toutes aux mêmes besoins. Alexandre Berthe, économiste et enseignant-chercheur à l'université de Rennes 2, revient sur ces enjeux et sur les évolutions possibles des modèles économiques. [...]

Liens : *Accès au document*

La Nouvelle-Aquitaine parie sur le marché du carbone

Agri-mutuel, 29/12/2022

La Nouvelle-Aquitaine, plus grande région agricole de France d'une superficie aussi grande que l'Autriche parie sur le marché du carbone avec une MAEC forfaitaire « transition bas carbone », la seule en France, dans le cadre de la prochaine Pac. « Les agriculteurs s'engagent pendant cinq ans à réduire leur empreinte carbone de 15 %, entraînant une prime de 1 800 € sur les cinq ans », résume Thierry Coutand, sous-directeur à la direction de l'agriculture de la région, lors d'un débat public intitulé « Pac et Pacte vert » à Limoges, le 18 novembre 2021.

[...]. En élevage laitier, les éleveurs [...] ont mis en œuvre des modifications de leur système de production, à la suite du ou des diagnostics, pour faire évoluer positivement leur bilan carbone : diminution de l'âge au vêlage, pâturage tournant, couverture de la fosse à lisier, épandeur à pendillard, etc. Et, selon eux, les résultats sont au rendez-vous. [...]

Liens : *Accès au document*

Céréales à paille conduites en bio : téléchargez la synthèse des essais 2021

Arvalis-info, 17/12/2021

Dans ce nouveau guide « Choisir et Décider - Céréales à paille conduites en agriculture biologique », retrouvez l'expertise et les résultats d'essais conduits en 2020/2021 par ARVALIS et ses partenaires. Au sommaire : [....] résultats du réseau d'essais sur la fertilisation organique du blé tendre – [...]

Liens : *Accès au document*

Les scientifiques réagissent quant à l'impact de la méthanisation sur le sol

Web-agri, 17/12/2021

Pierre Aurousseau, Jean-Pierre Jouany, Gérard Fonty, Daniel Chateigner, quatre scientifiques réagissent à un récent article paru sur Web-agri quant à l'impact du digestat dans le sol.

« Suite à l'article paru dans Web-agri et intitulé *Méthanisation : Sabine Houot (Inrae) rétablit les vérités quant à l'impact du digestat dans le sol*, il nous a semblé nécessaire de commenter cet article. Dans ce qui suit vous constaterez que nous partageons la plupart des analyses de notre collègue Sabine Houot mais en y apportant des compléments qui en changent substantiellement la lecture. » [...]

Liens : *Accès au document*

Des litières en copeaux de bois dans le Doubs

Entraid, 17/12/2021

Au Gaec du Rocheret (25), les associés replantent des haies et visent l'autonomie pour l'approvisionnement des litières. L'occasion de rappeler les intérêts des plaquettes de bois pour cette utilisation. [...] Ensuite, la dégradation au champ se fait aussi naturellement, sans forcément composter même si cela accroit l'efficacité. Et contrairement aux idées reçues, les sols ne deviennent pas acides même avec l'utilisation d'essences résineuses. [...]

Liens : *Accès au document*

Se diversifier pendant la saison creuse

Wikiagri, 17/12/2021

C'est un concours de circonstance qui a permis à l'ETA Cadeau de débuter l'épandage de compost dans les vergers en 2006. Aujourd'hui cette activité représente une part importante du chiffre d'affaire hivernale. [...]

Liens : *Accès au document*

Un épandage en haute performance avec l'ETA Guillon - Vidéo

Réussir, 15/12/2021

[...] En février-mars, nous avons des fenêtres de tir très courtes. Nous devons donc être très efficaces », explique Jérôme Guillon. L'entrepreneur a donc investi un système de caisson en bout de champ. Le dispositif permet d'épandre 800 à 1000 m3 par jour.

Des capteurs NIR calculent également la valeur du lisier. La dose est donc adaptée à chaque parcelle.

Liens : *Accès au document*

Entrée en production du dosage du chrome hexavalent des boues

Auréa, 15/12/2021

L'analyse du Chrome hexavalent Cr(VI), qui correspond à un état spécifique toxique d'oxydation du chrome, est appelée à se généraliser dans les matrices environnementales. Pour accompagner ce nouveau besoin, AUREA a investi dans des travaux de R&D et dans du matériel de pointe, permettant de proposer une analyse fiable et rapide du Cr(VI) dans les matrices organiques, avec une capacité d'analyse en phase avec l'augmentation attendue des besoins. [...]

Liens : *Accès au document*

Lemken Une option de broyeur répartiteur disponible sur l'Heliodor 9

Terre-net, 13/12/2022

À partir de mars 2022, le déchaumeur à disques Heliodor de Lemken sera disponible avec un kit de montage pour y placer un broyeur-répartiteur DosiMat DMX de la société Vogelsang. Le broyeur est équipé d'un rotor à couteaux qui homogénéise le lisier. Celui-ci est ensuite réparti dans les différents canaux de distribution, en évitant ainsi le risque de bouchons. Les tuyaux de distribution injectent le lisier directement derrière la première rangée de disques du déchaumeur, et ensuite incorporé par la deuxième rangée de disques et les rouleaux. Cette association entre le déchaumeur et le broyeur exige une faible puissance de traction, et propose une réponse à la flambée des *prix* des *engrais*, en permettant d'exploiter pleinement le potentiel nutritif des engrais organiques que sont le lisier et le digestat. [...]

Liens : *Accès au document*

« La méthanisation a des impacts environnementaux majoritairement bénéfiques »

Agri-mutuel, 10/12/2021

Quel est l'impact de la méthanisation agricole sur l'environnement ? C'est la question à laquelle des chercheurs de l'Inrae, mandatés par GRDF, ont répondu dans une étude basée sur l'analyse du cycle de vie (ACV). Ils concluent à « des impacts environnementaux majoritairement bénéfiques ou neutres pour la méthanisation ». [...]

Liens: *Accès au document*

Veille Scientifique Agro et Impact

Environmental Performance in the Production and Use of Recovered Fertilizers from Organic Wastes Treated by Anaerobic Digestion vs Synthetic Mineral Fertilizers

Herrera, A., D'Imporzano, G., Zilio, M., Pigoli, A., Rizzi, B., Meers, E., . . . Adani, F. Environmental Performance in the Production and Use of Recovered Fertilizers from Organic Wastes Treated by Anaerobic Digestion vs Synthetic Mineral Fertilizers. Acs Sustainable Chemistry & Engineering, 12
DOI: 10.1021/acssuschemeng.1c07028.

Abstract: Recovered fertilizers (RFs), in the form of digestate and digestate-derived ammonium sulfate, were produced from organic wastes by thermophilic anaerobic digestion (AD) at full scale. RFs were then used for crop production (maize), substituting synthetic mineral fertilizers (SFs). Environmental impacts due to both RF and SF production and use were studied by a life cycle assessment (LCA) approach using, as much as possible, data directly measured at full scale. The functional unit chosen was referred to as the fertilization of 1 ha of maize, as this paper intends to investigate the impacts of the use of RF (Scenario RF) for crop fertilization compared to that of SF (Scenario SF). Scenario RF showed better environmental performances than the system encompassing the production and use of urea and synthetic fertilizers (Scenario SF). In particular, for the Scenario RF, 11 of the 18 categories showed a lower impact than the Scenario SF, and 3 of the categories (ionizing radiation, fossil resource scarcity, and water consumption) showed net negative impacts in Scenario RF, getting the benefits from the credit for renewable energy production by AD. The LCA approach also allowed proposing precautions able to reduce further fertilizer impacts, resulting in total negative impacts in using RF for crop production. Anaerobic digestion represents the key to propose a sustainable approach in producing renewable fertilizers, thanks to both energy production and the modification that occurs to waste during a biological process, leaving a substrate (digestate) with high amending and fertilizing properties.

Is application of biochar to soil really carbon negative? The effect of methodological decisions in Life Cycle Assessment

Matustik, J., Pohorely, M., & Koci, V. (2022). Is application of biochar to soil really carbon negative? The effect of methodological decisions in Life Cycle Assessment. Science of the Total Environment, 807, 10
DOI: 10.1016/j.scitotenv.2021.151058.

Abstract: One of the proposed solutions for improving soil conditions and mitigating climate change, two of the urgent en-vironmental issues of today, is application of biochar to soil. This carbonaceous material made from a large variety of biomass feedstocks, by several different processes, and at various conditions is envisaged to remain stable in soil for centuries and thus effectively keep carbon out of the atmosphere. Nevertheless, a careful analysis of the entire system of biochar production and application is necessary, before such solutions are applied at a large scale, to avoid creating an even bigger environmental problem. One well-established method to do so is Life Cycle Assessment (LCA). This method has already been applied by many authors to assess biochar-to-soil pro-jects, and based on this literature it appears that biochar application indeed contributes to climate change miti-gation. However, even with such a standardized and widely used method like LCA, there are vast methodological differences between the LCA studies. Furthermore, whether the climate impact of biogenic carbon should be con-sidered is an unresolved issue common to all assessments of biomass-utilizing projects. The effects of those and other methodological issues are investigated in the case study of the gasifier in Zlata Olesnice. The results show that whether a project of biochar application to soil is deemed environmentally beneficial largely depends both on the context of the project as well as the methodological decisions, especially regarding biogenic carbon. Nevertheless, it can be concluded that biochar production from waste feedstock in most cases leads to climate change mitigation. (c) 2021 Elsevier B.V. All rights reserved.

Soil Organic Carbon Sequestration after Biochar Application: A Global Meta-Analysis

Gross, A., Bromm, T., & Glaser, B. (2021). Soil Organic Carbon Sequestration after Biochar Application: A Global Meta-Analysis. Agronomy-Basel, 11(12), 21 DOI: 10.3390/agronomy11122474.

Abstract : Biochar application to soil has the potential to sequester carbon in the long term because of its high stability and large-scale production potential. However, biochar technologies are still relatively new, and the global factors affecting the long-term fate of biochar in the environment are still poorly understood. To fill this important research gap, a global meta-analysis was conducted including 64 studies with 736 individual treatments. Field experiments covered experimental durations between 1 and 10 years with biochar application amounts between 1 and 100 Mg ha(-1). They showed a mean increase in soil organic carbon (SOC) stocks by 13.0 Mg ha(-1) on average, corresponding to 29%. Pot and incubation experiments ranged between 1 and 1278 days and biochar amounts between 5 g kg(-1) and 200 g kg(-1). They raised SOC by 6.3 g kg(-1) on average, corresponding to 75%. More SOC was accumulated in long experimental durations of >500 days in pot and incubation experiments and 6-10 years in field experiments than in shorter experimental durations. Organic fertilizer co-applications significantly further increased SOC. Biochar from plant material showed higher C sequestration potential than biochar from fecal matter, due to higher C/N ratio. SOC increases after biochar application were higher in medium to fine grain textured soils than in soils with coarse grain sizes. Our study clearly demonstrated the high C sequestration potential of biochar application to agricultural soils of varying site and soil characteristics.

Can Bottom Sediments Be a Prospective Fertilizing Material? A Chemical Composition Analysis for Potential Reuse in Agriculture

Matej-Lukowicz, K., Wojciechowska, E., Strycharz, J., Szubska, M., Kulinski, K., Beldowski, J., & Winogradow, A. (2021). Can Bottom Sediments Be a Prospective Fertilizing Material? A Chemical Composition Analysis for Potential Reuse in Agriculture. Materials, 14(24), 20 DOI: 10.3390/ma14247685.

Abstract: Every year, huge amounts of bottom sediments are extracted worldwide, which need to be disposed. The recycling of bottom sediments for soil fertilization is in line with the long-promoted circular economy policy and enables the use of micro and macronutrients accumulated in sediments for soil fertilization. When considering potential agricultural reuse of the dredge sediments, the first necessary step should be to analyze whether the heavy metal content meets the obligatory criteria. Then, the contents of valuable elements required for plant growth and their ratios should be assessed. In this

study, the content of nitrogen, organic carbon, phosphorus, and potassium was tested and iron, sulfur, calcium, and magnesium were also analyzed along vertical profiles of sediments extracted from four urban retention tanks in Gdansk (Poland). The sediments were indicated to have a low content of nutrients (Ntot 0.01-0.52%, Corg 0.1-8.4%, P2O5 0.00-0.65%, K 0.0-1.0%), while being quite rich in Fe and S (0.2-3.3%, 0.0-2.5%, respectively). The C/N ratio changed in the range of 17.4-28.4, which proved good nitrogen availability for plants. The mean values of the Fe/P ratio were above 2.0, which confirms that phosphorus in the sediments would be available to the plants in the form of iron phosphate. To summarize, the bottom sediments from municipal retention reservoirs are not a perfect material for soil fertilization, but they are a free waste material which, when enriched with little cost, can be a good fertilizer. Future research should focus on cultivation experiments with the use of sediments enriched with N, P, Corg.

What sewage sludge is and conflicts in Swedish circular economy policymaking

Burgman, L. E. What sewage sludge is and conflicts in Swedish circular economy policymaking. Environmental Sociology, 10 DOI: 10.1080/23251042.2021.2021603.

Abstract: Recycling nutrients from renewable sources, like sewage sludge, has been promoted as a step towards a circular economy by decreasing extraction and dependency on inorganic fertilizers. Implementation, however, is often controversial. In 2018, a Swedish governmental inquiry was commissioned to propose a complete ban on land application of sewage sludge to reduce soil pollution and increase phosphorus recovery. In 2020, the inquiry suggested two pathways, one to ban all land application, and one where agricultural land use should continuously be allowed. This paper is based on interviews with experts tied to the inquiry where they reference to sewage sludge, related objects, and future management. The inquiry's inability to propose a coherent suggestion is analysed inspired by the concept of multiple ontology. Several ontological versions of sewage sludge emerge that unveil tensions between concepts of danger and cleanliness, pollution and naturalness, often captured in previous studies of waste. Some versions of sewage sludge conflict, which can explain the difficulty to establish an ontologically singular knowledge base for a transformation of sewage sludge from waste to resource. Though most of the experts agree that circular economy and nutrient recycling are good things, policymaking is caught in an ontological conundrum.

Replacing Synthetic Nitrogen Fertilizer with Different Types of Organic Materials Improves Grain Yield in China: A Meta-Analysis

Fan, X. R., Chen, Z. K., Niu, Z. H., Zeng, R. Y., Ou, J. M., Liu, X. X., & Wang, X. L. (2021). Replacing Synthetic Nitrogen Fertilizer with Different Types of Organic Materials Improves Grain Yield in China: A Meta-Analysis. Agronomy-Basel, 11(12), 12 DOI: 10.3390/agronomy11122429.

Abstract : Synthetic nitrogen fertilizer substitution (NSS) with different types of organic material is a cleaner agricultural practice for reducing the application of synthetic N input in farmlands while also relieving the environmental issues caused by the discharge of organic wastes. However, the effects of the NSS practice on crop yields, being the primary objective of agricultural activity, is still uncertain in China. This study conducted a meta-analysis to assess the impacts of the NSS practices with different types of organic materials on crop yields. Results showed that the average crop yield was increased by 3.4%, with significant differences under NSS, thereby demonstrating that this practice contributed to improving crop yields, especially of rice and maize. According to published reports, the NSS practices involving chicken manure, pig manure, and crop straw increased crop yields by 4.79, 7.68, and 3.28%, respectively, with significant differences, thus demonstrating the superior effects needed for replacing synthetic N fertilizer. Moreover, substitution ratios (SR) between 0% and 60% could be suggested when using the NSS practice, with the high SR recommended when the original soil fertility was adequate for crops. Considering the long-term effects of applied organic materials, improving the grain yield with the NSS practice should be expected in the long-term. By effectively applying the NSS, this study attempted to scientifically decide on the type of organic materials and the appropriate SR based on the conditions of the soil and the crop. The results provide research information for the development of clean agricultural production and food security in China.

Sewage Sludge as N-Fertilizers for Crop Production Enabling the Circular Bioeconomy in Agriculture: A Challenge for the New EU Regulation 1009/2019

Cucina, M., De Nisi, P., Sordi, S., & Adani, F. (2021). Sewage Sludge as N-Fertilizers for Crop

Production Enabling the Circular Bioeconomy in Agriculture: A Challenge for the New EU Regulation 1009/2019. Sustainability, 13(23), 16 DOI: 10.3390/su132313165.

Abstract: The fertilizer framework in the European Union has recently been reviewed by EU Regulation 1009/2019 that excluded sewage sludge from the list of the possible constituents of organic fertilizers relying on their origin, not on their quality. This paper aimed to carry out a complete characterization of sewage sludge obtained from a pharmaceutical manufacturing process (PDSS) to demonstrate that sewage sludge obtained from a standardized and controlled manufacturing process can be safely recycled as organic fertilizer. The agronomic and environmental characteristics of the PDSS product were analyzed and compared to other organic fertilizers. Its fertilizing potential was also evaluated through plant growth trials. PDSS was characterized by a high concentration of total N (6.6% w/w), which was all present in organic form. PDSS also showed a low concentration of heavy metals, an absence of pathogens and low concentrations of organic contaminants. Plant growth trials showed that the PDSS was able to improve lettuce and carrot growth (+25 and +46% of dry weight compared to the unfertilized control), as well as their physiological status. Considering all the results, the exclusion of sewage sludge relying only on its origin and not on its quality appears to conflict with the principles of the circular bioeconomy.

Effect of high soil C/N ratio and nitrogen limitation caused by the long-term combined organic-inorganic fertilization on the soil microbial community structure and its dominated SOC decomposition

Cui, J. W., Zhu, R. L., Wang, X. Y., Xu, X. P., Ai, C., He, P., . . . Zhu, P. (2022). Effect of high soil C/N ratio and nitrogen limitation caused by the long-term combined organic-inorganic fertilization on the soil microbial community structure and its dominated SOC decomposition. Journal of Environmental Management, 303, 15

DOI: 10.1016/j.jenvman.2021.114155.

Abstract: The application of organic fertilizers, such as straw and manure, is an efficient approach to maintain soil productivity. However, the effect of these organic fertilizers on soil microbial nutrient balance has not yet been established. In this study, the effects of the long-term combined organic-inorganic fertilization on microbial community were investigated by conducting a 30-year-long field test. Overall, the following five fertilizer groups were employed: inorganic NP fertilizer (NP), inorganic NK fertilizer (NK), inorganic NPK fertilizer (NPK), NPK + manure (MNPK), and NPK + straw (SNPK). The results indicated that the mean natural logarithm of the soil C:N:P acquisition enzyme ratio was 1.04:1.11:1.00 under organic-inorganic treatments, which showed a deviation from its overall mean ratio of 1:1:1. This indicates that microbial resources do not have a balance. Vector analysis (vector angle <45°) and threshold elemental ratio analysis (RC:N-TERC:N > 0) further demonstrated that the microbial metabolism was limited by Nitrogen (N) under SNPK and MNPK treatments. N limitation further influenced soil microbial community structure and its dominated SOC decomposition. Specifically, Microbial communities transformed into a more oligotrophic-dominant condition (fungal, Acidobacteria, Chloroflexi) from copiotrophic-dominant (Proteobacteria, Actinobacteria) condition with increasing N limitation. Lysobacter genus and Blastocatellaceae family, in the bacterial communities along with the Mortierella elongata species in fungal communities, were markedly associated with the N limitation, which could be the critical biomarker that represented N limitation. Both correlation analysis and partial least squares path modeling showed significant positive effects of N limitation on the ratio of bacterial functional genes (Cellulase/Amylase), involved in recalcitrant SOC degradation.

Nitrous oxide and nitrate as indicators of subsoil removal of N in pig slurry applied to Luvisols in Western Denmark

Wolf, K. A., Borgesen, C. D., Plauborg, F., & Petersen, S. O. (2022). Nitrous oxide and nitrate as indicators of subsoil removal of N in pig slurry applied to Luvisols in Western Denmark. Geoderma Regional, 28, 12

DOI: 10.1016/j.geodrs.2021.e00441.

Abstract: This one-year study examined effects of autumn- vs. spring- application of pig slurry, and the effect of a nitrification inhibitor (DMPP) for autumn-applied slurry, on transport and transformations of nitrogen in the soil profile. Duplicate field plots had ceramic suction cells at 50, 100, and 150 cm depths to calculate leaching for each treatment using NO3- concentrations and percolation simulated using a water transport model. Furthermore, soil moisture, soil texture and bulk density at 50, 100 and 150 cm depth, and water table level, were recorded. During campaigns, subsurface N2O concentrations at 20, 50, 100, and 150 cm depths, and N2O fluxes to the atmosphere, were monitored for indicators of denitrification activity. Autumn-applied pig slurry showed evidence for NO3- removal between 50

and 100 cm depth, and N2O concentration profiles indicated high denitrification activity around 50 cm depth. Autumn-applied slurry showed higher N2O emissions and lower crop yields compared to spring application, indicating losses occurred during winter. DMPP did not reduce average NO3- leaching, nor affect N2O emissions, but treatment effects were confounded by heterogeneity in compaction, clay content, and water table depth at plot level. The study showed that accounting for transport and transformations of N in the subsoil can contribute to understanding the environmental controls of N leaching, as well as direct and indirect N2O emissions.

Carbon emissions inventory of farm size pig husbandry combining Manure-DNDC model and IPCC coefficient methodology

Li, Q., Gao, M. F., & Li, J. G. (2021). Carbon emissions inventory of farm size pig husbandry combining Manure-DNDC model and IPCC coefficient methodology. Journal of Cleaner Production, 320, 9

DOI: 10.1016/j.jclepro.2021.128854.

Abstract: The increasing demand for pork products has contributed to the increase in greenhouse gas emissions (GHG). Based on survey data of pig farms in Yancheng, Jiangsu Province, China, we developed a hybrid model DICPig (DNDC and IPCC combined model for pig husbandry) by combining the Manure-DNDC (denitrification and decomposition model for manure) model with the IPCC (Intergovernmental Panel on Climate Change) agricultural greenhouse gas calculation method to calculate the total GHG emissions from the pig husbandry life cycle. This hybrid model allowed the analysis of the pig husbandry carbon emissions component structure and the identification of the factors affecting the level of emissions. The results showed that CO2 (Carbon Dioxide) emission per pig in its life cycle is about 672.27 kg CO2-eq. In the process of pig waste disposal, the N2O (Nitrous oxide) emitted is 1.17 kg, and the CH4 (Methane) emitted is 1.36 kg. Pig waste disposal and feed production processes were the two most important contributors to total pig husbandry GHG emissions, accounting for 56.92% and 28.62% of the total emissions respectively. GHG emissions from pig farms could be reduced significantly by optimizing manure management measures, constructing and utilizing biogas digesters, reducing the amount of fertilizer applied to cropping, and adopting a planting-breeding combination policy.

Abating Ammonia Emissions through Slurry Acidification during Spreading: Farmers' Willingness to Participate in a Support Scheme

Thiermann, I., Breustedt, G., & Latacz-Lohmann, U. (2021). Abating Ammonia Emissions through Slurry Acidification during Spreading: Farmers' Willingness to Participate in a Support Scheme. German Journal of Agricultural Economics, 70(3), 192-207, DOI: 10.30430/70.2021.3.192-207.

Abstract: This article sought to determine farmers' willingness to join a hypothetical support scheme for slurry acidifica-tion during spreading. Slurry acidification is a novel technique to reduce ammonia emissions, which has been pioneered in Denmark. In an online discrete choice survey of German livestock farmers, the re-spondents were asked to choose between different pol-icy schemes to promote the use of acidification tech-niques and an opt-out option. The support schemes were characterized by the following attributes: cost share, expected emission reduction as well as a relief from, and a tightening of, the German Fertilizer Ordi-nance. The relief was a waiver of the legal requirement to incorporate slurry immediately after spreading. The tightening related to the provision to account for the additional nitrogen in a farmer's fertilizer planning. The data was estimated using a mixed logit model and latent class analysis. The estimated probability of choosing a support scheme was 90 % in the mixed logit estimation. All attributes were crucial for the decision to use acidification techniques during slurry spreading. Higher emission reduction increased the chances of participation in a support scheme significantly. Fur-thermore, the cost share offered and the exemption from the requirement to incorporate slurry immediately after spreading had a significantly positive impact on farmers' willingness to participate. By contrast, the more of the extra nitrogen contained in acidified slurry had to be accounted for in a farmer's fertilizer plan-ning, the lower the probability of participation.

Do interactions between application rate and native soil organic matter content determine the degradation of exogenous organic carbon

Mendoza, O., De Neve, S., Deroo, H., Li, H. C., & Sleutel, S. (2022). Do interactions between application rate and native soil organic matter content determine the degradation of exogenous organic carbon? Soil Biology & Biochemistry, 164, 9, DOI: 10.1016/j.soilbio.2021.108473.

Abstract: Although the amendment of various forms of exogenous organic matter (EOM) is a

common practice in cropland production, it is to date not clear if its mineralisation in soil depends on application rate. Previous research suggested that spatial concentration of EOM in soil positively impacts its degradability. Here, we seek to test these reports and furthermore to investigate if an interactive effect exists with native soil organic carbon (SOC) concentration. We hypothesised that at a low EOM dose, more EOM remains undecomposed in soil and that this effect becomes stronger at lower SOC level. Moreover, as a secondary goal, we explored if priming of native SOC mineralisation depends on EOM dose. Therefore, we set up seventy-day soil incubation experiments with six varying C4-maize residue (813C = - 12.7 parts per thousand) doses (0-6 g kg-1) in soil mesocosms of loamy sand subsoils (813C = - 25.7 parts per thousand) with three different native SOC levels (i.e. 0.1, 0.5, and 1.0%). Soil CO2 emissions and isotopic signature measurements of CO2 allowed to discern EOM and SOC mineralisation. We found that EOM-derived C mineralisation increased proportionally to EOM dose, refuting the hypothesised relative undecomposed EOM at low concentration. Volumes of larger pore neck size diameter classes (60-100 and >300 mu m) almost doubled at high EOM dose, demonstrating formation of macropores. Yet, this apparently did not impact EOM mineralisation, probably because O2 supply was always sufficient to allow unlimited activity of EOM degraders, even at higher EOM doses, as indicated by generally higher measured redox potential. With EOM dose, fungal marker PLFA abundances increased in the 1% SOC soil and protozoan abundances increased in all three soils, but apparently these shifts did not result in an enhanced relative degradation of the EOM. Increasing EOM doses induced negative priming, e.g. EOM >= 1 g kg- 1 reduced SOC mineralisation by >43% and >24% compared to the control in the 0.1 and 0.5% SOC soils, respectively; whereas no priming occurred in soil with 1% SOC. These results were largely explained by the amount of added C relative to microbial biomass carbon, and the theorised switch of slow decomposers (so called K-strategists and involved in recalcitrant compound decomposition) from SOM to preferentially decompose EOM at higher doses. We also postulate that at low SOC %, the obvious increased O2 consumption with higher EOM dose more readily results in local anaerobic conditions in finer pores, i.e. where SOC is located and mineralised. We conclude that on the short term, agricultural management for SOM thus does not need to consider EOM doses but only the total amount of EOM.

Acidification Effects on In Situ Ammonia Emissions and Cereal Yields Depending on Slurry Type and Application Method

Wagner, C., Nyord, T., Vestergaard, A. V., Hafner, S. D., & Pacholski, A. S. (2021). Acidification Effects on In Situ Ammonia Emissions and Cereal Yields Depending on Slurry Type and Application Method. Agriculture-Basel, 11(11), 20 DOI: 10.3390/agriculture11111053.

Abstract : Field application of organic slurries contributes considerably to emissions of ammonia (NH3) which causes sever environmental damage and can result in lower nitrogen (N) fertilizer efficiency. In recent years, field acidification systems have been introduced to reduce such NH3 emissions. However, combined field data on ammonia emissions and N use efficiency of acidified slurries, in particular by practical acidification systems, are scarce. Here, we present for the first time a simultaneous in situ assessment of the effects of acidification of five different organic slurries with a commercial acidifications system combined with different application techniques. The analysis was performed in randomized plot trials in winter wheat and spring barley after two applications to each crop (before tillering and after flag leave emergence) in year 2014 in Denmark. Slurry types included cattle slurry, mink slurry, pig slurry, anaerobic digestate, and the liquid phase of anaerobic digestate. Tested application techniques were trail hose application with and without slurry acidification in winter wheat and slurry injection and incorporation compared to trail hose application with and without acidification in spring barley. Slurries were applied on 9 m x 9 m plots separated by buffer areas of the same dimension. Ammonia emission was determined by a combination of semi-quantitative acid traps scaled by absolute emissions obtained from Draeger Tube Method dynamic chamber measurements. Experimental results were analysed by mixed effects models and HSD post hoc test (p < 0.05). Significant and almost quantitative NH3 emission reduction compared to trail hose application was observed in the barley trial by slurry incorporation of acidified slurry (89% reduction) and closed slot injection (96% reduction), while incorporation alone decreased emissions by 60%. In the two applications to winter wheat, compared to trail hose application of non-acidified slurry, acidification reduced NH3 emissions by 61% and 67% in cattle slurry, in anaerobic digestate by 45% and 57% and liquid phase of anaerobic digestate by 58%, respectively. Similar effects but on a lower emission level were observed in mink slurry, while acidification showed almost no effect in pig slurry. Acidifying animal manure with a commercial system was confirmed to consistently reduce NH3 emissions of most slurry types, and emission

reductions were similar as from experimental acidification systems. However, failure to reduce ammonia emissions in pig slurry hint to technical limitations of such systems. Winter wheat and spring barley yields were only partly significantly increased by use of ammonia emission mitigation measures, while there were significant positive effects on apparent nitrogen use efficiency (+17-28%). The assessment of the agronomic effects of acidification requires further investigations.

A review of post-consumption food waste management and its potentials for biofuel production

Pour, F. H., & Makkawi, Y. T. (2021). A review of post-consumption food waste management and its potentials for biofuel production. Energy Reports, 7, 7759-7784 DOI: 10.1016/j.egyr.2021.10.119.

Abstract: The global world production of food waste is expected to increase by 33% within the next decade. The current annual food waste stands at around 1.6 billion tonnes, which is worth around $ 1.2 trillion loss. Out of this, nearly 50%-60% comes from post-consumption waste (leftover). Besides, food waste is causing serious environmental concerns as it contributes to the total global greenhouse gas emissions. This paper is focused on reviewing the latest trends and challenges in post-consumption food waste management and assessing its potentials for the production of biofuel and biochar. This includes identifying the major characteristics of post-consumption food waste, disposal methods (landfill, animal feed, and donation) and recycling through chemical, biological and thermochemical conversion. The review indicates that recycling through integrated pyrolysis-gasification processes can lead to the production of multiple high-value products (biofuel, biochar/ash and water) with almost zero or negative impact on the environment. The biochar and water have great potentials in soil amendment, thus, extending the benefits of food waste to increasing water resources, livestock and food security, especially in arid and semi-arid regions. Similarly, integrated transesterification and anaerobic digestion may allow overcoming some of the negatives associated with the standalone implementation of these technologies. However, the implementation of modern food waste management technologies is hindered by the lack of standard processing procedures due to the regional diversity of the food waste characteristics. Besides, there are social and technical challenges associated with the lack of proper post-consumption food waste segregation mechanism at the industrial and community levels, as well as the lack of sufficient research on sustainability and life cycle assessment (LCA) of the food waste management options.

Mechanical pruning and soil organic amendments in vineyards of 'Syrah': effects on wine mineral composition

Botelho, M., Ribeiro, H., Cruz, A., Martins, M., Khairnar, K. S., Pardal, R., . . . Ricardo-da-Silva, J. (2021). Mechanical pruning and soil organic amendments in vineyards of 'Syrah': effects on wine mineral composition. Ciencia E Tecnica Vitivinicola, 36(2), 151-162 DOI: 10.1051/ctv/ctv20213602151.

Abstract: The interaction of mechanized pruning systems and soil organic amendment can affect vine vegetative and reproductive growth. However, since organic amendments supply several mineral elements, namely heavy metals, this study aimed to understand the effects of the interaction between these two practices on the mineral composition of wine. Two field trials were implemented in 'Syrah' vineyards in two Portuguese wine regions (Lisboa and Tejo). Mechanical hedge pruning was compared with hand spur pruning and four different organic amendments were tested: biochar, municipal solid waste compost, cattle manure and sewage sludge. The nitrogen (N), phosphorus (P) and potassium (K) wine contents were significantly reduced by mechanical pruning while calcium (Ca) and magnesium (Mg) contents were tendentially higher in this pruning system. Mechanical pruning also reduced the content of some minor elements, such as arsenic (As), molybdenum (Mo) and nickel (Ni). In 2014, the year with the higher reproductive growth, some other elements also decreased as a consequence of the mechanical pruning (gallium - Ga; lithium - Li; rubidium - Rb, thallium - Tl; yttrium - Y). Concerning the organic amendments, sewage sludge was associated with the wines with the lowest P and iron (Fe) content. Ca content was tendentially higher in municipal solid waste compost and sewage sludge treatments. Mechanical pruning and organic amendments had different effects on the mineral composition of wine, according to each specific element. However, the legal limits, recommended by OIV and established by European Union, as well as the technical limits, adopted by winemakers, were never exceeded and the interaction of both practices does not seem to be a problem in what concerns to the mineral composition of the produced wines.

Microplastics in soils: an environmental geotechnics perspective

O'Kelly, B. C., El-Zein, A., Liu, X. L., Patel, A., Fei, X. C., Sharma, S., . . . Singh, D. N. (2021). Microplastics in soils: an environmental geotechnics perspective. Environmental Geotechnics, 8(8), 586-618 DOI: 10.1680/jenge.20.00179.

Abstract: Microplastics (MPs) are emerging persistent contaminants in the terrestrial subsurface, and evidence has emerged for significant effects of MPs on the biological and ecosystem functions of soils. Main MP sources include land spreading of sewage sludge and biowaste composts, plastic mulching film used in horticultural fields, waste water irrigation and leachate from the landfills, among others. This updated state-of-the-art review paper describes recent experimental and numerical research and developments in understanding the accumulation and fate and effects of MPs in the soil environment (focusing on their storage, degradation, transportation, leaching to groundwater etc.), followed by mitigation and bioremediation measures, including MP-eating soil bacteria and fungi and the best management practices for reducing MP pollution of soil. Other areas covered are the combined effects of MPs and various other environmental contaminants (heavy metals, organic pollutants and antibiotics) in soil ecosystems and the standardisation of methods for detection, quantification and characterisation of MPs in soils, which is critical for MP research. The paper concludes by identifying knowledge gaps and presents recommendations on prioritised research needs.

Cropping system exerts stronger influence on antibiotic resistance gene assemblages in greenhouse soils than reclaimed wastewater irrigation

Liu, Y., Neal, A. L., Zhang, X. X., Fan, H. Y., Liu, H. L., & Li, Z. Y. (2022). Cropping system exerts stronger influence on antibiotic resistance gene assemblages in greenhouse soils than reclaimed wastewater irrigation. Journal of Hazardous Materials, 425 DOI: 10.1016/j.jhazmat.2021.128046.

Abstract : The effects of reclaimed wastewater (RW) irrigation on the spread of antibiotic resistance genes (ARGs) in soil is modulated by a myriad of biotic and abiotic factors and their relative significance remains vague. We compared microbial communities, assemblages of genes associated with microbial resistance to antibiotics, biocides and metals, and insertion sequences (ISs) in soils following 16 years of irrigation with groundwater (GW), RW or alternately with GW and RW in two greenhouses with different cropping systems, using shotgun metagenome sequencing. The results showed that cropping system exerted greater influence than irrigation on the profile of ISs and resistance genes. This influence was most strongly associated with concentrations of copper, mercury and perfloxacin in the soils. There was no significant difference in soil ARG profiles between continuous RW irrigation and alternating GW and RW irrigation. Proteobacteria, Actinobacteria and Firmicutes and a limited number of ISs were closely associated with the detected ARGs. Most ARGs were found to co-occur with metal and biocide resistance genes through the mechanism of efflux pumps. These findings highlight the significance of understanding and improving crop management in mitigating the dissemination of ARGs in soils irrigated with RW.

Long-term fertilization with urban and animal wastes enhances soil quality but introduces pharmaceuticals and personal care products

Vuaille, J., Gravert, T. K. O., Magid, J., Hansen, M., & Cedergreen, N. (2022). Long-term fertilization with urban and animal wastes enhances soil quality but introduces pharmaceuticals and personal care products. Agronomy for Sustainable Development, 42(1), 16 DOI: 10.1007/s13593-021-00726-8.

Abstract: Applying organic wastes such as manure or sewage sludge on agricultural fields improves soil physical structure and fertility, while giving purpose to otherwise disposed and burned waste products. Yet, xenobiotics, and especially pharmaceuticals and personal care products, may be present in these wastes and thereby enter the soil ecosystem. To investigate their occurrence and their potential effect on soil fauna, the CRUCIAL experimental fields, Denmark, were used. Here we combine, for the first time, a chemical wide-scope suspect screening analysis with a study of soil nematode faunal response on soils, which were fertilized with cattle manure, sewage sludge, human urine, and mineral fertilizers over 14 years. The suspect screening analysis was performed with a nanoflow ultra-high performance liquid chromatography coupled with high-resolution tandem mass spectrometry. The abundance of soil indigenous nematodes was determined in each treatment at two time-points, followed by laboratory tests with the nematode species Caenorhabditis elegans to assess its reproduction capacity in the soils. A total of 12 pharmaceuticals and personal care products were identified as being up- or down-concentrated in the different treatments compared to controls

(mineral fertilizers): 8 and 2 were found to be up-concentrated in sludge- and urine-treated soils, respectively. Our results, however, showed a significantly greater abundance of nematodes in soils amended with sludge and manure, while C. elegans had the lowest reproduction capacity in the controls. The reproduction capacity tests did not reveal any chronic toxicity. A principal component analysis showed a clear correlation between nematode abundance and soil organic matter, water content, nutrient contents, and porosity. Overall, urban and animal wastes enhanced soil quality. Pharmaceuticals were detected, but adverse effects on the measured endpoints could not be demonstrated. Although further investigations are needed to examine other associated risks, recycling nutrients from urban areas into fertilizers can contribute to a more sustainable fertilization strategy.

Liens: *Accès au document*

Antibiotic resistance genes in manure-amended paddy soils across eastern China: Occurrence and influencing factors

Guo, Y. W., Xiao, X., Zhao, Y., Liu, J. G., Zhou, J. Z., Sun, B., & Liang, Y. T. (2022). Antibiotic resistance genes in manure-amended paddy soils across eastern China: Occurrence and influencing factors. Frontiers of Environmental Science & Engineering, 16(7), 11 DOI: 10.1007/s11783-021-1499-y.

Abstract: Pig manure, rich in antibiotics and metals, is widely applied in paddy fields as a soil conditioner, triggering the proliferation of antibiotic resistance genes (ARGs) in soil. However, comprehensive studies on the effects of manure fertilization on the abundance of ARGs and their influencing factors are still insufficient. Here, pig manure and manure-amended and inorganic-amended soils were collected from 11 rice-cropping regions in eastern China, and the accumulation of antibiotics, metals, and ARGs was assessed simultaneously. The results showed that manure fertilization led to antibiotic residues and increased the metal content (i.e., Zn, Cu, Ni, and Cr). Tetracycline and sulfonamide resistance genes (tetM, tetO, sul1, and sul2) were also significantly enhanced with manure fertilization. According to variance partitioning analysis, the most important factors that individually influenced ARGs were soil physicochemical properties, accounting for 12% of the variation. Significant correlations between soil nutrients and ARGs indicated that manure application enhanced the growth of resistant microorganisms by supplying more nutrients. Metals and antibiotics contributed 9% and 5% to the variations in ARGs, respectively. Their co-occurrence also increased the enrichment of ARGs, as their interactions accounted for 2% of the variation in ARGs. Interestingly, Cu was significantly related to most ARGs in the soil ($r = 0.26$-0.52, $p < 0.05$). Sulfapyridine was significantly related to sul2, and tetracycline resistance genes were positively related to doxycycline. This study highlighted the risks of antibiotic and ARG accumulation with manure fertilization and shed light on the essential influencing factors of ARGs in paddy soils. (C) Higher Education Press 2021

Liens : *Accès au document*

The Use of Stable Zinc Isotope Soil Labeling to Assess the Contribution of Complex Organic Fertilizers to the Zinc Nutrition of Ryegrass

Yan, B. F., Durr-Auster, T., Frossard, E., & Wiggenhauser, M. (2021). The Use of Stable Zinc Isotope Soil Labeling to Assess the Contribution of Complex Organic Fertilizers to the Zinc Nutrition of Ryegrass. Frontiers in Plant Science, 12 DOI: 10.3389/fpls.2021.730679.

Abstract: Manure and sewage sludge are known to add significant amounts of zinc (Zn) and other metals to soils. However, there is a paucity of information on the fate of Zn that derives from complex organic fertilizers in soil-plant systems and the contribution of these fertilizers to the Zn nutrition of crops. To answer these questions, we grew Italian ryegrass in the presence of $ZnSO_4$, sewage sludge, and cattle and poultry manure in an acidic soil from Heitenried, Switzerland, and an alkaline soil from Strickhof, Switzerland, where the isotopically exchangeable Zn had been labeled with Zn-67. This allowed us to calculate the fraction of Zn in the shoots that was derived from fertilizer, soil, and seed over 4 successive cuts. In addition, we measured the Zn-67:Zn-66 isotope ratio with the diffusive gradients in thin films technique (DGT) on soils labeled with Zn-67 and incubated with the same fertilizers. After 48 days of growth, the largest fraction of Zn in the ryegrass shoots was derived from the soil (79-88%), followed by the Zn-containing fertilizer (11-20%); the least (<2.3%) came from the seed. Only a minor fraction of the Zn applied with the fertilizer was transferred to the shoots (4.7-12%), which indicates that most of the freshly added Zn remained in the soil after one crop cycle and may thereby contribute to a residual Zn pool in the soil. The Zn-67:Zn-66 isotope ratios in the DGT extracts and the shoots measured at cut 4 were identical, suggesting that the DGT and plant took up Zn from the same pool. The proportion of Zn derived from the fertilizers in the DGT extracts was also identical to that measured in ryegrass shoots at cut 4. In conclusion, this work shows that stable Zn

isotope labeling of the soil available Zn can be used to precisely quantify the impact of complex organic fertilizers on the Zn nutrition of crops. It also demonstrates that DGT extractions on labeled soils could be used to estimate the contribution of Zn fertilizers to plant nutrition.

Fate of heavy metals and bacterial community composition following biogas slurry application in a single rice cropping system

Wang, Q., Chen, Z. M., Zhao, J., Ma, J. W., Yu, Q. G., Zou, P., . . . Ma, J. C. Fate of heavy metals and bacterial community composition following biogas slurry application in a single rice cropping system. Journal of Soils and Sediments DOI: 10.1007/s11368-021-03117-4.

Abstract: Purpose Biogas slurry (BS) is widely used as a valuable fertilizer for crop production. However, little is known about the effects of long-term BS application on potential pollution risk of heavy metals and bacterial community in paddy field. This study aimed to determine the accumulation and rice plant uptake of heavy metals (Cd, Cr, Pb, Cu, and Zn), as well as soil bacterial community composition following repeated BS application in a single rice cropping system. Materials and methods In this study, four treatments were included in a long-term field experiment: CK, no fertilizers; MF, mineral fertilizers, 270 kg urea-N ha(-1); and two application rates of BS (BS1, 270 kg N ha(-1) and BS2, 540 kg N ha(-1)). The heavy metals (Cd, Cr, Pb, Cu, and Zn) in soils and rice plants were measured by an inductively coupled plasma mass spectrometer and the soil bacterial community composition was analyzed using Illumina MiSeq sequencing of the 16S rRNA. Results and discussion Soil Zn concentrations were significantly greater in the BS treatments than in the MF treatment. Biogas slurry application significantly increased the heavy metals concentrations in rice plants, compared to the CK treatment. The concentrations of Cd and Pb in grain, and Cu and Zn concentrations in straw were significantly increased by the BS2 treatment compared to the MF treatment, respectively. However, the Cd, Cr, Pb, Cu, and Zn concentrations in grain and soil were all within the safety limits after long-term BS application. Application of BS and of MF resulted in similar bacterial alpha-diversities, and both increased them compared to the CK treatment. Fertilization significantly enhanced the relative abundances of phyla Proteobacteria, Actinobacteria, and Myxococcota but reduced that of Planctomycetota compared to the CK. While, there were no significant differences in those phyla among fertilized treatments. The relative abundances of genera Thiobacillus and Ellin6067 was decreased by the BS2 treatment compared to the MF treatment. Redundancy analysis (RDA) showed that soil organic carbon, available phosphorus and available potassium were the main factors shaping soil bacterial community composition. Spearman's correlation demonstrated that soil Cd concentration had stronger correlation with some bacterial genera of Bryobacter, Vicinamibacteraceae, and Ellin6067. Conclusions Overall, we conclude that BS application can be considered to substitute mineral fertilizers for rice production. However, the accumulation of heavy metals in paddy soil, especially for Zn, should be considered after long-term BS application.

Land application of municipal sewage sludge: Human health risk assessment of heavy metals

Yakamercan, E., Ari, A., & Aygun, A. (2021). Land application of municipal sewage sludge: Human health risk assessment of heavy metals. Journal of Cleaner Production, 319, 11 DOI: 10.1016/j.jclepro.2021.128568.

Abstract: Land application of municipal sewage sludge has become an attractive option and disposal method used worldwide. Hence, the suitability of the sludge with regards to toxic and carcinogenic chemicals is crucial to prompt informed decisions regarding its use on agricultural areas. This study aims to assess ecological and human health risks of heavy metals in sewage sludge samples collected from 22 different cities' wastewater treatment plants to determine their agricultural application potential in Turkey. The average metal concentrations of the samples decreased as the following order of Zn > Cu > Cr > Pb > Ni > Mo > As > Cd > Se > Hg without a significant seasonality. To evaluate the carcinogenic and non-carcinogenic health risks, site-specific overall total cancer risk (TCR) and Hazard Index (HI) values were calculated as the sum of all heavy metals' ingestion, inhalation, and dermal contact exposures for children and adults. Contribution of the inhalation exposure due to the dust re-suspension during agricultural work to the total health risk has seemed be negligible when compared to ingestion and dermal contact. The carcinogenic risk for the adults were within the acceptable range (10(-6) to 10(-4)) proposed by USEPA based on our estimations (2.4 x 10(-5)), but the risk value was slightly exceeded the safe levels for children (1.6 x 10(-4)). Similarly, HI values for adult subjects were below the reference value of 1, whereas they were higher for children (up to 2.52). Pb, As, and Cr were the major contributing metals to carcinogenic risks for both children and adults. Although the heavy metal concentration of

collected samples was within the agricultural land application legal standards proposed by the Environmental Protection Agency (EPA) and the Ministry of Environment and Urbanization of Turkey (MEU), but the results of human health risk assessments showed that the risks may occur especially for sensitive individuals like children. This study showed that the evaluation of waste materials such as municipal sewage sludge should be applied only if it is proper for both ecological and health-safe, and assessing based on the regulatory limit values would not be enough to protect all population.

A review on the incorporation and potential mechanism of heavy metals on the recovered struvite from wastewater

Liu, X. N., Wang, Y. Z., & Chang, J. B. (2021). A review on the incorporation and potential mechanism of heavy metals on the recovered struvite from wastewater. Water Research, 207, 10 DOI: 10.1016/j.watres.2021.117823.

Abstract: Phosphorus, as a non-renewable element, is flowing out too fast in the past decades. To sustain the development of this globally scarce resource, efficient measures were taken to recover more phosphorus in the struvite form from wastewater. However, heavy metals in the wastewater might produce an inhibitory effect on phosphorus recovery, and even worse, pollutants might be incorporated in/onto the crystals precipitated. Impurities on struvite will reduce the quality of struvite as a potential slow-release fertilizer and affect the safe application of struvite in agriculture. This review aims to identify the trends in the literature to present the residues of heavy metals in struvite. It summarizes the current status in the residues of main metal elements on crystals and its response to wastewater properties, composition, and oxidation state of metals. The adsorption process and potential adsorption mechanism of heavy metals during the struvite crystallization are deeply explored, which might determine the latter release rate of metals when applying into the soil. Possible solutions are further provided to minimize the amounts of heavy metals mainly through adjusting operational conditions or employing pretreatment methods. Finally, this review critically analyzes the limitation gap between theory and actual generalization and potential application of struvite products in the market, and corresponding perspectives in the future are given to safely utilize the phosphorus resource from wastewater in the form of struvite.

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