



UK Agri-Science & Innovation

**Supporting international
actions to mitigate
agricultural GHG emissions**

Issue 4

October 2015

Welcome

to the fourth newsletter on United Kingdom (UK) activities which support the Global Research Alliance (GRA) on Agricultural Greenhouse Gases. UK technical and scientific participation in the GRA builds upon the UK Government investment in the [UK Agricultural Greenhouse Gas \(GHG\) Research Platform](#) and aims to promote and enhance UK research into agricultural GHG monitoring and mitigation.

The aim of the newsletter is to update UK and international readers on UK-led GRA actions, recent UK contributions at international meetings and capability building activities, and participation in GRA networks. The newsletter also features topical UK projects of international interest, with this publication covering the UK research on Digestate and Compost in Agriculture (page 5).

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ABOUT THE GRA

The GRA brings countries together to address the global challenge of meeting the increasing demand for food while reducing GHG emissions intensity. The GRA encourages active exchange of data and research findings and provides a framework for cooperation between scientists and agricultural experts. It aims to enhance the scientific capacity of participating countries. GRA activities are progressed via three research groups (Livestock, Croplands and Paddy Rice) and two cross-cutting groups (Inventory & Monitoring and Soil Carbon & Nitrogen Cycling). Established in 2009, the GRA now has 46 participating countries and 7 partner organisations. Further information on what the GRA does and why it is needed is provided the [GRA brochure](#) and on the [GRA website](#).

GRA ACTIVITIES LED BY THE UK

Global Research Alliance Modelling Platform (GRAMP) website launch



GRAMP is a free, open source modelling platform. The ambition is for GRAMP to become a vibrant virtual lab where specialist researchers, modellers and students can come together to build capacity, share experience, correct errors and develop new insights. The platform will enable participants to look more strategically at the capabilities of various model versions in accounting for the effect of agricultural management practices on GHG emissions, in identifying promising mitigation options, and in assessing the effect of future climate on emissions.

The GRAMP [website](#) was launched on World Environment Day (5th June 2015) and is now open for user registration. There have been over 250 registrations from 40 countries with most GRA countries represented. As part of GRAMP, regular webinars from eminent scientists in the field are telecast. The first webinar was by Professor Changsheng Li on “Modelling soil GHG emissions based on biogeochemical concepts” and the second was by Professor Pete Smith on “Quantitative Methods for Model Evaluation” (both are available on [YouTube](#))



Two model families, DNDC and ECOSSE are currently located on GRAMP and work is underway to add the Century and Daycent family of models. A geo-referenced publication database is being developed to display papers against their relevant regional coverage. The GRAMP team is also working on integrating the MAGGnet (Managing Agricultural GHGs network) database with this platform. MAGGnet is a parallel activity of the GRA Croplands Research Group that is compiling metadata from experimental sites throughout the world, where GHGs and soil carbon dynamics are monitored.

Some of the recent publications from the project include:

Gilhespy, S.L., Anthony, S., Cardenas, L., Chadwick, D., del Prado, A., Li, C., Misselbrook, T., Rees, R.M., Salas, W., Sanz-Cobena, A., Smith, P., Tilston, E.L., Topp, C.F.E., Vetter, S., Yeluripati, J.B., 2014. First 20 years of DNDC (DeNitrification DeComposition): Model evolution. *Ecological Modelling* 292, 51–62. doi:10.1016/j.ecolmodel.2014.09.004

Yeluripati, J.B., del Prado, A., Sanz-Cobena, A., Rees, R.M., Li, C., Chadwick, D., Tilston, E., Topp, C.F., Cardenas, L.M., Ingraham, P., others, 2015. Global Research Alliance Modelling Platform (GRAMP): An open web platform for modelling greenhouse gas emissions from agro-ecosystems. *Computers and Electronics in Agriculture* 111, 112–120.

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Animal Health and GHG Emissions Intensity Network

The Animal Health and GHG Emissions Intensity Network is a UK-led initiative of the GRA Livestock Research Group. The Network brings together researchers to explore links and synergies between animal diseases and GHG emissions intensities, and possible mitigation through disease control. Annual, regional and joint workshops have been held during the past year to progress the Network aims.

Network workshop alongside CSA2015

The Network's second annual workshop was held in the margins of the [Climate-Smart Agriculture Conference](#) (CSA2015) in Montpellier, France. The aim was to share knowledge via presentations and identify data needs and expertise required to address the relationship between animal health and GHG emissions intensity. Researchers and research funders from 11 countries participated with some invited to represent initiatives the Network has links with.

Discussions identified the wide range of expertise, within the areas of animal health, GHG research and social science, required to progress the network aims. It will be important to engage social scientists to ensure research outputs are successfully communicated to farmers. Exact requirements for data were identified and participants agreed that spatial and temporal issues, trade-offs and stakeholder interpretation are important considerations when addressing data needs. Data managers and systems analysts will be required in the network to bring together data from the different disciplines. Read more in the workshop [report](#).

The Network has links with:

Global Strategic Alliances for the Coordination of Research on the Major Infectious Diseases of Animals and Zoonosis ([STAR-IDAZ](#))

Joint Programming Initiative on Agriculture, Food Security and Climate Change ([FACCE-JPI](#))

Modelling European Agriculture with Climate Change for Food Security ([MACSUR](#))

Networking to enhance the use of economics in animal health education, research and policy-making in Europe and beyond ([NEAT](#))

Global Agenda for [Sustainable Livestock](#)



Regional Focus - Africa

There is significant synergy between improving food security and reducing GHG emissions intensities particularly in developing countries, and multiple win-wins derive in terms of poverty alleviation.

To explore this further in relation to animal health in Africa, and to progress the Network objective to develop regional groupings, a workshop was held in Addis Ababa, Ethiopia, on the 5th November 2014. Held in the margins of the [ILRI@40](#) celebrations and alongside the regional meeting of [STAR-IDAZ](#), the workshop attracted 19 participants.



Two methods for increasing the uptake of GHG mitigation measures were identified. Firstly through shifting the focus to human health benefits resulting from an increased level of production. The second driver identified was the influence of market integration (especially in peri-urban areas). For further details see the workshop [report](#).

Regional Focus - Latin America

The next regional Network event focusses on Latin America and takes place at the XXIV [Congress of the Latinoamerican Association of Animal Production](#) (ALPA) (9th-13th November 2015). Professor Ilias Kyriazakis will be hosting a session titled “The relationship between Livestock health and Greenhouse Gas Emission Intensity: a win-win situation” at 16.45 on Thursday 12th November 2015.

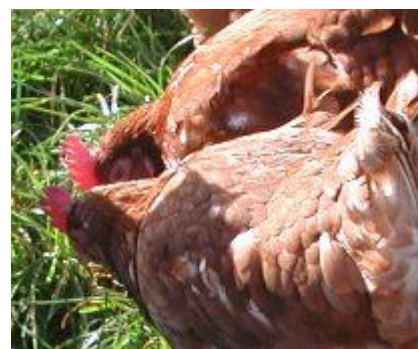
Joint workshop to progress links with MACSUR

MACSUR is a FACCE-JPI Knowledge Hub bringing together modelling expertise to illustrate to decision makers how climate will affect regional farming systems and food production in Europe. MACSUR's [LiveM](#) group has a task to explore modelling the impacts of livestock disease on climate change, and vice versa (climate change impacts on livestock disease). The Network held a joint workshop with MACSUR at the University of Reading, UK on the 25th June 2015, to share and compare research priorities, identify complimentary areas and overlaps, and discuss next steps for working together.

Common objectives are to address data quality and access, deliver scoping studies on impacts of diseases, prioritise experimental research and explore interdisciplinary issues. A number of joint activities and funding options were identified to engender collaboration between the two groups in order to tackle these objectives including the development of a state-of-the-art-paper which is in progress. See the workshop [report](#) for all the discussions and outcomes.

Visit the new Network webpages hosted on the [GRA website](#).

Please contact animalhealthnetwork@adas.co.uk to be added to the Network's email circulation list, to gain access to the online Members Area, or if you have any questions.



GRA countries participate in survey on Earth Observation for GHG inventory

As part of a wider project to investigate the potential for earth observation (EO) to provide agricultural activity data for inventory compilation, GRA countries have participated in an international survey developed by UK researchers. The survey collected information on both activity data requirements for inventory compilation and country experiences of using EO for capturing activity data. The survey broadly followed the IPCC tier 1 inventory methodology to identify data requirements and priority improvements in data for specific activities. For activities where EO had been utilised, the survey gathered information on perceived strengths and weaknesses, and it's potential. The survey was also used to identify any barriers and constraints to the use of EO, as well as country needs for capacity building and access to resources.

Eleven countries completed the survey and additional countries have expressed interest in the project outputs which will soon be available. This UK-led activity provides an excellent example of GRA countries coming together to share information on their needs and experiences in quantifying GHG emissions.

UK PARTICIPATION IN LIVESTOCK RESEARCH GROUP NETWORKS

Joint Networks workshop hosted by the UK

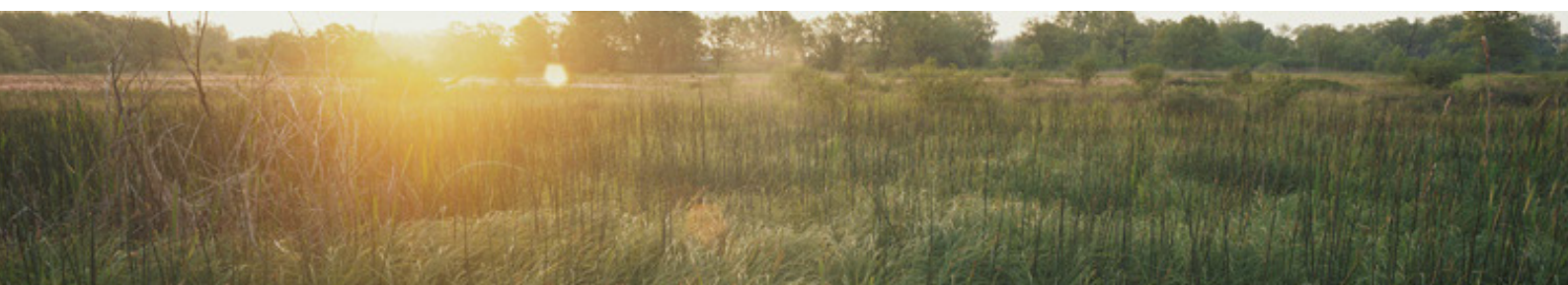
The first Joint workshop of Livestock Research Group Networks was held at the University of Reading, UK, on 26th June 2015. The objectives were to improve communication and collaboration amongst the research networks and explore interdisciplinary approaches for tackling GHG emissions from animal agriculture. The workshop had 52 participants from 18 countries representing all six networks (Networks on Feed and Nutrition, Rumen Microbial Genomics, Animal Health, Grasslands, Manure management, and Animal Selection Genetics and Genomics). Presentations on each of the Networks and scientific presentations made for a very informative morning session. The afternoon breakout discussions addressed the benefits and roadblocks to enhanced collaboration, both within and between networks, and ideas for ways to increase joint activities. The workshop was live-streamed on YouTube and live-tweeted by [@AHGHGN](#), [@RMG_network](#) and [@METHAGENE](#).



Improved collaboration between the networks will increase awareness of, and access to, databases and protocols, it will help to avoid duplication of effort, and will make the networks better placed to explore the whole farm system. Funding was raised as a barrier to progressing the networks but a number of potential funding routes were identified. Other issues discussed on the day included the need to build stronger links with industry, to create multi-disciplinary research proposals, encourage smaller active groups within the networks, and engage early-career scientists.

Participants agreed that this was a productive workshop and they would be keen to attend another which had greater involvement from PhD students and post-docs. In the meantime better communication between networks needs to be supported (e.g. webinars, sharing newsletters). The workshop [report](#) provides a full overview of the day.

Visit the [Livestock Research Group webpages](#) for further information on the research networks.



Digestate and Compost in Agriculture (DC-Agri)

A programme of replicated scientific field experiments, funded by the Department for the Environment Food and Rural Affairs (Defra), [WRAP](#) and the governments of Scotland and Wales, is helping farmers maximise the potential of anaerobic digestate (and compost) to grow quality crops whilst helping to meet climate change and waste reduction commitments.

There has been a significant increase in anaerobic digestion (AD) plants in the last 5 years with >97% of digestate recycled to land. Food-based digestate is a particularly valuable source of readily available nitrogen (RAN) and provides a 'low-carbon' alternative to manufactured nitrogen fertiliser. Laboratory analysis has shown that typically 80% of the total nitrogen (N) content of food-based digestate is present in a readily available form, compared with around 70% for pig slurry and 45% for cattle slurry. It is very important to provide farmers with the information necessary to quantify how much crop available N will be provided by digestate to optimise yields and profits, maintain crop quality, and minimise the potential impacts on the environment.



As part of a series of 15 replicated field experiments, three experiments measured how efficiently crops took up and used N supplied by food-based digestate as well as measuring environmental emissions. Autumn and spring applications were made at the sites which had contrasting soil types and climates. Digestate applications were compared with manufactured fertiliser N and N supply from compost, solid manures and cattle slurry, applied by either surface broadcasting or bandspreading.

Ammonia emissions were higher from digestate than from cattle slurry applications at Pwllpeiran in Wales (medium/heavy soil) (Figure 1), which was largely a reflection of the

greater RAN content of the digestate (72% of total N applied, compared with 53%). Notably, bandspreading reduced ammonia losses from both the digestate and cattle slurry treatments, compared with surface broadcast applications, although emissions were still high. Shallow injection has been demonstrated to be even more effective at reducing ammonia losses from livestock slurry, and the team are confident that shallow injection will deliver greater benefits for digestate use too. The research has been extended to test this. Ammonia emissions were low from the green compost and cattle farmyard manure (FYM)

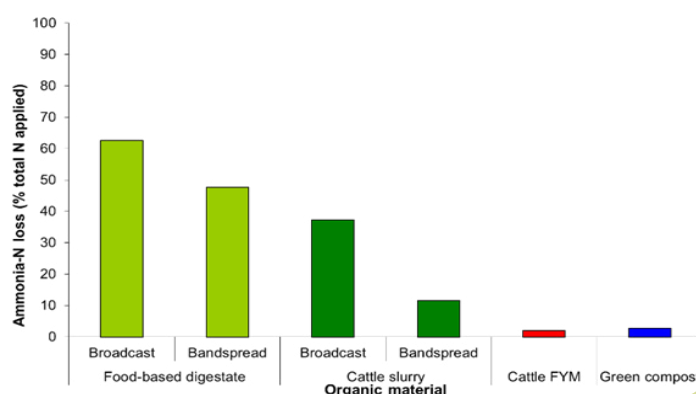


Figure 1. Ammonia emissions following spring (2nd May) organic material applications to grassland at Pwllpeiran



applications, reflecting the lower RAN content of these materials (<10% of total N applied). It is recommended that precision application methods (i.e. a bandspreader or shallow injector) are used when applying digestate, to maximise the fertiliser replacement value of the digestate and to minimise ammonia losses.

Nitrate, ammonium-N, phosphorus and E.coli leaching losses were measured following the autumn organic material applications at the sandy soil site at Wensum. The digestate and pig slurry applications increased nitrate leaching losses above the untreated control; losses were equivalent to 15-20% of the total N applied and reflected the high RAN content of these materials (c. 80% of total N applied). In contrast, nitrate leaching losses were low following the green/food compost and pig FYM applications, reflecting the lower RAN content of these materials (c.10% of total N applied). None of the organic material applications had an effect on ammonium-N, phosphorus or E.coli losses in drainage waters.

At Wensum in Eastern England (sandy/light soil), of the total N supplied from food-based digestate applied in autumn, only around 20% was used efficiently by the winter wheat crop (Figure 2). In spring, when the winter wheat was growing actively, the uptake of applied N increased dramatically to around 80%. The N efficiency of the pig slurry, food and manure-based digestates was consistently much greater when applied in the spring, compared with the autumn application.

Similarly, at ADAS Pwllpeiran, the grass silage crop utilised N from the applied food and manure-based digestates and cattle slurry much more efficiently in the spring, when the crop was growing actively, than from the autumn application. This reflected the relative RAN contents of the different materials.

WRAP has published a series of Bulletins summarising results from DC-Agri. This includes results from some longer term effects on soil organic matter, potentially available N and biomass as well as more detail of N supply from food-based digestate. The Bulletins can be downloaded at www.wrap.org.uk/dc-agri. Also at this page is a video on use of anaerobic digestate.

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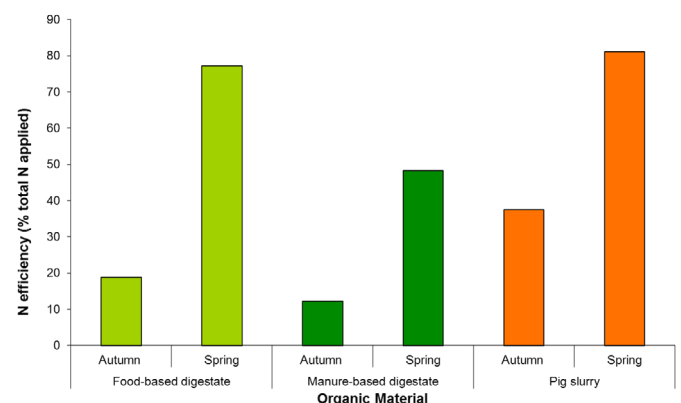


Figure 2. Wensum: N use efficiency - winter wheat (bandspread)

Working towards more resilient and climate friendly agriculture: Connecting research, policy and farmers

Acknowledging the pivotal role of farming systems in decision-making is important when changes and transitions in farm management are needed to achieve food security and the formulation of a low carbon development pathway. Farm level decisions and the resulting operational field management ultimately determine the success of agriculture in terms of productivity improvement, the reduction of GHG emissions and the overall resilience and sustainability of the system.

Farming system characterisation provides a way to conceptualise and contextualise farm and field management. Most farming system approaches consider both biophysical and socio-economic elements and some of them focus more on material and/or nutrient flows. Meanwhile, others have a stronger focus on socio-economic variables. Thus, understanding the factors within a farming system that influence GHG emissions and the socio-economic influences on farmer decisions will help guide a transition to more climate safe and climate friendly production systems. Improving the understanding of farm systems also provides a vehicle to connect farmers, science and policy makers.

The Ministry of Agriculture and Cooperatives (MoAC) of Thailand and the government of The Netherlands co-hosted a workshop in Bangkok, Thailand, on 11th-12th February 2015 to start-up a regional network for farming systems, an activity of the GRA Inventory & Monitoring Cross-cutting Group. Scientific representatives from Indonesia, Korea, Malaysia, Myanmar, Philippines, Vietnam, UK (represented by Dr Rob Simmons, Cranfield University) and Thailand participated during the two-day workshop. In addition, with the support of Agriterria, farmer representatives from the Philippines and Indonesia also actively participated in this meeting.

During the workshop, the policy and research country representatives explored the challenges and difficulties of developing 'resilient and climate friendly' farming systems that can meet the impact of a changing climate. Through small group discussions and group feedback sessions, participants critically evaluated the country presentations made and identified common areas of interest. As a result they identified and agreed to put their efforts into main thematic areas with the intention that these will be developed into participant led Association of South East Nations (ASEAN) regional projects.

The thematic areas were: 1) Mixed Farming Systems in Climate Smart Agriculture, 2) Knowledge transfer/adoption of mitigation technologies/adaptations for GHG reduction, 3) Development of information systems for tools and technologies, and 4) Increased collaboration between policy makers, researchers and farmers.

For each area, one or two leading countries will initiate the development of projects. This very successful workshop makes an impressive start to the regional collaboration initiated and supported by the GRA. A follow-up meeting is expected in 2016.



UK REPRESENTATION AT GRA MEETINGS



- **Livestock Research Group meeting** Yogyakarta, Indonesia (14th – 15th November 2014)
- **Regional Farming Systems workshop** Bangkok, Thailand (11th – 12th February 2015)
- **Livestock Research Group meeting** Lodi, Italy (23rd – 24th June 2015)
- **Soil Carbon in Grasslands workshop** Lodi, Italy (25th June 2015)
- **Feed and Nutrition Network workshop** Reading, UK (25th June 2015)
- **Manure Management Network workshop** Reading, UK (25th June 2015)
- **Joint Animal Health Network and MACSUR workshop** Reading, UK (25th June 2015)
- **Joint Livestock Research Group Networks workshop** Reading, UK (26th June 2015)
- **Croplands Research Group meeting** Brasilia, Brazil (11th – 12th July 2015)
- **GRA Council meeting** Des Moines, USA (8th – 11th September 2015)

Contact gra@adas.co.uk for further information on any of these meetings.

FURTHER INFORMATION

Please contact ADAS UK Ltd for further information on UK participation in the GRA and FACCE-JPI. Details of UK participation in the GRA is also available on the UK pages of the [GRA website](#) including previous UK Agri-Science & Innovation Newsletters.

Please send your email address to Adele Hulin (contact details below) in order to receive regular updates on GRA activities, meeting reports, funding opportunities, publications and events.

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Check out the recent publication '[Reducing Greenhouse Gas Emissions from Livestock: Best Practice and Emerging Options](#)' which was produced by the GRA Livestock Research Group and the Dairy and Beef Working Groups of the Sustainable Agriculture Initiative (SAI) Platform.