TACKLING AMMONIA EMISSIONS FROM AGRICULTURE

SPECIAL REPORT | 24 - 27 APRIL 2018
http://eurac.tv/9Oum
Agriculture generates around 94% of all ammonia emissions in the EU, the vast majority of which comes from livestock excreta. Greenpeace estimates the livestock share at almost 80%, while mineral fertiliser application accounts for approximately 20%.

What should the member states do to tackle air pollution from agriculture? What is the role of new technologies in reducing ammonia emissions? What role do fertilisers play?
Contents

Vella: Ammonia emissions is an ‘enormous’ problem that needs to be tackled 4

Fertilisers Europe chief: No need for ‘rocket-science’ to reduce agricultural emissions to reduce ammonia emissions 6

Hogan: New technologies ‘very important’ to reduce agricultural emissions 8

Customised nitrogen fertilisation saves money and the environment, Yara says 10
In order to fight air pollution, an integrated approach is needed, according to Karmenu Vella, the EU Commissioner in charge of environment, maritime affairs and fisheries.

“One of the main sources of particulate matter, for example, is agriculture. Once ammonia gets into the air, it combines with other chemicals to form secondary particulate matter. It’s an enormous problem all across the continent,” the Maltese Commissioner told EURACTIV.com.

Agricultural air pollution comes mainly in the form of ammonia, which enters the air as gases from fertilisation with products prone to volatilisation and livestock.

In total, 94% of all ammonia emissions in the EU result from agriculture, of which livestock excreta is responsible for the lion’s share – Greenpeace estimates it at almost 80% of the total, while mineral fertiliser application accounts for approximately 20%.

The fight for cleaner air is one of the key environmental policy issues of the EU since the late 1970s. The Commission points out that over the last three decades, particular policies have managed to improve air quality throughout Europe. But, emissions from agriculture show the smallest decrease.

Ammonia volatilisation into the atmosphere has a negative impact on agriculture, ecosystems and human health and represents a high cost to society.

Ammonia, a compound of nitrogen and hydrogen, is a pungent smelling gas and air pollutant causing soil acidification, eutrophication and ground-level ozone.

According to the European Nitrogen Assessment, the loss of welfare and effects on human health due to ammonia emissions is estimated at between 2 to 20 euros per kg of ammonia emitted. Others estimate the effects even higher.

A revised National Emissions Ceilings (NEC) Directive entered into force on 31 December 2016 and ammonia is part of it.

“All member states have to reduce their ammonia emissions by 2020 and 2030 with at least the percentage in the Directive,” an EU official told EURACTIV.

The official stressed that the member states have to submit the first national air pollution control programmes no later than 1 April 2019, so they still have a year left to prepare the programmes.

“As it is quite a big task and there is the need to consult, it is not something that can be done very fast. So it is no surprise that no programmes have been submitted yet,” the official added.

Isabel Proaño, the communications
Continued from Page 4

manager at the European Federation of Allergies and Airways Diseases’ Patients Associations (EFA), said patients with chronic diseases such as allergy, asthma and chronic obstructive pulmonary disease (COPD) are looking for an environment that does not compromise their quality of life even more.

“As we cannot choose what or where to breathe, we find ourselves inhaling harmful pollutants coming from traffic, farming, industry and construction.”

“Otherwise, the burden of air pollution will continue to fall on people’s health, especially on the lives of respiratory patients, and our society cannot accept the more than 400,000 preventable deaths from the dirty air every year,” Proaño said.

THE PROBLEM OF LIVESTOCK

Greenpeace says the Common Agricultural Policy (CAP) is not delivering results for the environment.

“This is particularly true where the livestock sector is concerned. Increasingly intensive livestock farms emit a lot of pollutants, affecting our air, water and soil. Emissions of ammonia (NH₃) are a perfect example,” Greenpeace’s food and agriculture director Marco Contiero told EURACTIV.

Referring to new research, he said it proves that the CAP is supporting some of the most polluting livestock farms.

“CAP subsidies are being paid to industrial livestock installations which emit so much ammonia that they are required to submit data to the European register from pollution for industrial facilities (E-PRTR). However, even the high ammonia emissions from the biggest industrial livestock facilities on this register represent only a fraction of all ammonia released by the livestock sector in Europe. And it does not say anything about the many other pollutants that such sector releases into the environment.”

As for the post-2020 CAP, which is currently under discussion, Contiero said it should design policies that drive down the production and consumption of livestock products while encouraging the production of plant proteins and the adoption of ecological livestock farming practices.

MINERAL FERTILISERS

Nitrogen plays a major role in all biological processes and it is essential for life on the planet. For crop production and healthy soil, farmers apply nitrogen in several fertiliser forms, ranging from anhydrous ammonia (NH₃) direct application to Urea and Urea ammonium nitrate solutions, all potentially harmful when applied in excessive quantities.

When Urea or Urea Ammonium Nitrate (UAN) remains on the surface of the soil for extended periods, soil urease enzymes will start the hydrolysis process, converting the urea to carbon dioxide and ammonia, during which a portion will evaporate as ammonia gas.

According to the Gothenburg Protocol, which among others examines the optimal fertiliser use, ammonia emission from fertilisers’ application is dependent on the fertiliser ‘type, weather and soil conditions.

The proposed guidelines aim at retaining the crucial nitrogen (N) element in the farming system, preventing losses and thus ensuring maximised productivity and reduced environmental impact.

“Emissions from urea-based fertilisers are much greater than other fertiliser types because rapid hydrolysis of urea will cause a localised rise of pH,” the Protocol reads.

An alternative that can help reduce ammonia emissions from urea-based fertilisers could be urease inhibitors. But many stakeholders are concerned about the potentially harmful effects that adding massive amounts of another chemical in agricultural production can bring.

Also based on the recommendation of the Gothenburg protocol, others suggest the use of nitrate-based fertilisers, such as ammonium nitrate or calcium ammonium nitrate, as the best way to apply the optimum amount of nitrogen with the right timing.

This is done via the use of precision farming tools to reduce losses and enhance N uptake by plants and soil microorganisms. Backers of this alternative say it wouldn’t bring further chemicals into agriculture along with the nutrients.

The Protocol stresses that the ammonia emissions from non-urea fertilisers are low, although minor volatilisation may occur partly as a result of direct fertiliser emission and partly from indirect emission resulting from plants as a consequence of fertilisation.

In Europe, a big share of the fertilisers is already nitrate-based, which could become an advantage for EU farmers, who can leverage on lower emissions per tonne of food than farmers of other regions.

However, other nitrogen-containing fertiliser which is particularly prone to volatilisation, like urea and UAN, have an important share of the market, mainly due to its low cost.

Asked what farmers should do to make crops stronger while simultaneously reducing ammonia’s environmental impact, Pekka Pesonen, EU farmers’ union (Copa-Cogea) Secretary-General, replied, “By knowing better the soil and the plants’ needs, farmers can use fertiliser at the right time, right place and right quantity.”

“In this sense productivity, climate change mitigation and adaptation, as well as protection of the environment can work in tandem. This is why soil and nutrient management go hand in hand and can be a win-win situation.”
Fertilisers Europe chief: No need for ‘rocket-science’ to reduce ammonia emissions

By Sarantis Michalopoulos | EURACTIV.com

No rocket science, or even innovation, is needed to reduce ammonia emissions from fertilisers, the European fertiliser industry boss Jacob Hansen told EURACTIV.com in an interview. As an example, he pointed to the use of nitrate fertilisers instead of urea.

"For the fertilisers’ part, we don’t need rocket science but we need to do the right thing. So, the first thing is the product itself, because there are different types of fertilisers. If you use urea, you emit ammonia because it's an ammonia-based fertiliser,” Hansen said.

Agriculture generates around 94% of all ammonia emissions in the EU, the vast majority of which comes from livestock excreta, while mineral fertiliser application accounts for approximately 20%.

Hansen explained that many efforts have already been made in terms of both animal husbandry and fertilisers to reduce ammonia emissions. But when it comes to the 20% from mineral fertilisers, more contributions could be made, he said.

"If you use nitrate fertilisers, ammonium nitrate or calcium ammonium nitrate, one has few emissions of ammonia. One way to improve ammonia emissions from fertilisers is to use nitrate fertilisers instead of urea. That would

Continued on Page 7
immediately reduce emissions by up to 60%,” Fertilisers Europe chief emphasised.

Considering that nitrogen is essential for crop production and healthy soil, farmers apply nitrogen in several fertiliser forms, ranging from anhydrous ammonia (NH3) direct application to Urea and Urea ammonium nitrate solutions, all potentially harmful when applied in excessive quantities.

**THE APPLICATION**

As far as the application is concerned, Hansen said it was not so important for nitrates, which is not the case for urea.

“There are two things you can do: one is to incorporate urea because the problem is, if you spread it on the surface, this is where you have the ammonia emissions. If you incorporate it into the soil directly, then you have fewer emissions. But this is not new technology; this is what I mean by saying no rocket-science is needed to reduce ammonia emissions from fertilisers.”

Urea contains an NH-molecular combination \([\text{CO(NH}_2\text{)}_2]\) just like ammonium \((\text{NH}_4)\), while nitrate \((\text{NO}_3)\) has no recognisable NH-molecular combination.

“Of course, it takes more effort on the side of the farmers, but this can also be done. The other option is to use coated urea or inhibitors. Those technologies also allow a further emission reduction,” he said.

**DOING THE RIGHT THING**

According to Hansen, the fertilisers-related costs will not significantly increase.

“What we have to understand is also that if ammonia is emitted into the air, it means that ammonia does not go to the plant and, therefore, the farmer does not get anything out of the price he paid for ammonia that goes into the air.”

He explained that doing the right thing might be a bit more complicated, but farmers need to think how to use fertilisers in a better way and choose the right product.

However, he predicted that the really big discussion among the member states will be how to deal with the animals, how to deal with manure, and how to reduce emissions from animal housing.

“This will be the most difficult discussion because this is where farmers are sensitive, as animal production is an important part.”
Agriculture has to modernise to take account of the new technologies that are coming on the market as this is a “win-win situation” both financially and environmentally, EU Agriculture Commissioner Phil Hogan told EURACTIV.com.

According to the EU agricultural outlook 2017, the emissions linked to agriculture set to decrease by 2030 thanks to modern farming techniques reducing the use and improving the efficiency of inputs such as fertiliser.

Agricultural air pollution comes mainly in the form of ammonia, which enters the air as gases from livestock and from fertilisation using products prone to volatilisation.

In total, 94% of all ammonia emissions in the EU result from agriculture, of which livestock excreta is responsible for the lion’s share – almost 80% of the total – while mineral fertiliser application accounts for approximately 20%.

According to the agricultural outlook, thanks to growing development of new technologies, ammonia emissions linked to agriculture in Europe are expected to decline by approximately 10% between 2008 and 2030.

Farmers agree that agriculture should step up its action in tackling emissions from the sector. They also agree that new and precise technologies could significantly help in this direction.

Continued on Page 9
“New technologies that include soil mapping, preferably with the soil organic matter considered, such as the variable rate in PPPs, nitrogen application, that can be incorporated to land management,” Pekka Pesonen, secretary-general of the EU farmers’ union Copa Cogeca, told EURACTIV.

The idea, Pesonen said, is that technology has to work for the farm economics as well as for the environment and climate and in that sense “we could add the launch of the joint ‘EU Code of Conduct on agricultural data sharing by contractual agreement’.”

“Technology has to work for farmers and the wider society and not the other way around,” he added.

On 23 April, a number of agri-food stakeholders launched a voluntary initiative to create a framework of cooperation among agri-food chain operators to make the best use of much-needed data in a constantly digitising farming sector.

Speaking to EURACTIV on the sidelines of that event, Hogan said that new technologies, in general, are a win-win situation for farmers in terms of their income but also for the environment.

Referring to the role of technologies in reducing the agricultural emissions, he said: “I think we have good examples of that in relation to environment and climate about ammonia and phosphorus emissions, water quality, soil fertility; we have to set targets in the future, we have to measure by performance and new technologies play a very important role.”

THE ORGANIC FERTILISERS

Bandry explained that a big problem is the homogeneity of the organic fertiliser in terms of nitrogen, phosphate and potassium ‘NPK’ content.

“Depending on where the manure is pumped up in the reservoir and depending on the farm practices (type of livestock, type of cleaning) this content can vary significantly. For instance, nitrogen levels can change a lot and therefore if you just apply it without knowing the nitrogen content of your manure, you could apply too much, thereby increasing the risk of contaminating groundwater.”

On the other side, he noted, a scarce application of nitrogen will require additional mineral fertilizer later in the crop production process.

“The fact is that organic manure is for free, actually, agri-businesses with a surplus of manure (e.g. pig production) now pay farmers to have manure being placed on their fields. It’s a professional business, so more and more what you see on organic fertilisers, meaning manure, is that the amount of precision technology use is increased to understand better and homogenise the nitrogen application on fields,” he underlined.

Bandry said that by doing so, the biggest cost, which is the nitrogen that you have to add later on, could be minimised.

“In addition, by optimising more these processes of manure application, it’s possible that you will need much less intermediate mineral fertiliser to be applied and if applied, it could be done by precision tools or others systems, such as drones for local spots,” he concluded.
Referring to a case study in France, Norwegian multinational fertiliser and crop nutrition company Yara says that nitrogen fertiliser efficiency generates additional income for farmers and reduces ammonia’s climate and environmental impacts.

Agriculture generates around 94% of all ammonia emissions in the EU, the vast majority of which comes from livestock excreta. The livestock share is at around 80%, while mineral fertiliser application accounts for approximately 20%.

A revised National Emissions Ceilings (NEC) Directive entered into force on 31 December 2016 and ammonia is part of it. Now, member states have to reduce their ammonia emissions by 2020 and 2030 by at least the percentage set in the Directive.

Ammonia being at the base of every nitrogen-containing nutrient for plant growth, farmers face a dual challenge: make crops stronger and increase yields while simultaneously reducing ammonia’s environmental impact.

Ammonia’s volatilisation into the atmosphere has negative consequences for agriculture and human health, among others.

Continued on Page 11
In an interview with EURACTIV earlier this week, European fertiliser industry boss Jacob Hansen pointed out that the fertiliser product farmers use does matter. “If you use nitrate fertilisers, ammonium nitrate or calcium ammonium nitrate, one has few emissions of ammonia. One way to improve ammonia emissions from fertilisers is to use nitrate fertilisers instead of urea. That would immediately reduce emissions by up to 60%,” Fertilisers Europe chief emphasised.

Yara’s flagship tool to reduce ammonia emissions from agriculture is the application of nitrate-based fertilizers, like ammonium nitrate, CAN or NPKs, combined with precision farming, to make it even more efficient. A concrete example of this is the “N-Tester”, a handheld leaf nitrogen measurement tool which enables readings to be taken in a growing crop in order to establish its exact nitrogen status.

“This allows fast and accurate field-specific recommendations to fine-tune nitrogen application during the growing season”, Yara noted.

The company explained that the nutritional status of the plant determines the timing and amount of fertilisers, meaning it is possible to identify the exact nitrogen requirements of the plants directly on the field and therefore reduce fertiliser inputs and avoid oversupplies, improving the environmental performance of the farm.

**THE FRENCH CASE**

In 2016, 21,000 French farmers used the device called N-Tester on 710,000 hectares of wheat.

Referring to data from 240 trials conducted in France over 10 years, Yara calculated that the use of its hand-held device to measure nitrogen status in crops generated an additional income of €19 million for the French farmers in 2016.

But it also reduced nitrogen-based fertiliser’s carbon footprint and environmental impact. “This figure includes the value created by higher yields, the premium for high protein content in wheat and cost savings from lower fertiliser application, it specified, adding that the additional yield led to an extra production of approximately 85,000 tons of wheat.”

Customised nitrogen fertilisation also contributed to lower greenhouse gas emissions by 71,000 tonnes of CO2 in the same period of time, Yara underlined.

**ECOSYSTEM IMPLICATIONS**

According to the European Nitrogen Assessment, it is estimated at 12 euros per kg of emitted ammonia for health damages and 2 euros for ecosystem damages.

Ammonia runoff from fertilisers or manure slurry also leads to the rapid growth of algae in rivers, lakes and seas, depriving plants and animals of oxygen.

The rapid proliferation of algae is a major problem in the French region of Brittany, where agriculture plays a major part in the economic growth.

But the presence of algae on Brittany’s shores has also become a major issue for villages depending on tourism.

In February 2018, the Administrative Court of Rennes heavily sanctioned the French state for not having taken measures to fight against and prevent the proliferation of green algae in the bay of Saint-Brieuc (Britany).

The agglomeration, which has to pick up the algae from the beaches and pay for it, had initiated a procedure in the administrative court. The state must now pay the small city €556,500.
For information on EURACTIV Special Reports...

Contact us

Davide Patteri  
Public Affairs Manager  
davide.patteri@euractiv.com  
tel. +32 (0)2 788 36 74

Sarantis Michalopoulos  
Reporter  
sarantis@euractiv.com  
tel. +32 (0)2 226 58 28