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'Best available techniques' as a mandatory basic standard for more sustainable agricultural land use in Europe?

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ABSTRACT

Substance emissions resulting from modern agriculture in the European Union (EU) affect the entire environment and are no less harmful than those caused by industrial installations. Even so, the EU requires only industrial installations, which include large intensive livestock holdings, to use the best available techniques (BAT). Agricultural land use, by contrast, needs simply to meet the standard of tried-and-tested technologies and generally accepted farming methods (good practice). This paper seeks to add a new perspective to existing political debates and scientific investigations by questioning the adequacy of existing regulatory requirements concerning agricultural land use and proposing that the BAT-Standard should be applied to agricultural land use, especially for high-input-farms. Were the BAT standard to be applied to agricultural land use, those techniques and farming methods which are most advanced and efficient in preventing environmental emissions, and so most effectively help to achieve a generally high level of protection of the environment as a whole, would have priority by law. The paper discusses which techniques and methods might meet these criteria by looking at four examples: conservation tillage, integrated pest protection, precision farming and organic farming.

Agricultural emissions

The European Union now consisting of 28 member states (EU-28), has 12.2 m farms working approximately 40% of the total land area (1 78.6 m ha) (Eurostat, 2013, p. 24, Eurostat, 2014i). There are, however, considerable differences between the various member states, and especially between western and eastern Europe. Intensive agriculture in western and central Europe almost entirely utilises the natural yield potential of net primary production (Haberl et al., 2007), even though only a small variety of plants are cultivated and used in arable and intensive grassland. The high yields are achieved through optimal structuring and intensive cultivation of the agricultural land but – most crucially – as a result of high inputs of fertilisers and pesticides. 2007 in the EU-27 40.7 m ha (26%) of agricultural land was classified as having high inputs, 50.8 m ha (33%) medium inputs and 63.3 m ha (41%) low inputs (Eurostat, 2014c). In comparison to other regions of the world, agricultural production in the EU is highly intense (only exceeded by Japan and partly by China) with corresponding negative consequences for the environment and biodiversity (Buckwell et al., 2014, p. 19; Stoate et al., 2009).

In detail the farmers of the EU-28 applied to their fields and pastures 2011 almost 10.6 m t of nitrogen, 3.4 m t of phosphorous and phosphate and 4.8 m t of potassium and potash, in the form of manufactured fertilisers (Eurostat, 2014b,e). The 6 member states with the highest emissions (France, Germany, Italy, Poland, Spain, and United Kingdom) together contribute to more than 70% of the EU-28 emissions (13.4 m t). In the course of the global economic crisis, sales of manufactured fertilisers in the EU fell significantly in 2008, but they have been slowly recovering since (compared with 2007, sales in 2008 decreased by almost 14% for commercial nitrogen fertiliser and 47% for commercial phosphate fertilisers) (Eurostat, 2014b). However, in addition to synthetic or mineral fertilisers, farmers in the EU-28 also use livestock excrement as fertiliser, which, in 2011, resulted in the emission of a further 9.1 m t of nitrogen and 1.6 m t of phosphorous (Eurostat, 2014h). This high nutrient input is not, however, even remotely re-extracted by plants. Instead, the EU-28's gross balance in 2011 revealed unused nitrogen excesses of 8.4 m t (47 kg N/ha) and phosphorous excesses of 0.18 m t (1 kg P/ha) (Eurostat, 2014f,g). However, there are significant differences in surpluses between the states, as demonstrated by the following 2011 examples: Cyprus 202 kg N/ha, Netherlands 163 kg N/ha, Germany 97 kg N/ha, France 57 kg N/ha, Romania −17 kg N/ha (Eurostat, 2014g). These excesses remain in the soil, leach into water bodies or are emitted into the atmosphere. Such emissions contribute to eutrophication of water and biotopes

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among other issues (Hettelingh et al., 2009, p. 65). As a consequence of the continued nutrient input discussed above, biodiversity losses are increasing in rivers and lakes, especially regarding the loss of oligo- and mesotraphent species (e.g. Steffen et al., 2013).

For the impact of current intensive agricultural production on the atmosphere, the high levels of ammonia and laughing gas emissions produced by livestock, fertilisers and tillage are especially relevant. More than 93% of ammonia originates from agriculture in the EU-28 (EEA, 2014). In 2011 the amount was 3.4 m t, 15.4% of which was emitted by German agriculture alone (Eurostat, 2013, p. 117). High near-ground concentrations of ammonia can directly harm plants (Hettelingh et al., 2009, p. 65). Agriculture's share in laughing gas emissions is correspondingly high, contribution to 75% of the EU-27's total emissions (as at 2008) (EEA, 2010, p. 14). These laughing gas emissions, amounting to 315 000 t, account for 57% of the total agricultural emissions of greenhouses gases in the EU-27 (EEA, 2012; Velthof et al., 2010, p. 36). For the most part, these emissions result from the use of nitrogen fertilisers and animal manure, although those arising from drained soil are also significant (Velthof et al., 2010, p. 38). The greenhouse gas emissions from European land ecosystems investigated as part of the CarboEurope research project show that forests and permanent grasslands, taken as a whole, act as greenhouse gas sinks, whereas arable land and drained peat bogs are greenhouse gas sources (Schulze et al., 2009, pp. 845–846). Taken as a whole, agriculture in the EU-28 caused around 10% of European greenhouse gas emissions (461.6 m t of CO_2 equivalent) in 2010 (Eurostat, 2013, 2014d, p. 106). In Germany the contributing amount is 13% (SRU, 2009, p. 168).

A less obvious type of pollution caused by the intensive application of fertiliser is the pollution from heavy metals and other harmful substances which are included in fertilisers and thus also make their way into the environment. For example in Germany the input of heavy metal and harmful organic pollutants from agricultural production is significant (SRU, 2009, p. 122). The Federal Environment Agency found that the agricultural share of heavy metal inputs into surface waters in Germany amounts to between 20 and 40% and, in the case of chromium, as much as 60% (UBA, 2010, p. 97). In addition, some mineral phosphorous fertilisers contain natural traces of toxic uranium which, as a result of accumulation in agricultural soil, can pose a long-term risk to groundwater (UBA, 2012). Finally, veterinary medicines have also recently begun to be recognised as yet another source of contamination. Antibiotics or their by-products are excreted by the treated animals and so make their way, through manure applied to the land, into the environment. Recent studies show that the contamination of European soil by antibiotics used in livestock farming has now reached a considerable dimension (de la Torre et al., 2012; SRU, 2009, p. 126).

In addition to fertilisers, European farmers also use pesticides on a large scale to protect their harvests. According to the most recent data available for all member states, more than 368 800 t of active pesticide substances were sold to farmers in the EU-28 in 2012 (Eurostat, 2014m, own addition). In EU-15 sales have thus increased by 11% compared with 1992, though the 1998 figure even exceeded 355 000 t (Eurostat, 2014l). 2012 farmers in EU-28 mostly use fungicides (145 740 t), followed by herbicides (134 743 t), insecticides (24 596 t), plant growth regulators (13 194 t), molluscicides (1344 t) and other plant protection products (49 209 t) (Eurostat, 2014m, own addition). The widespread use of these substances not protects crops but also pollutes environmental media and threatens biodiversity, and traces of the substances can be found in water and soil (EU-Commission, 2006, p. 3). Recent studies of the chemical contamination of the four major rivers in northern Germany (Elbe, Weser, Aller and Ems) show that, in addition to monitored substances, some of which are classified as priority substances, the water can be shown to contain concentrations of other active pesticide substances likely to have adverse effects on water fauna and flora (Schäfer et al., 2011). Of the 500 substances the researchers studied, 49 were pesticides (von der Ohe et al., 2001). The active pesticide substances diazinon, azoxystrobin, terbuthylazine, heptachlor und PS endosulfan 1, were found to be the highest priority in terms of their hazardous nature and frequency. In addition, recent studies show that pesticides were strongly responsible for the exceedances of the acute risk thresholds related to fish, invertebrates and algae. Although the chronic risks for many organism groups at a large-scale are even higher because of the accumulation and the long-term effects of substances (Malaj et al., 2014).

Using pesticides also has dangerous implications for human health. An evaluation of long-term studies on the impact of pesticides on humans, initiated by the European Parliament in preparation for EU Regulation No 1107/2009, revealed significant cause-and-effect relationships between some active pesticide substances and certain diseases like cancer, infertility or neurological diseases (e.g. Parkinson's) and showed that these substances also alter hormonal balance and the immune system (Blainey et al., 2008). The ingestion of even small amounts over a long period or during embryonic or infant development increases the risk of contracting such diseases. Especially at risk are those working in the agricultural sector and their children and people – again, children especially – who live on or in the vicinity of agricultural holdings.

Finally, agriculture also contributes considerably to particulate pollution in Europe: in 2011, the PM_{10} emissions exceeded 200 000 t. These emissions have been increasing slightly since 1990 and have exceeded the PM_{10} emissions of the energy sector since 2007 (EEA, 2013, p. 37).

All in all, it can be concluded that modern agriculture in western and central Europe, characterised by large-scale livestock and intensive arable farming, accounts for a significant share of anthropogenic substance inputs into the environment which, in some cases, even exceeds that of industrial emissions.

Regulatory concepts of current EU agri-environmental law

Current EU agricultural policy makes use of a variety of regulatory instruments to protect the environment, but two types predominate: firstly, administrative standards for the authorisation and use of fertilisers and pesticides, the protection of water and species and the establishment of agricultural installations; and secondly, subsidies which, in the case of direct payments, were linked to environmental obligations or, in the case of agri-environmental measures, reward specific environmental achievements. In addition, agri-environmental law uses the instrument of certification of sustainability standards for organic farming and liquid biofuels.

However, overall, the existing protection standards and the underlying concepts of agri-environmental law are diverse, lack coherence and contain gaps and therefore do not provide an adequate standard of environmental protection. The regulatory landscape will now be briefly examined including critique of existing instruments.

In 2009, the EU directly regulated the authorisation of plant protection products in the Pesticides Regulation 1107/2009[1] and its four implementing regulations. These regulations tightened up the approval criteria for active substances and products in the earlier Directive 91/414[2] as a precautionary means of protecting human health and the environment. Also, the new Pesticide Regulations

[1] Regulation concerning the placing of plant protection products on the market, Official Journal (OJ) L 309, 24.11.2009, pp. 1–50.

[2] Directive concerning the placing of plant protection products on the market, OJ L 230, 19.8.1991, pp. 1–32.