Plastics in Soils

Plastic emissions from agriculture and horticulture in Germany

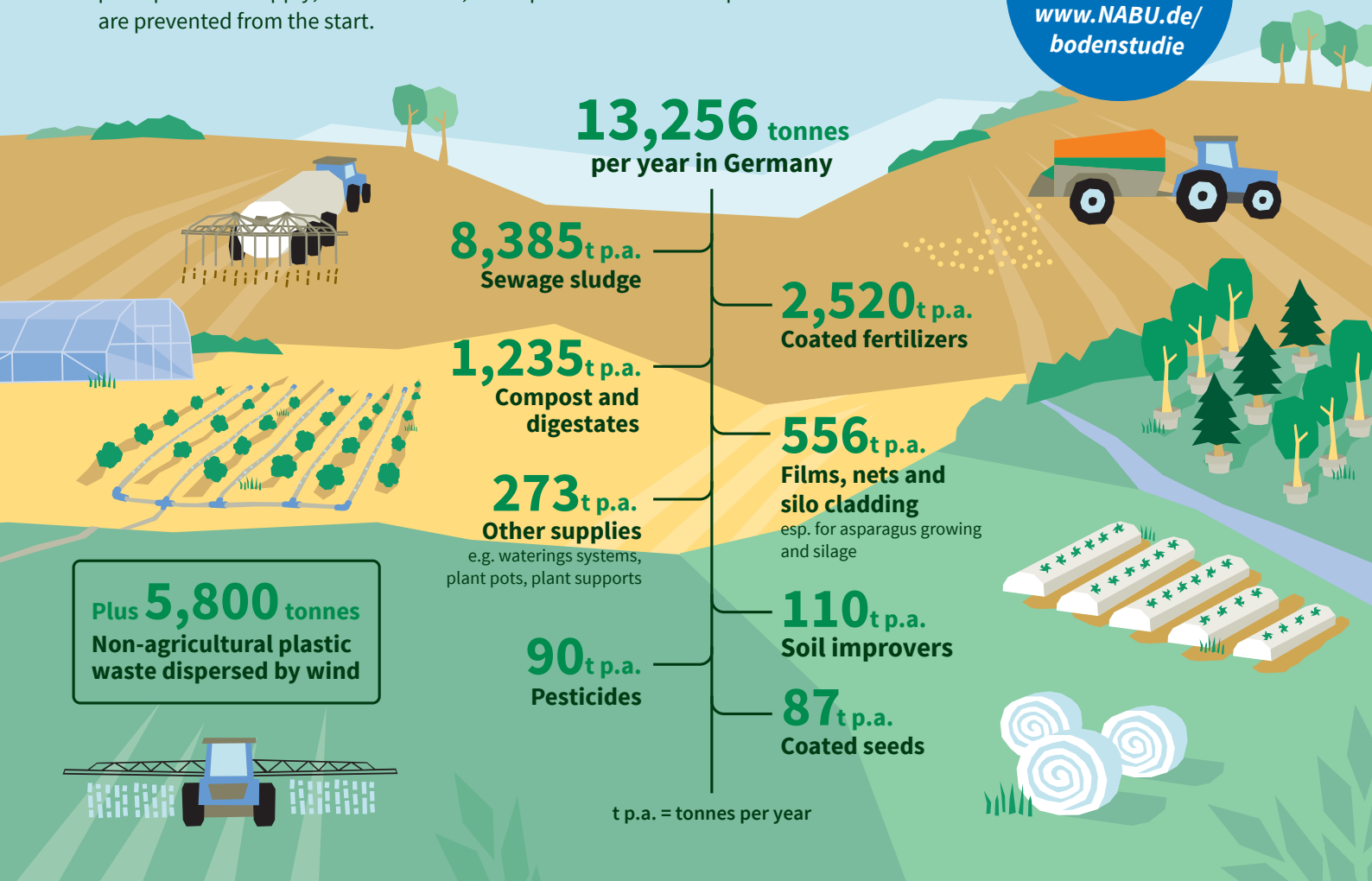
At present, relatively little is known about plastic pollution in soils. Initial investigations suggest that microplastics are ingested by organisms such as earthworms, and that this upsets their metabolism and causes inflammation. Much more research needs to be done however – not only on these impacts, but also on the quantities and sources of plastic inputs in soils.

On behalf of NABU, research institutes Fraunhofer UMSICHT and Ökopol have produced the first study calculating plastic emissions[1] from agriculture and horticulture (incl. tree nurseries) in Germany. According to their figures, these sectors release 13,256 tonnes of plastic into the environment each year. The biggest source of plastic inputs is the use of sewage sludge, compost and digestates as fertilisers. Here, the problem originates not with agriculture or horticulture itself but elsewhere – with the contamination of municipal organic waste collections, for instance. As microplastics in the soil cannot be retrieved, the precautionary principle should apply; in other words, it's imperative that such inputs are prevented from the start.

NABU key demands

- Development of a coherent strategy for environmentally sound plastics use in agriculture and horticulture and for minimising plastic inputs in soils
- Use of biodegradable plastics or polymers only where prudent and where biodegradability in real-world, on-the-ground conditions is proven
- Development of appropriate and consistent methods of measuring plastics levels in soil

Download the study (in German) at ***www.NABU.de/bodenstudie***



Plastic inputs via fertilisers

Sewage sludge is the biggest input source

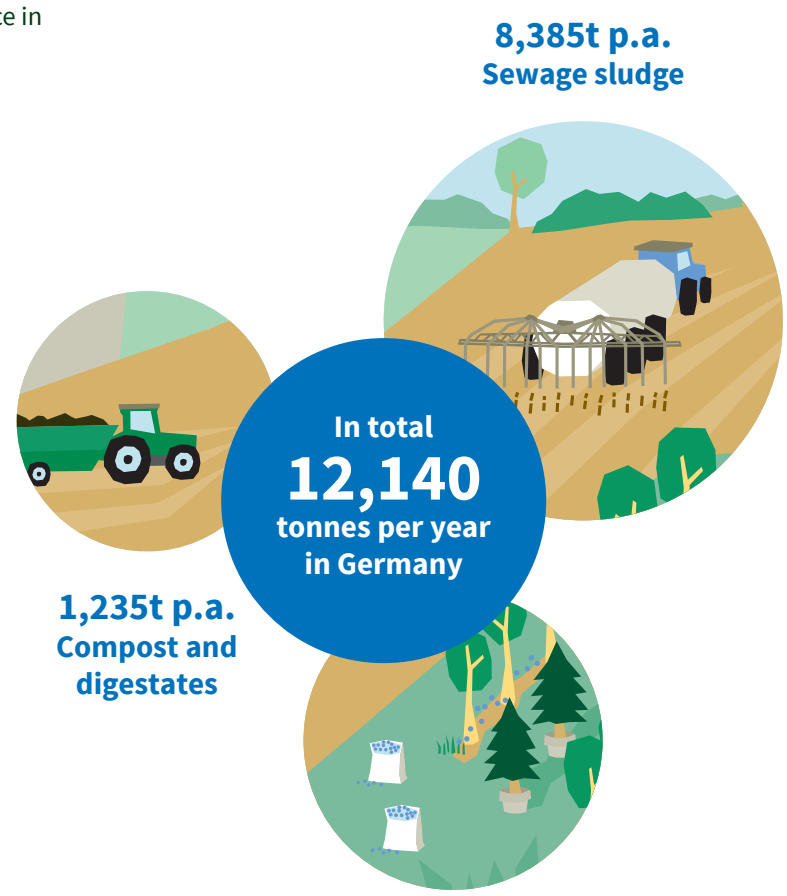
Used as a fertiliser because of its nutrient content, **sewage sludge** is currently the biggest source of plastic inputs in agricultural soils, being responsible for 8,385 tonnes of plastic per year. Two kinds of plastic are found in sewage sludge: one is the flocculants that help to dehydrate solids in sewage treatment plants; the other is plastics that find their way into sewage via drains. The latter can come either via surface run-off (which can contain tyre wear particles, for instance) or via greywater (which can contain textile fibres, for instance). During sewage treatment, it is estimated that more than 95 per cent of microplastics are retained in the sludge, which prevents them from entering rivers. If the sludge is then applied as a fertiliser, however, these plastics end up on farmland. Because of the high levels of pollutants it contains, strict legal limits (though not an outright ban) on the spreading of sewage sludge will come into force in Germany in 2032.

Another input source is industrial **compost and digestates**. These alternative fertilisers play an important role in improving the soil's humus and providing nutrients. Industrially produced composts, however, are contaminated with plastic. When plastic bags and plastic-packaged foods are placed in organic waste bins, they end up in municipal composters and anaerobic digesters, where they are only partially separated out. Some plastic remains in the compost or digestate and thus ends up in soils.

Slow-release or **encapsulated fertilisers** control nutrient availability in line with the plant's specific needs. They are coated in a plastic shell and are primarily used in horticulture and tree nurseries.

NABU demands

- A ban on the spreading of sewage sludge
- Stricter biodegradability standards for polymer-based flocculants in sewage treatment plants
- Stricter limits on the amount of plastics in compost along with robust, standardised testing
- Optimisation of organic waste collection (public education, spot checks of bins, etc.)
- Ban on packaged foods in anaerobic digesters
- Proven biodegradability in real-world conditions for fertiliser coatings



Plastic films, nets and silo cladding

Key input sources: asparagus growing and silage

Plastics also feature in the cultivation of fodder crops and of energy crops such as maize for biogas plants. According to study data, 376 tonnes of these plastics enter the environment each year. To protect and preserve the harvested crop, hay, straw and grass are packaged up into **round or square** bales using plastic film, netting, fleece and twine. Almost all maize is processed in what are known as **bunker silos**. Here, plastics are used for silage covers and nettings as well as to clad the floor and inside walls of the silo. Plastic emissions result from mechanical strain, weather factors, improper disposal and vandalism.

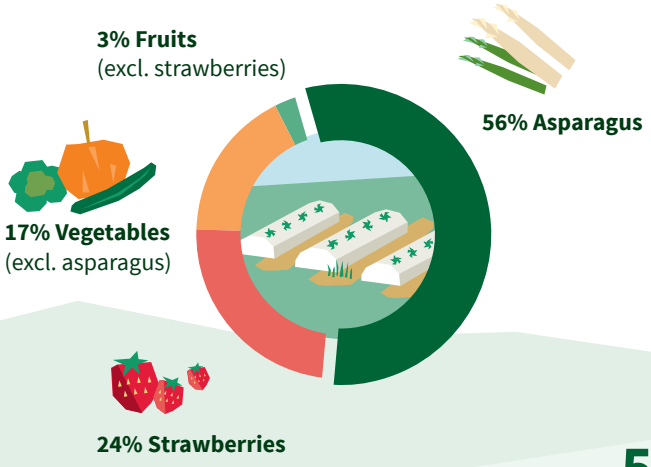
In the growing of fruit and vegetable crops such as strawberries and asparagus, **thermal or perforated films** serve to raise soil temperature, enabling earlier sowing. White film, on the other hand, slows the rise in soil temperatures, allowing for later harvests. **Mulch film** helps to improve the soil's humus and nitrogen content, suppresses weeds, protects soil from drying out and raises its temperature. Plastic films, fleeces and nets are also used to protect fruit and vegetable crops from extreme weather events and from being eaten by animals.

NABU demands

- In conservation areas, a ban on plastic film that completely covers the soil (in asparagus growing, for instance)
- Switch to more durable forms of sheeting plus statutory take-back schemes; no overuse of plastic films
- Where biodegradable films are used (e.g. for mulching), it needs to biodegrade in actual environmental conditions
- Wider range of naturally derived materials (such as sisal fibres) for use in silage and elsewhere
- Reduction in silage feeding and development of effective alternative mulching practices

Plastic films are exposed to strain from wind and rain, and sections can tear off when manipulated manually or mechanically. The thinner the material, the greater the risk of this happening. Pieces then escape into the fields, accumulating in soils or blowing into the surrounding countryside. It is estimated that 180 tonnes of such plastic is introduced into the environment every year from crop growing. Biodegradable mulch films are used only rarely, and even they often decompose far too slowly.

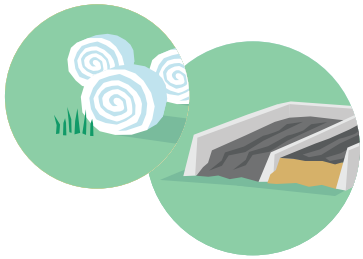
Plastic emissions from plant cultivation 180 tonnes p.a. (esp. films, netting, fleece)



Plastic emissions from fodder and energy crop production 376 tonnes p.a.

Round or square bales
(esp. films and twine)

88t p.a.



Bunker silos

Foils Sheeting

In total 556 tonnes per year in Germany

Soil improvers, pesticides and seeds

Direct inputs that persist in the soil

Soil improvers made of plastic can improve the water retention of soil. Farmers are responsible for a fifth of the total amount used, applying them in strawberry and asparagus growing, for example. This usage results in an estimated 110 tonnes of plastic being introduced into soils in Germany every year. Plastics also feature in **pesticides**, serving as binding agents and carriers, for instance. Plastic-encapsulated pesticides allow for a more controlled release of the product over a longer period of time. They contribute an estimated 90 tonnes of plastic emissions each year. **Seeds**, too, are often encased in plastic, which acts as a binding agent and protective layer, thereby facilitating mechanised sowing. In some cases, their coatings also contain pesticides, nutrients or enzymes. Here, the annual input of plastics is estimated at 87 tonnes.

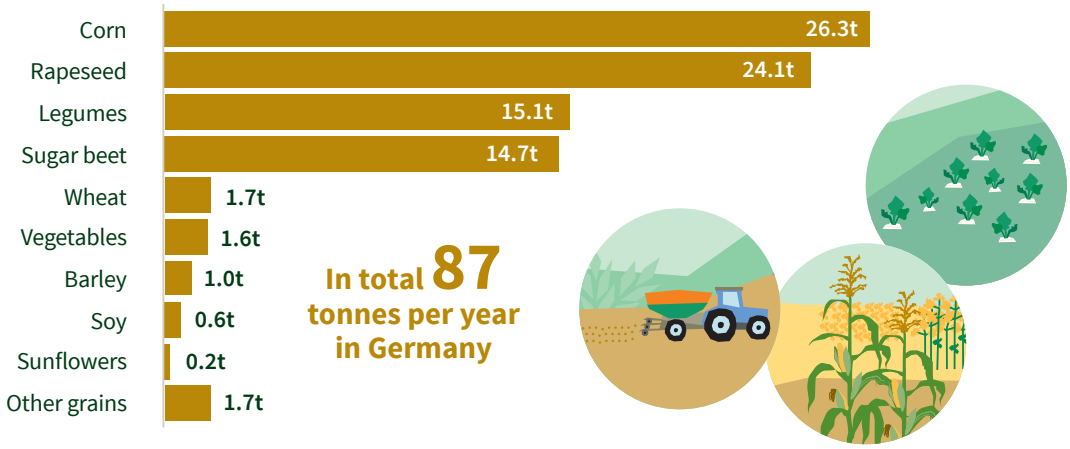
Other supplies

Plant pots, plant supports, watering systems, etc.

Plastic features in numerous other products used in agriculture and horticulture – be it plant pots, containers, seed trays and small transport trays, supports such as sticks, protective wrappers, coated wire and ribbons or watering systems. Pieces of plastic can enter the soil due to inappropriate use, incorrect disposal, or via mechanical strain on or degradation of the material. Often these pieces are too small to be retrieved. Plastics also feature in products that are deliberately left in the soil, such as propagating plugs and press pots for seedlings. Emissions from such supplies are estimated to total 273 tonnes per year, 179 tonnes of which is from supports, 58 tonnes from containers and 36 tonnes from watering systems.

Plastic input from coated seeds into the soil

in Germany in tonnes per year



NABU demands

- EU-wide ban on poorly biodegradable polymers in seeds, soil improvers, fertilisers and pesticides
- Implementation of integrated pest management strategies: no prophylactic seed coating with pesticides and an overall reduction of pesticide use
- Development of take-back schemes for watering systems
- Proven biodegradability in real-world conditions for all propagating plugs, press pots and small plastics proven to end up in the environment
- All plant pot trays to be reusable

[1] A distinction is made between the terms plastic emissions and plastic inputs. Emissions relate to plastics that are emitted in agriculture and horticulture but whose ultimate destination in the environment cannot be precisely determined. Inputs, on the other hand, relate to plastics that are applied directly to the soil, e.g. via fertilisers or seed.

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