

Country Report

for Poland

Implementation and status of priority measures

Baltic Compass WP3

Cover Note

In order to keep the focus of the data collection narrow, we are not interested in collecting information on EU regulatory requirements that are common to the BSR. Instead please focus on those requirements that are specifically national or local in design. For example, do not cover Nitrates Directive requirements that are common BSR (eg N-limit) but DO cover the way that action plans have been devised, what they include and how they operate.

To avoid repetition, if the information you are supplying in a section is common to several measure then please provide a description on one form only and then make links back to this form.

1. Promoting long-term grass cultivation of arable land

Cultivation of grass or legume/grass crops on arable land with high/low inputs of nitrogen (N) and phosphorus (P) and high/low outputs of feed, food or other services can reduce nitrogen and phosphorus leaching and surface run-off losses as well as soil erosion, compared with annual crops on arable land.

Crop rotations including **permanent grass or legume/grass crops** can decrease N leaching with 50%, compared with crop rotations dominated by annual crops.

Describe this measure in your country if different : Grasses grown in field rotations are an important element in sustainable agriculture and organic farming. They leave a good position for many crops, which is rich in organic matter from remaining crop residues and abundant root system. Strongly developed in the topsoil roots of grasses effectively draw nutrients from the mineral and organic fertilizers, reducing their release into the groundwater. Grasses are insensitive to compaction by heavy mechanical equipment, and effectively protect the soil against erosion. Their large ecological diversity offers the crop possibility in almost any habitat conditions [1]. Growing grass on arable land in Poland was conducted on the total of 371 964 ha in 2009, including 318 345 hectares for fodder collection and 53 619 hectares for grazing (grazing use) [2].

Literature: [1] Ćwintal M. Polowa uprawa traw pastewnych. Nasza Rola 2010 nr 6 (31), s. 23-26. www.naszarola.pl/archiwum.htm; [2] Produkcja upraw rolnych i ogrodnictwa w 2009 r. Główny Urząd Statystyczny Departament Rolnictwa. Warszawa, kwiecień 2010 ss. 153.

1. Is there any official quantified goal that states to what extent this measure should be implemented? **No**

- If "Yes";
 - a) specify quantity and unit:
 - b) if applicable, what year to be realized?
 - c) give reference(s):
- If "No", what is your expert opinion of the desirable level in 5 years?
quantity and unit: ~ 400 000 ha in 2015

2. To what extent is this measure implemented today in relation to goal set above? **0**
"0"=Not at all; "10"=Goal already reached

3. If goal is not reached; how do you judge the possibilities to fulfill it? **3**
"0"=Impossible; "10"=Very good

Comments: Not expected to significantly increase the acreage of grasses on arable land in the near future.

Comments on why the goal is easy/difficult to reach, what are the most important parameters in your country:

Growing grass for fodder under field conditions is justified in households with insufficient part of permanent grassland in the balance of feed for ruminants. In Poland there is a large area of permanent grassland which is a basis of feed for this group of animals.

Currently it is not fully utilized. Due to the existing milk quota system, there is no need to extend grass crops on arable land. If necessary, first of all will be appropriate to use the production potential of permanent pasture. Subsidies are not a sufficient incentive for farmers to increase area planted grasses on arable land.

Is this measure regulated in legislation? **No** If "Yes"; national or regional rules

Reference(s) to legislation:

Comments:

Is this measure entitled to economic subsidy? **No** If "Yes"; national or regional subsidy rules

Reference(s) to subsidy rules:

Comments:

2. Vegetative cover in autumn and winter of arable land

Annual winter crops, such as winter wheat or winter rape, can provide a vegetative cover that actively takes up available nitrogen and phosphorus from the soil more efficient than annual spring crops at a seasonal period with high precipitation and cool climate.

Catch crops can be under-sown in the main crop, simultaneously with, or just after the sowing of this crop. When the main crop is harvested, the catch crop has an established root system ready to take up nitrogen from the soil during late summer and autumn. Nitrogen that otherwise could have been leached is then taken up and incorporated into plant material. The catch crop is then ploughed-in as late as possible in autumn or in spring. Perennial ryegrass (*Lolium perenne* L.) as a catch crop is an effective measure to reduce N leaching in spring cereal crop production. The use of catch crops has reduced N leaching by 50% or more in several studies. The effect of the catch crop on N leaching depends on precipitation and drainage conditions, available N amounts in soil and how successful the establishment of the catch crop was.

Describe this measure in your country if different : Sowing after crop plants should be carried out at the latest by the end of September and they should be kept on the field without plowing until the end of February. Recommended as winter aftercrop plants: /i/ agrimony (low soil and climatic requirements, cultivated after cereals, sowing in the first week of September), /ii/ rapeseed (*Brassica napus*) (requires medium and fertile soil, in culture - grown after cereals, sowing not later than August 25), /iii/ mix of agrimony (*Agrimonia*) and rye (principles of cultivation and fertilization are the same as for rzepek - agrimony), /iv/ rye (*Secale cereale*) (sowing a little earlier than rye grain), /v/ mix of perennial ryegrass (*Lolium perenne*) or Italian ryegrass (*Lolium multiflorum*) with winter vetch (*Vicia villosa*) (possibly with the addition of Italian clover (*Trifolium incarnatum*)) - optimum sowing takes place in the second half of August, /vi/ *Lolium multiflorum westerwoldicum* or *Lolium multiflorum* in single-species crops: sowing until August 25 (crop gave the best results on warm soils, in good culture, the limiting factor of growing these grasses is their low winter hardiness [3]).

Literature: [3] Opala Z. Poplony w gospodarstwie rolnym. <http://www.lodr->

1. Is there any official quantified goal that states to what extent this measure should be implemented? **Yes**

- If "Yes";
 - a) specify quantity and unit: 1 000 000 ha of catch crops, 100 000 farms
 - b) if applicable, what year to be realized? 2013
 - c) give reference(s): The Polish rural development programme 2007-2013
- If "No", what is your expert opinion of the desirable level in 5 years?
quantity and unit:

2. To what extent is this measure implemented today in relation to goal set above? **3**
"0"=Not at all; "10"=Goal already reached

3. If goal is not reached; how do you judge the possibilities to fulfill it? **6**
"0"=Impossible; "10"=Very good

Comments: In 2010, the measure - catch crops, introduced under the RDP 2007-2013, 29 139 households in the area of 343 600 ha [4].

Literature: [4] Anna Klisowska. Program rolno środowiskowy dziś i jutro. Ministerstwo Rolnictwa i Rozwoju Wsi. Departament Płatności Bezpośrednich. Falenty, 8-9 grudnia 2010 r.

http://ksow.pl/uploads/media/Program_rolno%C5%9Brodowiskowy_Falenty_8_12.pdf

Comments on why the goal is easy/difficult to reach, what are the most important parameters in your country: To achieve the goal will be difficult. This is shown by the results obtained in the RDP 2004-2006, in which the catch crops were applied in 51 985 households. It does not appear that this number will increase significantly.

Is this measure regulated in legislation? **Yes** If "Yes"; national or regional rules

Reference(s) to legislation: The Minister of Environment regulation dated on 23 December 2002 on detailed requirements to be met by action programs aimed at reducing nitrogen runoff from agricultural sources. (Journal of Laws 4.3.1944 dated 15 January 2003)

Comments: Legislation concerns only NVZs.

Is this measure entitled to economic subsidy? **Yes** If "Yes"; national or regional subsidy rules

Reference(s) to subsidy rules: The Polish rural development programme for 2007-2013, Ministry of Agriculture and Rural Development, Warsaw, July 2007, p. 400

Comments:

3. Soil tillage management

3.1. Reducing soil tillage by conversion from ploughing to minimal or no cultivation management systems or conversion from deep ploughing to shallow ploughing can reduce mineralization of organic matter in soil. Type of techniques can be, i.e. using discs or tines to cultivate the soil, or direct drill into stubbles (no-till).

Describe this measure in your country if different : Each tillage treatment increases the supply of oxygen to the soil and accelerates the mineralization of organic matter, and particularly intensive is the ploughing impact . Therefore, it is recommended to [5]: /i/ possibly replace plowing tools which do not invert the soil (reduced tillage) such as cultivators with rigid-tine cultivators (grubbers), rotary or disk harrows, different seed-drill kits and special drills for direct seeding; /ii/ reduce the intensity and depth of cultivation in order to reduce the rate of humus mineralization

Literature: [5] Kuś J., Jończyk K., 2005. *Dobra Praktyka Rolnicza w gospodarstwie rolnym*. Materiały szkoleniowe. Radom: Centrum Doradztwa Rolniczego w Brwinowie Oddział w Radomiu ss. 42

1. *Is there any official quantified goal that states to what extent this measure should be implemented?* **No**

- *If "Yes";*
 - a) *specify quantity and unit:*
 - b) *if applicable, what year to be realized?*
 - c) *give reference(s):*
- *If "No", what is your expert opinion of the desirable level in 5 years? quantity and unit. ?*

2. *To what extent is this measure implemented today in relation to goal set above?* **0**
"0"=Not at all; "10"=Goal already reached

3. *If goal is not reached; how do you judge the possibilities to fulfill it?* **1**
"0"=Impossible; "10"=Very good

Comments: Currently in Poland, the above measure possesses the norm status in relation to the areas vulnerable to nitrates. Within this scope it is formulated as following "While the cultivation is located on slopes, it is preferred to replace plow cultivation by reduced tillage. Then a rigid-tine cultivator is used for soil cultivation, and for the cultivation before sowing - tillage set consisting harrow or cultivator and ring or string roller" [6]

[6] Rozporządzenie Ministra Środowiska z dnia 23 grudnia 2002 r. w sprawie szczególnych wymagań, jakim powinny odpowiadać programy działań mających na celu ograniczenie odpływu azotu ze źródeł rolniczych. (Dz. U. 03.4.44 z dnia 15 stycznia 2003 r.)

Comments on why the goal is easy/difficult to reach, what are the most important parameters in your country: The goal is difficult to reach due to the fact, that its implementation requires the purchase of special machines by farms. Because of the difficult economic situation, most of the farms cannot afford it. Besides, the benefits of the mentioned measure are not conclusive. In addition to advantages such as: /i/ slowing processes of organic matter mineralization due to smaller depth and number of soil conditioners treatments, which contributes to the increase in organic carbon content; /ii/ savings in fuel consumption and labour requirements; /iii/ the possibility to reduce some agricultural tools and machines at the farm (appropriately matched seed drill unit performs procedures, which require at least several types of tools necessary to make the traditional tillage operations; this measure has also disadvantages. Lower, than in case of plowing, depth of cultivation, reduces mixing the soil with fertilizers, causing the accumulation of nutrients in the top subsurface soil layer. In years with limited rainfall, drying of the topsoil

occurs, which increases the concentration of nutrients in the soil solution, which in turn contributes to difficulties in absorbing nutrients by plants. The consequence of reduced tillage, especially for a long time, is the increase of the soil density. Increased soil compaction allows for an earlier start of the spring field work, at the same time causes an obstruction in the development of root system of plants, especially in dry years. Observations of several years of experience with reduced tillage indicate, that on the fields with direct sowings, number of rodents increases. An evidence is the number of molehills and burrows. The field area is often furrowed by foxes, dogs, wild rodents in search of nests [7].

Literature: [7] Włodek S., 2010. Uprawa tradycyjna kontra uproszczona. IUNG-PIB w Puławach. Zakład Herbologii i Technik Uprawy Roli.
<http://rolnictwo.re.pl/artykul/11525.html>

Is this measure regulated in legislation? **Yes** If "Yes"; national or regional rules

Reference(s) to legislation: The Minister of Environment regulation dated on 23 December 2002 on detailed requirements to be met by action programs aimed at reducing nitrogen runoff from agricultural sources. (Journal of Laws 4.3.1944 dated 15 January 2003)

Comments: Legislation concerns only NVZs.

Is this measure entitled to economic subsidy? **No** If "Yes"; national or regional subsidy rules

Reference(s) to subsidy rules:

Comments:

3.2 Time-of the year effects. By postpone tillage actions from autumn to spring, the mineralized nitrogen will be available for uptake by the established spring crops, which also will provide surface cover.

Describe this measure in your country if different : Postponement of the soil tillage from autumn to spring reduces the risk of nitrate leaching, probably due to lower mineralization rates and larger absorption of nitrogen by weeds and herbs in the autumn.

1. Is there any official quantified goal that states to what extent this measure should be implemented? **No**

- If "Yes";
 - a) specify quantity and unit:
 - b) if applicable, what year to be realized?
 - c) give reference(s):
- If "No", what is your expert opinion of the desirable level in 5 years?
 quantity and unit: on the experimental level

2. To what extent is this measure implemented today in relation to goal set above? **0**
 "0"=Not at all; "10"=Goal already reached

3. If goal is not reached; how do you judge the possibilities to fulfill it? **1**
 "0"=Impossible; "10"=Very good

Comments: The measure is unknown in Poland. There is a need to conduct experiments aimed at recognizing its effectiveness and appropriateness of use in the conditions of Polish agriculture.

Comments on why the goal is easy/difficult to reach, what are the most important parameters in your country: Goal possible to achieve at the experimental level.

Is this measure regulated in legislation? **No** If "Yes"; national or regional rules

Reference(s) to legislation:

Comments:

Is this measure entitled to economic subsidy? **No** If "Yes"; national or regional subsidy rules

Reference(s) to subsidy rules:

Comments:

4. Fertilisation management

4.1. Adapting amounts applied for both chemical fertilizer and manure.

Animal density is a tool to express the number and type of animals kept at the farm in relation to the arable area available for spreading their manure. The tool is used to balance amounts of produced N and P in manure to available spreading area at the farm in order to avoid surplus application of N and P with manure.

Considering crop requirements of N and P in the fertilising plan is a prerequisite for avoiding excessive applications. Nitrogen and P content in manure shall be considered in the fertiliser plan in order to adapt the need of chemical fertilizers and avoid excessive applications.

Sampling and analysing N and P in manure gives information of the N and P concentration and the distribution of plant available-N and organic-N. Then the effect of the manure can be valued in the fertilising plan. Manure characteristics can vary a lot. Liquid manure is a general term that denotes any manure from housed livestock that flows under gravity and can be pumped. Liquid manure can have a high proportion of plant available N (NH₄-N + NH₃-N) of total-N content. Solid manure is a general term that denotes any manure from housed livestock with large amounts of bedding that does not flow under gravity, cannot be pumped but can be stacked in a heap. Solid manure can have a high proportion of organic-N of total-N content.

Sampling and analysing N and P in arable soil gives information of soil fertility concerning these nutrients, which should be considered in the fertilising plan in order to avoid excessive fertilizer applications or deteriorated soil fertility.

Describe this measure in your country if different : 1. Doses of minerals should be determined on the basis of the fertilizer demand of plants, which include the number of components taken from a particular yield of the plants and their quantity, which can be taken from the soil without damage to its fertility. This applies in particular to nitrogen, which the dosage should be carefully chosen. Doses of mineral fertilizers are calculated as

the difference between the nutritional needs of plant and the amount of ingredients brought to the soil with natural fertilizers flowing from other sources (plowed by-products, nitrogen fixation by legumes, precipitation) the nutrient content in soil is also included. Doses of manure shall be determined according to the content of the so-called acting nitrogen. Acting nitrogen has the same fertilizing effect as the nitrogen in the mineral fertilizers. Knowledge of the mineral nitrogen content Nmin in soil allows more precise fertilization planning of this component. For this purpose an analysis need to performed about the soil Nmin content in the soil sample collected before the first dose of fertilizer.

2. IPCC farms are required to fertilization according to the fertilization plan developed on the basis of chemical composition of fertilizers and nutritional needs of plants and soils richness, including the used wastes, plant conditioners and additives to enrich the soil.

1. Is there any official quantified goal that states to what extent this measure should be implemented? **No**

- If "Yes";
 - a) specify quantity and unit:
 - b) if applicable, what year to be realized?
 - c) give reference(s):
- If "No", what is your expert opinion of the desirable level in 5 years?
quantity and unit: 200 000 farms

2. To what extent is this measure implemented today in relation to goal set above? **5**
"0"=Not at all; "10"=Goal already reached

3. If goal is not reached; how do you judge the possibilities to fulfill it? **5**
"0"=Impossible; "10"=Very good

Comments:

1. Currently in Poland, the above measure posses the norm status in relation to the nitrate vulnerable zones. It is estimated, that in 2008, fertilization plans were applied in about 84% of households located in nitrate vulnerable zones to and in about 4% of households located outside those areas. It is expected, that in 2012 nitrates vulnerable zones will cover a much larger area than now (1.5% of Polish territory).

2. IPCC farms - farms that keep breeding or raising poultry of more than 40 000 places, or breeding or raising pigs over 2 000 places for production pigs over 30 kg or 750 places for sows.

Comments on why the goal is easy/difficult to reach, what are the most important parameters in your country: The goal is difficult to achieve inter alia due to the large number of households - in 2010 in Poland there were 1583 farms over 1 ha of agricultural land [8].

Literatutre: [8] Wstępne wyniki Powszechnego Spisu Rolnego 2010.
http://www.stat.gov.pl/cps/rde/xbcr/gus/PUBL_nsp_psr_2010_wyn_wstepne_konf_280111.pdf

Is this measure regulated in legislation? **Yes** If "Yes"; national or regional rules

Reference(s) to legislation:

1. The Minister of Environment regulation dated on 23 December 2002 on detailed

requirements to be met by action programs aimed at reducing nitrogen runoff from agricultural sources. (Journal of Laws 03.4.44 dated 15 January 2003).

2. The Act on fertilizers and fertilization dated 10 July 2007 (Dz. U. 2007, no 147, pos. 1033).

Comments: Legislation concerns only NVZs and IPPC farms

Is this measure entitled to economic subsidy? Yes If “Yes”; national or regional subsidy rules

Reference(s) to subsidy rules: he Polish rural development programme for 2007-2013, Ministry of Agriculture and Rural Development, Warsaw, July 2007, p. 400

Comments: Subsidy in the package "Sustainable Agriculture - variant: Sustainable farming system" under the RDP

Within the framework of the package „Sustainable Agriculture" RDP2007-2013, it was assumed that: /i/ the number of supported holdings will be 6000; /ii/ the subsidized area will cover 150 000 ha.

4.2. Calculating nutrient balances on farm- and/or field level

Calculating N and P inputs/outputs and balances on farm and/or field level is a performance tool and a policy tool for assessing the environmental impact. The tool can also be used to monitor and evaluate the impacts of alternative manure and chemical fertilizer management practices and technologies on N and P use at the farm. When farm N and P balances can be linked to within-farm N and P sources and flows, there is a good possibility to identify the weakest link and possible improvements on the farm. The tool can be used to assess the risk of ammonia losses from manure management and the risk of N leaching losses to water.

Describe this measure in your country if different : The management of minerals should be based on their balance sheets. In balance sheets, revenues components from all sources and their expenditures from the crop plants, harvested from the field, are included. In the nitrogen balance on the revenue side is included, nitrogen from fertilizers (natural, organic, organic-mineral and mineral), nitrogen from plowed plant by-products (straw, leaves), the nitrogen biologically bound by legumes and nitrogen in the atmospheric precipitation. On the expenditure side the only one measurable position is nitrogen in harvested crops from field crops (yield main and side).

In the balance of phosphorous and potassium on the revenue side are included ingredients in fertilizers (mineral, natural, organic-mineral and organic), and on the side of expenditures – the amount of phosphorus and potassium in the crop harvested from field plants (main and side yield).

1. Is there any official quantified goal that states to what extent this measure should be implemented? **No**

- If "Yes";
 - a) specify quantity and unit:
 - b) if applicable, what year to be realized?
 - c) give reference(s):
- If "No", what is your expert opinion of the desirable level in 5 years?
quantity and unit: 200 000 farms

2. To what extent is this measure implemented today in relation to goal set above? **5**
"0"=Not at all; "10"=Goal already reached

3. If goal is not reached; how do you judge the possibilities to fulfill it? **5**
"0"=Impossible; "10"=Very good

Comments: Currently in Poland, the above measure poses the norm status in relation to the Nitrate Vulnerable Zones which cover about 1.5 % of the Polish territory (4623,14 km²).

It is estimated that in 2008 fertilization plans were applied in about 84% of households located in nitrate vulnerable zones and in about 4% of households located outside those areas.

It is expected, that in 2012 nitrates vulnerable zones will cover a much larger area than now.

Comments on why the goal is easy/difficult to reach, what are the most important parameters in your country: The goal is difficult to achieve inter alia due to the large number of households - in 2010 in Poland there were 1583 farms over 1 ha of agricultural land.

Is this measure regulated in legislation? **Yes** If "Yes"; national or regional rules

Reference(s) to legislation: Regulation of the Minister of Environment of 23 December 2002 on detailed requirements to be met by action programmes aimed at reducing nitrogen runoff from agricultural sources. (Journal of Laws 03.4.44 dated 15 January 2003)

Comments: Legislation concerns only NVZs

Is this measure entitled to economic subsidy? **No** If "Yes"; national or regional subsidy rules

Reference(s) to subsidy rules:

Comments:

4.3. Avoiding the spreading of chemical fertilizers and manure during high-risk periods.

The timing of chemical fertilizer and manure application is a key factor to have a high plant nutrient use efficiency. Poor timing is one of the most important sources of large N leaching loads.

Describe this measure in your country if different :

1. Fertilizers should not be used at times and conditions, when the contained therein minerals, especially nitrogen compounds, are susceptible to leaching into groundwater or wash into surface waters. Applies especially in the winter period and other periods, depending on soil type, rainfall intensity and soil cover.

2. Regardless of the weather pattern and condition of the soil in winter, from early December to the end of February, it is not allowed the use natural fertilizers in solid and liquid form and organic fertilizers, including compost. In other periods, fertilizer should not be applied when the soil is unsown or plants are not very advanced in growth, and more rainfall may occur.

3. Avoid the use of nitrogen fertilizers in the late period of growth and development of plants, since their surplus remaining in the soil is exposed to leaching into groundwater.

1. Is there any official quantified goal that states to what extent this measure should be implemented? **No**

- If "Yes";
 - a) specify quantity and unit:
 - b) if applicable, what year to be realized?
 - c) give reference(s):
- If "No", what is your expert opinion of the desirable level in 5 years?
quantity and unit: 200 000 farms.

2. To what extent is this measure implemented today in relation to goal set above? **7**
"0"=Not at all; "10"=Goal already reached

3. If goal is not reached; how do you judge the possibilities to fulfill it? **8**
"0"=Impossible; "10"=Very good

Comments:

Comments on why the goal is easy/difficult to reach, what are the most important parameters in your country: Relatively easy goal to achieve, since it requires no extra resources.

Is this measure regulated in legislation? **Yes** If "Yes"; national or regional rules

Reference(s) to legislation: The Act on fertilizers and fertilization dated 10 July 2007 (Dz. U. 2007, no 147, pos. 1033)

The Minister of Environment regulation dated on 23 December 2002 on detailed requirements to be met by action programs aimed at reducing nitrogen runoff from agricultural sources. (Journal of Laws 03.4.44 dated 15 January 2003)

Comments: Currently in Poland, the above measure possesses the norm status particularly in relation to the nitrate vulnerable zones.

In whole country according The Act on fertilizers and fertilization "It is forbidden to use fertilizers mineral and natural on soils flooded with water, covered with snow, frozen to a

depth of 30 cm and during rain”.

Is this measure entitled to economic subsidy? **No** If “Yes”; national or regional subsidy rules

Reference(s) to subsidy rules:

Comments:

4.4. No or reduced P-fertiliser for high soil P fields or part of fields.

When the soil P values increase beyond agronomical optimum ranges, there is a reasonable consistence pattern whereby P leaching increase significantly. However, P leaching has large spatial and temporal variations and can be influenced by several factors interacting with each other. It is therefore important to consider site-specific factors to be able to find measures to reduce P leaching.

Describe this measure in your country if different : Rational phosphorus fertilization should take into account the soil abundance in this component and the expected yield.

1. Is there any official quantified goal that states to what extent this measure should be implemented? **No**

- If “Yes”;
 - a) specify quantity and unit:
 - b) if applicable, what year to be realized?
 - c) give reference(s):
- If “No”, what is your expert opinion of the desirable level in 5 years?
quantity and unit: 200 000 farms.

2. To what extent is this measure implemented today in relation to goal set above? **5**
“0”=Not at all; “10”=Goal already reached

3. If goal is not reached; how do you judge the possibilities to fulfill it? **5**
“0”=Impossible; “10”=Very good

Comments: The measure does not exist in the form of separate standards of conduct. However, it is realized in the framework of the requirements for the preparation of fertilization plans in nitrate vulnerable zones. These plans take into account that the level of phosphorus fertilization is to be adapted to the abundance of soil in available phosphorus .

Comments on why the goal is easy/difficult to reach, what are the most important parameters in your country: The goal is difficult to achieve in whole country inter alia due to the large number of households - in 2010 in Poland there were 1583 farms over 1 ha of agricultural land [8].

Is this measure regulated in legislation? **Yes** If “Yes”; national or regional rules

Reference(s) to legislation: The Minister of Environment regulation dated on 23 December 2002 on detailed requirements to be met by action programs aimed at reducing nitrogen runoff from agricultural sources. (Journal of Laws 03.4.44 dated 15 January 2003)

Comments: Legislation concerns only NVZ-es

Is this measure entitled to economic subsidy? **No** If "Yes"; national or regional subsidy rules

Reference(s) to subsidy rules:

Comments:

5. Improved spreading technology of manure and chemical fertiliser

5.1 Site-specific dosage. In all fertiliser application, the use of **Global Positioning System** (GPS) signals for the purpose of determining the device's current location on earth can improve the possibilities for a controlled and proper distribution. GPS devices provide latitude and longitude information, and some may also calculate altitude. GPS in combination with **steering aid systems** means that the fertiliser can be spread with a minimum of bare spots and overlaps. The simpler variant of the steering aid system is called **guidance**, where a ramp with a series of LEDs shows whether the driver is located right on line or if he should adjust to the right or left. **Auto steer** is an automated steering system where the driver does not need to actively steer the vehicle except perhaps in curves or when turning. With the use of GPS technology, it is also possible to map different properties in the field, and later on use this information e.g. for **site specific spreading** of fertilisers.

Describe this measure in your country if different : The global positioning system (GPS) for the precise guidance of machines cultivating the soil, greatly reduce the expenses incurred for the purchase of fertilizers and saves time. Technology also eliminates the environmental risks, posed from the overdose of nutrients for plants. Knowing the exact soil fertility in the individual minerals allows precise dosage of fertilizers, in places where there are their greatest shortages, especially lime.

1. Is there any official quantified goal that states to what extent this measure should be implemented? **No**

- If "Yes";
 - a) specify quantity and unit:
 - b) if applicable, what year to be realized?
 - c) give reference(s):
- If "No", what is your expert opinion of the desirable level in 5 years?
quantity and unit: on the experimental level

2. To what extent is this measure implemented today in relation to goal set above? **2**
"0"=Not at all; "10"=Goal already reached

3. If goal is not reached; how do you judge the possibilities to fulfill it? **5**
"0"=Impossible; "10"=Very good

Comments: 2. close to 0 (single cases)

The measure is very rarely used in agricultural practice in Poland. The high cost of the system and the fragmented agrarian structure will not facilitate the introduction of GPS in Polish agriculture.

Comments on why the goal is easy/difficult to reach, what are the most important

parameters in your country: The limitation in the use of GPS in Polish agriculture is its high cost, and also fragmentation of agricultural holdings. As it is believed, introduction of the system to the farms of the agricultural area of less than 200-300 hectares is rather uneconomical. Farms with an area ≥ 200 -300 hectares occupy 19% of the total area of agricultural holdings. Theoretically, in these holdings GPS can be applied in economic conditions conducive to this.

Goal possible to achieve at the experimental level.

Is this measure regulated in legislation? No If "Yes"; national or regional rules

Reference(s) to legislation:

Comments:

Is this measure entitled to economic subsidy? No If "Yes"; national or regional subsidy rules

Reference(s) to subsidy rules:

Comments:

5.2 Combined drilling is when seeding and fertilisation is done with one and the same machine in one working operation. A drilling machine with normal distance between the drill coulters is equipped with coulters for chemical fertilisers placed in front of the drill coulters between every other row. Fertiliser coulters are placing chemical fertiliser a few centimetres deeper than the seeds.

Chemical fertiliser placed at this depth, provides good conditions for the crop to take up the added nutrients. This procedure is, in addition to time savings and a better nutrient utilization, reducing competition for plant nutrients from weeds and reduces the risk of nutrient surface runoff. Phosphorus in fertilizers binds quickly to soil particles and is thus less exposed to leaching.

The recommended nitrogen ration at a given harvest level can be reduced by 10 kg N / ha, if combined drilling is applied (Albertsson, 2010). Leaching will probably be reduced by 1-2 kg N/ha compared with other fertilization techniques.

Describe this measure in your country if different : Sowing (planting) and fertilization using a single machine improves the acting efficiency of nitrogen, phosphorus and potassium in crop plants with a wide row spacing, inter alia, sugar beet, fodder, chicory, maize, potatoes and other vegetables. Increasing the concentration of fertilizer in the immediate vicinity of the root lets the plant to uptake ingredients (NPK) with the minimal energy effort to expand the system of lateral roots [11]. Simultaneous sowing of seeds and fertilizer with the same machine (combined drilling) is also used for undersowing meadows and pastures in a belt way. Working parts of the machinery, mills the strips of the sod with a width of 10 cm and put inside seeds and fertilizers. This method eliminates the need of plowing the old sod, keeps some part of the vegetation of the old sod and reduces losses of components arising after its plowing (due to mineralization). Through the use of a belt of cultivation, you can resign from the use of chemicals for the destruction of the plants of the old sod [12].

Literature: [11] Nowakowski M. , 2003. Technika nawożenia rzędowego buraków cukrowych. Aplikator z siewnikiem.

http://www.apra.pl/archiwum/rpt/archiwum/rpt_040516.htm; [12] Krzywiec D. Nowy agregat

do posiewu łąk i pastwisk.
http://www.wodr.konskowola.pl/index.php?option=com_content&view=article&id=136:nowy-agregat-do-posiewu-k-i-pastwisk&catid=63:trwae-uytki-zielone-&Itemid=131

1. Is there any official quantified goal that states to what extent this measure should be implemented? **No**

- If "Yes";
 - a) specify quantity and unit:
 - b) if applicable, what year to be realized?
 - c) give reference(s):
- If "No", what is your expert opinion of the desirable level in 5 years?
quantity and unit: 50 farms

2. To what extent is this measure implemented today in relation to goal set above? **0**
"0"=Not at all; "10"=Goal already reached

3. If goal is not reached; how do you judge the possibilities to fulfill it? **1**
"0"=Impossible; "10"=Very good

Comments: 2. Close to 0 (single cases).

Comments on why the goal is easy/difficult to reach, what are the most important parameters in your country: A limitation in Polish agriculture, in the use of technology of fertilizer and seed sowing at the same time with the same machine, are certain economic factors related to the low profitability of most farms.

Measure possible to apply in a small number of farms, mainly for undersowing needs for meadows and pastures.

Is this measure regulated in legislation? **No** If "Yes"; national or regional rules

Reference(s) to legislation:

Comments:

Is this measure entitled to economic subsidy? **No** If "Yes"; national or regional subsidy rules

Reference(s) to subsidy rules:

Comments:

5.3 Incorporation of manure and chemical fertiliser may be achieved with equipments such as discs or cultivators depending on soil type and soil conditions. Usually the incorporation is done in a separate working operation. The manure/chemical fertiliser must be completely incorporated within the soil to achieve maximum efficiency. As regards liquid manure, incorporation should be made quickly after spreading as ammonia losses takes place immediately after spreading.

This method will help to prevent the exposure of manure to the surface runoff and drain-flow losses. It will also increase the utilisation of manure nutrients compared with surface application.

Describe this measure in your country if different : Natural and organic fertilizers must be covered or mixed with soil by tillage tools, not later than the next day after their use, in order to avoid loss of components. For covering, plowing or treatments made by cultivator or disc harrow can be used. On light soils organic fertilizer should be covered deeper and on soils concise-shallower.

1. Is there any official quantified goal that states to what extent this measure should be implemented? **No**

- If "Yes";
 - a) specify quantity and unit:
 - b) if applicable, what year to be realized?
 - c) give reference(s):
- If "No", what is your expert opinion of the desirable level in 5 years?
quantity and unit: 90% of agricultural land

2. To what extent is this measure implemented today in relation to goal set above? **9**
"0"=Not at all; "10"=Goal already reached

3. If goal is not reached; how do you judge the possibilities to fulfill it? **8**
"0"=Impossible; "10"=Very good

Comments: Currently in Poland, the above measure posses the norm status in relation to the nitrate vulnerable zones

Comments on why the goal is easy/difficult to reach, what are the most important parameters in your country: The goal is relatively easy to achieve, because it does not require funding for its implementation.

Is this measure regulated in legislation? **Yes** If "Yes"; national or regional rules

Reference(s) to legislation: The Minister of Environment regulation dated on 23 December 2002 on detailed requirements to be met by action programs aimed at reducing nitrogen runoff from agricultural sources. (Journal of Laws 03.4.44 dated 15 January 2003)

Comments: Legislation concerns only NVZ-es

Is this measure entitled to economic subsidy? **No** If "Yes"; national or regional subsidy rules

Reference(s) to subsidy rules:

Comments:

5.4 Liquid manure. Distribution uniformity of liquid manure has improved significantly with the introduction of **band spreading** technology, where the manure is discharged just above ground level in strips or bands through a series of hanging or trailing pipes attached to a boom. As the liquid manure is distributed laterally via a ramp, good lateral distribution uniformity is achieved. The spread in the longitudinal direction can also be kept at a constant level by means of the pumping equipment which is part of the equipage. Some newer spreaders are also equipped with a **control system** that automatically adjusts the output to the driving speed, which will keep the application rate to the desired level.

Injection of liquid manure means that it is applied directly into the active layer of soil, either in open or in closed slots. In the latter case manure is fully covered after injection, by closing the slots with press wheels or rollers fitted behind the injection tines. Closed-slot injection is more efficient than open-slot for decreasing the ammonia emission. To obtain this added benefit, soil type and conditions must allow effective closure of the slot.

Describe this measure in your country if different : Slurry and liquid manure should be placed directly into the soil using hoses connected to the teeth of the cultivator. The capitation use of these fertilizers is done by using spilling hoses. Only on grasslands and permanent crops, tiles for splashing can be used.

1. *Is there any official quantified goal that states to what extent this measure should be implemented?* **No**
 - *If "Yes";*
 - a) *specify quantity and unit:*
 - b) *if applicable, what year to be realized?*
 - c) *give reference(s):*
 - *If "No", what is your expert opinion of the desirable level in 5 years?*
quantity and unit: 10% farms with animal production
2. *To what extent is this measure implemented today in relation to goal set above?* **3**
"0"=Not at all; "10"=Goal already reached
3. *If goal is not reached; how do you judge the possibilities to fulfill it?* **4**
"0"=Impossible; "10"=Very good

Comments: Currently in Poland, the above measure posses the norm status in relation to the nitrate vulnerable zones.

Comments on why the goal is easy/difficult to reach, what are the most important parameters in your country: The objective is difficult to achieve due to the high cost of waste removal vehicles for the slurry / liquid manure with strip systems or soil-applied fertilizers systems.

Is this measure regulated in legislation? **Yes** *If "Yes"; national or regional rules*

Reference(s) to legislation: The Minister of Environment regulation dated on 23 December 2002 on detailed requirements to be met by action programs aimed at reducing nitrogen runoff from agricultural sources. (Journal of Laws 03.4.44 dated 15 January 2003)

Comments: Legislation concerns only NVZ-es

Is this measure entitled to economic subsidy? **No** *If "Yes"; national or regional subsidy rules*

Reference(s) to subsidy rules:

Comments:

5.5 Solid manure. In solid manure handling, **disintegration equipment** has been developed that breaks the manure better and gives greater working width and more uniform spreading laterally. Distribution of solid manure in the longitudinal direction and opportunities to set the intended application rate still leaves much to be desired.

Describe this measure in your country if different : On permanent grasslands, manure must be scattered (spilled) over the entire surface to fertilization, without leaving them in heaps or piles.

Evenly spreading of manure (obtained by using manure spreaders with vertical adapters and system with shredding of the spread material) means that there are no places on the field that are poorly or excessively covered with this fertilizer, and later as a result - over fertilized or underfertilized plants. Evenly spreading of manure, results in evenly nutrient uptake by plants, and prevents their leaching into the soil.

1. *Is there any official quantified goal that states to what extent this measure should be implemented?* **No**

- If "Yes";
 - a) specify quantity and unit:
 - b) if applicable, what year to be realized?
 - c) give reference(s):
- If "No", what is your expert opinion of the desirable level in 5 years?
quantity and unit: 15% farms with animal production

2. *To what extent is this measure implemented today in relation to goal set above?* **5**
"0"=Not at all; "10"=Goal already reached

3. *If goal is not reached; how do you judge the possibilities to fulfill it?* **5**
"0"=Impossible; "10"=Very good

Comments: Currently in Poland, the above measure poses the norm status in relation to the nitrate vulnerable zones

Comments on why the goal is easy/difficult to reach, what are the most important parameters in your country: The objective is difficult to achieve in small farms due to the relatively high cost of waste removal vehicles, manure spreaders with vertical adapters and system with shredding of the spread material.

The measure applied in Poland in large-area farms.

Is this measure regulated in legislation? **Yes** If "Yes"; national or regional rules

Reference(s) to legislation: The Minister of Environment regulation dated on 23 December 2002 on detailed requirements to be met by action programs aimed at reducing nitrogen runoff from agricultural sources. (Journal of Laws 03.4.44 dated 15 January 2003)

Comments: Legislation concerns only NVZ-es. The legislation as it formulates the requirement: "On permanent pasture manure should be spread (spill) over the entire surface to be spreading, without leaving them in heaps or piles".

Is this measure entitled to economic subsidy? **No** If "Yes"; national or regional subsidy rules

Reference(s) to subsidy rules:

Comments:

5.6 Manure spreading and NH₃ emissions – general measures. Variables significantly affecting NH₃ emissions after spreading of manure are soil water content, air temperature, wind speed, manure type, dry matter content of manure, total ammoniacal nitrogen content of manure (TAN=NH₃-N+NH₄-N), application method and rate and manure incorporation. Losses of NH₃ can vary between 3 to 90% of the NH₄-N applied with manure.

Describe this measure in your country if different : Currently, the most effective way to reduce losses of NH₃ from liquid manure and slurry at the application stage is using modern waste removal vehicles, with soil-application systems and strip slurry and liquid manure spill. In the case of manure application, effective way to reduce emissions of NH₃, is, as soon as possible covering it with soil, after transporting on the field.

In addition to the mentioned methods, on reducing ammonia losses during application can be influenced by: / i / the choice of the appropriate application deadline: the emission of ammonia is the largest in during hot, dry and windy days, hence the application of fertilizers during cool, windless and humid days reduce the loss of ammonia; / ii / dilution of the slurry: diluted slurry infiltrates into the soil more easily than the natural (because it has lower viscosity), which affects the reduction of losses of ammonia - disadvantage of this solution is that it significantly increases the volume of circulating liquid; / iii / mechanical separation of slurry: the use of a separated liquid fraction of the slurry contributes to the reduction of ammonia emissions during application because of its easy penetration into the soil (as in the case of diluted slurry).

1. Is there any official quantified goal that states to what extent this measure should be implemented? **No**

- If "Yes";
 - a) specify quantity and unit:
 - b) if applicable, what year to be realized?
 - c) give reference(s):
- If "No", what is your expert opinion of the desirable level in 5 years?
quantity and unit: **150 000 farms**

2. To what extent is this measure implemented today in relation to goal set above? **3**
"0"=Not at all; "10"=Goal already reached

3. If goal is not reached; how do you judge the possibilities to fulfill it? **6**
"0"=Impossible; "10"=Very good

Comments: Partly, the above measure posses the norm status in relation to the nitrate vulnerable zones. Over the next five years it is likely that the NVZ area will increase. In this area this measure will be applied. Also, in connection to Polish international obligations (including under the Common Agricultural Policy, the Geneva Convention of 13 November 1979 and the Helsinki Convention), it is expected that farmers will be increasingly obliged, to implement these and similar measures.

Comments on why the goal is easy/difficult to reach, what are the most important parameters in your country: In relation to "cover or mixing with soil by tillage tools, not later than the next day after their use," this measure is easy to implement. Difficult to implement is the use of modern machinery for manure application due to their high cost.

Is this measure regulated in legislation? **Yes** If "Yes"; national or regional rules

Reference(s) to legislation: The Minister of Environment regulation dated on 23 December 2002 on detailed requirements to be met by action programs aimed at reducing nitrogen runoff from agricultural sources. (Journal of Laws 03.4.44 dated 15 January 2003)

Comments: Legislation concerns only NVZ-es. At NVZs there is a recommendation: "Natural and organic fertilizers must be covered or mixed with soil by tillage tools, not later than the next day after their use".

Is this measure entitled to economic subsidy? **No** If "Yes"; national or regional subsidy rules

Reference(s) to subsidy rules:

Comments:

6. Avoiding the application of chemical fertilisers and manure to high-risk areas

Examples of high risk areas on arable land are those: with a significant slope, with flushes draining to a nearby watercourse, soils with cracks over field drains, fields adjacent to water or fields with phosphorus values beyond agronomical optimum ranges.

Describe this measure in your country if different : Measure in the Polish legislation is described as follows:

- Natural fertilizers in liquid form, and mineral nitrogen fertilizers can not be applied to fields with a slope greater than 10% (6 °), if these fields are not under the cover of the vegetation.
- It is unacceptable to use any fertilizer on land - flooded, snow covered or frozen.
- On soils with high groundwater level (above 1.2 m) use of fertilizer requires special care and skill. It is not recommended to use natural fertilizers in liquid form, and nitrogenous fertilizers should be applied during periods of maximum demand of plants for this component.
- At a distance of 20 m from surface water, water protection zones and areas of the marine coastal strip, natural fertilizers can not be applied, and mineral fertilizers should be sowed manually.

1. Is there any official quantified goal that states to what extent this measure should be implemented? **No**

- If "Yes";
 - a) specify quantity and unit:
 - b) if applicable, what year to be realized?
 - c) give reference(s):
- If "No", what is your expert opinion of the desirable level in 5 years?
quantity and unit: **90% of agricultural land**

2. To what extent is this measure implemented today in relation to goal set above? **9**
"0"=Not at all; "10"=Goal already reached

3. If goal is not reached; how do you judge the possibilities to fulfill it? **7**
"0"=Impossible; "10"=Very good

Comments: Currently in Poland, the above measure possesses the norm status in relation to the nitrate vulnerable zones

Comments on why the goal is easy/difficult to reach, what are the most important parameters in your country: The goal is relatively easy to achieve, because it does not require funding for its implementation.

Is this measure regulated in legislation? **Yes** If "Yes"; national or regional rules

Reference(s) to legislation: The Minister of Environment regulation dated on 23 December 2002 on detailed requirements to be met by action programs aimed at reducing nitrogen runoff from agricultural sources. (Journal of Laws 03.4.44 dated 15 January 2003)

Comments: Legislation concerns only NVZ-es.

Is this measure entitled to economic subsidy? **No** If "Yes"; national or regional subsidy rules

Reference(s) to subsidy rules:

Comments:

7. Measures to optimize soil pH and improve soil structure

Measures to improve soil fertility and soil structure can increase the crop's plant nutrient use efficiency and decrease the risk of N and P leaching and surface run-off. Such measures can be liming for improved soil structure or liming for optimizing soil pH.

Describe this measure in your country if different : Liming of soils affects inter alia on: /i/ improving the availability of nutrients for plants, in soil and brought by organic and mineral fertilizers, / ii / lowering acidity, so the soil pH is suitable, adapted to the requirements of different plant species, / iii / stimulation of the growth of beneficial soil microflora, / iv / improve the physical properties of topsoil, / v / lowering denitrification processes in the structural soils. As a result of liming soils the outflow of their nutrients, including nitrogen and phosphorus to water is limited. Regulation of the soil pH in positions that require this, creates better conditions for growth and development of crops and consequently contribute to improving the use of plant nutrients, including nitrogen and phosphorus.

1. Is there any official quantified goal that states to what extent this measure should be implemented? **No**

- If "Yes";
 - a) specify quantity and unit:
 - b) if applicable, what year to be realized?
 - c) give reference(s):
- If "No", what is your expert opinion of the desirable level in 5 years?
quantity and unit: **about 4,5 mln ha**

2. To what extent is this measure implemented today in relation to goal set above? **0**
"0"=Not at all; "10"=Goal already reached

3. If goal is not reached; how do you judge the possibilities to fulfill it? **2**
"0"=Impossible; "10"=Very good

Comments: Soil testing conducted by chemical-agricultural stations in Poland indicate, that acidic and very acidic soils occupy more than about 50% of arable lands and more than 40% grasslands. The results of these studies prove the extent of the problem of soils acidification in Poland.

Comments on why the goal is easy/difficult to reach, what are the most important parameters in your country: Liming should be done for every soil, which are at risk of degradation, because of very acidic pH. The determinant of this degradation state, is the pH value below 4.8. In Poland, soils under the plowing-use (arable soil), pastures, young forest and fisheries production cover about 4.5 million ha. For the purpose of liming soils at least 12 million tonnes of CaO is needed, which implies spending of around 2.5 billion. Due to the high cost, this measure is difficult to achieve [13].

Literature: [13] Ogólnopolska konferencja naukowo – techniczna nt. „Narodowy program wapnowania gleb w Polsce na lata 2007 – 2013” Instytut Uprawy Nawożenia i Gleboznawstwa – PIB w Puławach, 1 - 2 czerwca 2006 roku. <http://www.ppr.pl/artykul-narodowy-program-wapnowania-gleb-w-polsce-130938.php>

Is this measure regulated in legislation? **No** If "Yes"; national or regional rules

Reference(s) to legislation:

Comments:

Is this measure entitled to economic subsidy? **No** If "Yes"; national or regional subsidy rules

Reference(s) to subsidy rules:

Comments:

8. Adapted feeding

8.1 Adopting phase feeding of livestock

Livestock at different growth stages or stages of the reproductive cycle have different optimum nutritional requirements. Greater division and grouping of livestock on the basis of their feed requirements allows more precise formulation of individual rations.

This increases the animal's nutrient use efficiency and results in reduced excreted amounts of nitrogen and phosphorus in fresh animal faeces and urine.

Describe this measure in your country if different : Animal demand for nutrients changes with their development cycle. Phase feeding in the feeding of pigs and poultry - (decrease in protein and phosphorus content in the diet of the animals successively to their stage of development of growth) lowers their excretion of nitrogen and phosphorus which reduces environmental pollution with these components.

1. Is there any official quantified goal that states to what extent this measure should be implemented? **No**

- If "Yes";
 - a) specify quantity and unit:
 - b) if applicable, what year to be realized?
 - c) give reference(s):
- If "No", what is your expert opinion of the desirable level in 5 years?
quantity and unit: 25% pigs and poultry farms (leading farms in the country focused on the production of pigs and poultry - large producers)

2. To what extent is this measure implemented today in relation to goal set above? **2**
"0"=Not at all; "10"=Goal already reached

3. If goal is not reached; how do you judge the possibilities to fulfill it? **4**
"0"=Impossible; "10"=Very good

Comments: The measure is rarely used in Poland.

Comments on why the goal is easy/difficult to reach, what are the most important parameters in your country: In Poland, the challenge is to reduce production costs, and in this context achieve higher daily gains at a lower consumption of feed per kg gain. In comparison to the leading countries in terms of pig production, Poland has a much higher production costs. This is caused mainly by the high cost of feed (60% of total costs) [14]. In order to meet the competition, pig producers will have to improve daily gains and feed efficiency (reduce losses). This situation will encourage, inter alia the introduction of phase feeding principles. Therefore, it seems the measure will be used in an increasing scale.

Literature: [14] Wilcock P., Wellock J. Efektywności produkcji świń w różnych krajach - analiza umożliwiająca poprawę wyników i obniżenie kosztów produkcji.
http://www.konferencjaswinie.pl/referaty/Miedzynarodowe_porownanie_1.pdf

Is this measure regulated in legislation? **No** If "Yes"; national or regional rules

Reference(s) to legislation:

Comments:

Is this measure entitled to economic subsidy? **No** If "Yes"; national or regional subsidy rules

Reference(s) to subsidy rules:

Comments:

8.2 Reducing dietary nitrogen and phosphorus intakes

Farm animals are often fed diets with higher than recommended contents of nitrogen and phosphorus as a safeguard against a loss of production arising from a deficit of these nutrients. A surplus intake of nitrogen and phosphorus is not utilised by the animal and is excreted with faeces and urine, leading to a larger N and P content in the manure. Therefore a ratio balancing of nutrients in feed is a key factor to both ensure animal health and production requirements and minimizing adverse environmental impacts. To improve nutrient use efficiency purchased as well as home-produced feed components need careful management and analysis of nutrient content and dietary value.

Describe this measure in your country if different : The emission from the mentioned sources is directly determined by a diet consumed by animals and their feed, and in particular, its protein content - a source of nitrogen and phosphorus. Feeding in accordance with the feeding demand (the norm) each group of livestock production is a prerequisite to the limitation of nutrients (nitrogen, phosphorus) in animal faeces. Regardless of species, any surplus of nutrients taken with the dose above the demand of animals, increases the emission of pollutants into the environment. Thus, from an environmental perspective, it is extremely important to ensure that the nutrients in the ration were balanced with the nutritional norm [15].

Literature: [15] Analiza oddziaływania rolnictwa na środowisko wodne w województwie Zachodniopomorskim. Potencjalne ograniczenia w rozwoju produkcji zwierzęcej. Inspekcja Ochrony Środowiska Wojewódzki Inspektorat Ochrony Środowiska w Szczecinie. Szczecin 2005. ss. 57.

<http://www.wios.szczecin.pl/bip/files/081EC94866D342D8B61056CD95F45815/Raport.pdf>

1. Is there any official quantified goal that states to what extent this measure should be implemented? **No**

- If "Yes";
 - a) specify quantity and unit:
 - b) if applicable, what year to be realized?
 - c) give reference(s):
- If "No", what is your expert opinion of the desirable level in 5 years?
quantity and unit: 25% pigs and poultry farms (leading farms in the country focused on the production of pigs and poultry - large producers)

2. To what extent is this measure implemented today in relation to goal set above? **2**
"0"=Not at all; "10"=Goal already reached

3. If goal is not reached; how do you judge the possibilities to fulfill it? **4**
"0"=Impossible; "10"=Very good

Comments: The measure is rarely used in Poland.

Comments on why the goal is easy/difficult to reach, what are the most important parameters in your country: See comment 8.1 and 8.4

Is this measure regulated in legislation? **No** If "Yes"; national or regional rules

Reference(s) to legislation:

Comments:

Is this measure entitled to economic subsidy? **No** If "Yes"; national or regional subsidy rules

Reference(s) to subsidy rules:

Comments:

8.3 Phytase supplementation

Supplementation of synthetic phytase to pig feed reduces the need for the addition of mineral phosphate. Phytase increases the availability of phosphorus in the feed and allows total phosphorus contents to be reduced without affecting productivity. With the addition of phytase the phosphorus content of the feed can be reduced by up to 30% for pig feed.

Describe this measure in your country if different : Phytase is one of the enzymes which are proteins with catalytic properties, governing processes of life, produced by any living organism. Phytase supplementation in feed improves digestion and utilization of protein and fat, thereby reduces the amount of not only phosphorus but also nitrogen, excreted with the faeces [16].

[16] Fitaza w żywieniu zwierząt. <http://www.ppr.pl/artykul-fitaza-w-zywieniu-zwierzat-1656-dzial-8.php>

1. Is there any official quantified goal that states to what extent this measure should be implemented? **No**

- If "Yes";
 - a) specify quantity and unit:
 - b) if applicable, what year to be realized?
 - c) give reference(s):
- If "No", what is your expert opinion of the desirable level in 5 years?
quantity and unit: 50% of farms specializing in production of pigs and poultry

2. To what extent is this measure implemented today in relation to goal set above? **4**
"0"=Not at all; "10"=Goal already reached

3. If goal is not reached; how do you judge the possibilities to fulfill it? **6**
"0"=Impossible; "10"=Very good

Comments: In Poland, the feeding of pigs is based on cereals produced on the farm, supplemented with compound feedingstuffs and premixes of purchase. Phytase is found in many commercially available premixes and compound feed.

Comments on why the goal is easy/difficult to reach, what are the most important parameters in your country: See comment 8.1 and 8.4

Is this measure regulated in legislation? **No** If "Yes"; national or regional rules

Reference(s) to legislation:

Comments:

Is this measure entitled to economic subsidy? **No** If "Yes"; national or regional subsidy rules

Reference(s) to subsidy rules:

Comments:

8.4 Wet feed and fermentation

Endogenous phytase in grain can be activated by wetting the pig feed some time before feeding thereby reducing or even eliminating the need for mineral phosphorus supplementation. This means that pig production with wet feed systems should be able to utilise feed with lower phosphorus content than normally recommended.

Fermentation of the feed can reduce the need for mineral phosphate supplementation. Fermentation occurs naturally in wet feed after a certain amount of time. The fermentation process is difficult to manage and the method is still to be developed.

Describe this measure in your country if different : When feeding livestock with the wet feed, the dilutions manage to keep more nitrogen in the body, which helps reduce ammonia emissions into the environment, making it more ecological. Moreover, also phytic phosphorus is better used, the excess of which have the cereal grains. The Danish study shows that soaking the ground grain for 2.5 hours before feeding causes, that the body excretes by faeces and urine from a few to several percent less phosphorus. Through a controlled fermentation of feed its nutritional value is increased. Studies have shown eg that fermented rapeseed grain for pigs contains 14% more digestible protein, and 75% more digestible phosphorus [17]. Thus, the fermentation of feed reduces excretion of N and P in the faeces of animals.

Literature: [17] Szymańska A. Białko przyszłości. W: Farmer 2011 nr 1, dodatek Ferma, s. III. http://rme.cbr.net.pl/index.php?option=com_content&view=article&id=113:ywienie-i-choroby-zwierz&catid=44:przegld-polskiej-prasy-rolniczej&Itemid=95

1. Is there any official quantified goal that states to what extent this measure should be implemented? **No**

- If "Yes";
 - a) specify quantity and unit:
 - b) if applicable, what year to be realized?
 - c) give reference(s):
- If "No", what is your expert opinion of the desirable level in 5 years?
quantity and unit: 10% of farms specializing in production of pigs (leading farms in the country - large producers)

2. To what extent is this measure implemented today in relation to goal set above? **1**
"0"=Not at all; "10"=Goal already reached

3. If goal is not reached; how do you judge the possibilities to fulfill it? **3**

"0"=Impossible; "10"=Very good

Comments: The measure is rarely used in Poland.

Comments on why the goal is easy/difficult to reach, what are the most important parameters in your country: In Poland, the dry feeding system dominates. The change in this area will require a lot of time because of that: /i/ farmers have become accustomed to the use of traditional feeding technology; /ii/ over the past few years the prices of the products, which are the loose feed (grain, high-protein grains) were relatively good (low); /iii/ Polish farms due to the continuous growth of production are still under-funded [18].

Literature: [18] Homanowski J. Płynne żywienie świń to mniejsze koszty i lepsza kontrola stada – wybór trudny, ale konieczny. http://www.trzoda-chlewna.com.pl/images/system_zywienia_na_mokro.pdf

Is this measure regulated in legislation? **No** If "Yes"; national or regional rules

Reference(s) to legislation:

Comments:

Is this measure entitled to economic subsidy? **No** If "Yes"; national or regional subsidy rules

Reference(s) to subsidy rules:

Comments:

9. Reducing ammonia losses in stable

Key emissions to air from animal housing emissions are ammonia (NH₃), odor and dust. The level and variation of ammonia emissions from animal housing are determined by many factors, which also interact. Factors influencing ammonia emissions from animal housing are:

- Increased nitrogen use efficiency.
- Decreased emitting areas with manure in the stable.
- Avoiding high temperature in stable and manure
- Adapting airflows along manure surfaces.
- Use and choice of bedding material.

Describe this measure in your country if different : The amount of ammonia losses from livestock buildings, in particular, depends on such factors as: /i/ the surface which is

covered by manure (emissions increases with the increase in surface area); /ii/ temperature of fertilizer (the lower the temperature, the fewer emissions); /iii/ fertilizers pH (lower emissions at low pH); /iv/ ammonium nitrogen content in fertilizers (larger emissions with higher content); /v/ velocity of an air flow over the fertilizer surface (higher flow rate leads to higher emissions).

1. Is there any official quantified goal that states to what extent this measure should be implemented? **No**

- If "Yes";
 - a) specify quantity and unit:
 - b) if applicable, what year to be realized?
 - c) give reference(s):
- If "No", what is your expert opinion of the desirable level in 5 years?
quantity and unit: 100% farms with intensive animal production

2. To what extent is this measure implemented today in relation to goal set above? **0**
"0"=Not at all; "10"=Goal already reached

3. If goal is not reached; how do you judge the possibilities to fulfill it? **6**
"0"=Impossible; "10"=Very good

Comments: This measure is not applied in Poland.

Comments on why the goal is easy/difficult to reach, what are the most important parameters in your country: The measure will be gradually implemented in Poland in connection with the planned ratification by Poland of the Convention on Long Range Transboundary Air Pollution - the Geneva Convention of 13 November 1979 (Poland is a party to this Convention since 17 October 1985). In connection with the ratification of the Convention, will enter into force Annex IX of the 1999 Protocol to Abate acidification, Eutrophication and Ground-level Ozone (Gothenburg Protocol) on Measures for the Control of Emissions of ammonia from agricultural sources.

Is this measure regulated in legislation? **No** If "Yes"; national or regional rules

Reference(s) to legislation:

Comments:

Is this measure entitled to economic subsidy? **No** If "Yes"; national or regional subsidy rules

Reference(s) to subsidy rules:

Comments:

10. Storage of manures

Adequate collection and storage facilities provide the possibility to choose a time to apply manure to fields when the crops can utilize N and P and there will be fewer occasions when lack of capacity forces the farmer to spread manure at unsuitable times.

Manure storage must be of such a quality that it prevents N, P and manure losses. The main influencing factors on the ammonia losses from storages are manure properties (pH, dry

matter content) temperature and wind conditions, filling technology, storage time, and for liquid manure storage ratio surface: volume, crust formation and mixing methodology.

Ammonia losses can be sharply reduced if the air directly above the liquid manure store is prevented from circulating. A method that efficiently reduces NH₃ losses is to cover the liquid manure stores with, for instance, a roof, a floating plastic cover or a stable natural crust. If the liquid manure storage is filled underneath the cover, this can be kept intact even during filling, which reduces the risk of NH₃ losses.

From storages with solid manure, especially if composting take place with high temperatures, NH₃ losses could be high. Peat included in the bedding material will reduce NH₃ losses during storage. Roofs on solid manure storages could be an effective measure to reduce ammonia losses from solid manure storages. Additionally, a roof keeps rainwater away, which could prevent nutrient leakage from the manure pad if it has insufficient or lacking drainage leading to a collection pit.

Describe this measure in your country if different : During storage of natural fertilizers, ammonia losses depends on the type and composition of a fertilizer, storage time, meteorological conditions (temperature, wind speed) and size of the tank. Ammonia losses from the tanks with liquid manure and slurry are rather low, respectively 2 and 2-9% and visibly lower than from traditionally stored manure, where their size reaches 25%.

Reduce ammonia emissions during liquid manure and slurry storage is achieved by minimising its contact with an open space (cover storage facilities). Currently, in the case of manure, there are no sufficiently effective methods to reduce ammonia emissions during storage.

1. Is there any official quantified goal that states to what extent this measure should be implemented? **Yes**

- If "Yes";
 - a) specify quantity and unit: all farms equipped with liquid manure tanks
 - b) if applicable, what year to be realized? since 1 January 2011
 - c) give reference(s): the Act on fertilizers and fertilization dated 10 July 2007
- If "No", what is your expert opinion of the desirable level in 5 years?
quantity and unit.

2. To what extent is this measure implemented today in relation to goal set above? **5**
"0"=Not at all; "10"=Goal already reached

3. If goal is not reached; how do you judge the possibilities to fulfill it? **7**
"0"=Impossible; "10"=Very good

Comments: In Poland, the regulation is effective from 1 January 2011, that the liquid manure and slurry shall be kept only in sealed tanks with a capacity enabling collection of at least 4-month production of fertilizer. These tanks should be closed tanks. Currently, in most cases, liquid manure is stored in closed containers, while the slurry is not.

Farms located in the NVZ-es are required to have tanks for liquid manure and slurry, and manure plates with a capacity corresponding to the six-month production of these fertilizers.

Comments on why the goal is easy/difficult to reach, what are the most important parameters in your country: The introduction of the principles of slurry storage in closed tanks encounters difficulties, because this would require to bear the additional costs by farmers. This problem does not occur in relation to manure, which is usually stored in

closed tanks. Reducing ammonia losses during storage of manure is difficult to practically implement because it requires organizational changes in the system of manure management, it is laborious, and is associated with the additional financial burden for farmers.

Is this measure regulated in legislation? **Yes** If "Yes"; national or regional rules

Reference(s) to legislation: The Act on fertilizers and fertilization dated 10 July 2007 (Dz. U. 2007, no 147, pos. 1033)

The Minister of Environment regulation dated on 23 December 2002 on detailed requirements to be met by action programs aimed at reducing nitrogen runoff from agricultural sources. (Journal of Laws 03.4.44 dated 15 January 2003)

Comments:

Is this measure entitled to economic subsidy? **No** If "Yes"; national or regional subsidy rules

Reference(s) to subsidy rules:

Comments:

11. Constructed wetlands for nutrient reduction/retention

11.1 Sedimentation ponds

Small surface flow wetlands designed primarily to retain phosphorous. This is achieved by retaining eroded phosphorous bound to aggregates and particulate materials in the run-off water by optimizing the conditions for sedimentation processes. To some extent phosphorous and other nutrients are reduced due to biological and chemical decomposition and transformation processes as well as plant uptake.

A sedimentation pond is suitable for establishment in highly intensive small-scale agricultural areas. The ponds are relatively small representing approximately 0.1 – 0.5 % of the run-off area. The sedimentation pond is constructed for instance by widening a section in a ditch into a sedimentation pond slowing down the speed of the run-off water hence increasing sedimentation.

A sedimentation pond is often designed as a serial combination of (i) a sedimentation basin with a water depth of 1-1.5 m representing 20-30% of the total area of the sedimentation pond where the main sedimentation of larger particles takes place, followed by (ii) a wetland filter covered with typical wetland plants providing good conditions for sedimentation of smaller particles. In case the area is highly sloped it is suitable to include an overflow area followed by a second wetland filter prior to the outlet to further induce the sedimentation efficiency.

The accumulated sediments in the sedimentation basin need to be removed on regular basis for maintenance.

Describe this measure in your country if different : In sedimentation ponds, located among arable fields, (mechanical) impurities from surface runoff are caught by sedimentation processes. Sedimentation ponds also trap fertilizer nutrients from sediment particles. Well-constructed pond could potentially remove 65-75% of sediment and 25-33% of the total

phosphorous in runoff at the entrance to the pond.

1. Is there any official quantified goal that states to what extent this measure should be implemented? **No**

- If "Yes";
 - a) specify quantity and unit:
 - b) if applicable, what year to be realized?
 - c) give reference(s):
- If "No", what is your expert opinion of the desirable level in 5 years?
quantity and unit: **on the experimental level**

2. To what extent is this measure implemented today in relation to goal set above? **0**
"0"=Not at all; "10"=Goal already reached

3. If goal is not reached; how do you judge the possibilities to fulfill it? **2**
"0"=Impossible; "10"=Very good

Comments: This measure is not applied in Poland as official measure. But in Poland there are hundreds of thousands of small reservoirs with an area <1 ha - these include mid-field ponds (so called „water little eyes”), which accumulate large quantities of nutrients flowing from the fields. Part of mid-field ponds play the role of sedimentation ponds.

Comments on why the goal is easy/difficult to reach, what are the most important parameters in your country: Lack of scientific research confirming effectiveness and purposefulness of application of sedimentation ponds in Poland.

Is this measure regulated in legislation? **No** If "Yes"; national or regional rules

Reference(s) to legislation:

Comments:

Is this measure entitled to economic subsidy? **No** If "Yes"; national or regional subsidy rules

Reference(s) to subsidy rules:

Comments:

11.2 Constructed wetlands

Large free water surface wetlands are designed and constructed primarily for removal of nutrients, e.g. nitrogen and phosphorous and other pollutants from run-off water through sedimentation, biological and chemical transformation and degradation and plant uptake. Constructed wetlands have additional benefits, i.e. improved biodiversity, water storage capacity, resource recovery, irrigation possibilities and production of crop biomass.

Constructed wetlands are established, or re-established, to receive water from large run-off areas in arable as well as agricultural areas. The run-off area should be represented by at least 50 percent intensive agricultural land use with the constructed wetland covering approximately 0.5–4 % of the total run-off area.

An important characteristic is the establishment of typical emerges and submerges wetland vegetation. A constructed wetland provides heterogenic water regimes and environments. It is common with a mixture of areas with (i) permanently high water level, more or less covered with typical wetland vegetation, as well as (ii) periodically waterlogged areas with low water level. The water regime can also vary over the year.

Describe this measure in your country if different : Constructed wetlands are built, especially to stop (retention) fertilizer nutrients which are flushed from the fields through denitrification, self-consolidation of soil and sorption. Constructed wetlands included, in a broad sense, in wetland systems, enable removing most of the nitrogen and phosphorus compounds in the surface runoff.

1. Is there any official quantified goal that states to what extent this measure should be implemented? **No**

- If "Yes";
 - a) specify quantity and unit:
 - b) if applicable, what year to be realized?
 - c) give reference(s):
- If "No", what is your expert opinion of the desirable level in 5 years? quantity and unit: **0**

2. To what extent is this measure implemented today in relation to goal set above? **0**
 "0"=Not at all; "10"=Goal already reached

3. If goal is not reached; how do you judge the possibilities to fulfill it? **0**
 "0"=Impossible; "10"=Very good

Comments: This measure is not applied in Poland as official measure.

In Poland, constructed wetlands are understood primarily as objects of the soil-plant wastewater treatment of sewage. They are defined as: root treatment, reed bed filters, soil-plant filters, soil-plant-soil treatment plant, constructed wetlands, wetland systems.

In Poland, constructed wetlands are not being built in order to retain nutrients flushed from fields, and in this way to reduce their charges migrating to the surface water (no data on this subject in the literature)

Comments on why the goal is easy/difficult to reach, what are the most important parameters in your country: Lack of scientific research confirming effectiveness and purposefulness of application of constructed wetlands in Poland.

Is this measure regulated in legislation? **No** If "Yes"; national or regional rules

Reference(s) to legislation:

Comments:

Is this measure entitled to economic subsidy? **No** If "Yes"; national or regional subsidy rules

Reference(s) to subsidy rules:

Comments:

12. Buffer-zones along water areas and erosion sensitive field areas

Buffer zones are uncultivated areas between fields and water courses, main ditches, ponds, lakes or gulfs. Buffer zones are also to be implemented in erosion sensitive field areas such as around surface water wells or surrounding field areas with high ground water levels.

Buffer zones reduce the speed of water surface run-off mitigating losses of eroded aggregates, soil particles, and particulate phosphorous and other soil borne pollutants. They also decrease the risk of freshly spread manure and pesticides to reach the water environment. Buffer zones are an especially important measure in areas with eroding problems. Buffer zones also provide conditions for biological and chemical transformation of pollutions as well as plant uptake.

The buffer zones are under permanent plant cover of dense grass or vegetation. Buffer zones are situated on former agricultural land and have a width of 5-20 m. They are not allowed to be cultivated, fertilized or sprayed with herbicides or pesticides. The vegetation should be kept dense and plants should be established if needed for maintenance.

Describe this measure in your country if different : Buffer zones are strips of land planted with permanent vegetation cover, located at the junction of agricultural land with a watercourse (including periodically dry), such as: rivers, streams, creeks, canals and ditches and water reservoirs such as lakes, water (aquatic) gardens and ponds. They act as filters of non-point source pollution flowing with surface and subsurface runoff from agricultural land to surface waters. In the area of buffer zones is not allowed to use nitrogen and phosphorus, mineral and natural fertilizers, grazing animals and cultivation of the soil.

1. Is there any official quantified goal that states to what extent this measure should be implemented? **Yes**

- If "Yes";
 - a) specify quantity and unit: **in the small-scale**
 - b) if applicable, what year to be realized? **2013**
 - c) give reference(s): **The Polish rural development programme 2007-2013**
- If "No", what is your expert opinion of the desirable level in 5 years?
quantity and unit: total length of buffer zones around 125 000 km

2. To what extent is this measure implemented today in relation to goal set above? **1**
"0"=Not at all; "10"=Goal already reached

3. If goal is not reached; how do you judge the possibilities to fulfill it? **8**
"0"=Impossible; "10"=Very good

Comments: In connection to the Council Regulation (EC) No 73/2009 of 19 January 2009, Poland as well as other EU Member States is required from 1 January 2012, to implement the new requirements of the cross-compliance system, for the designation of buffer zones along watercourses.

Comments on why the goal is easy/difficult to reach, what are the most important parameters in your country: Due to the coming into force the Council Regulation (EC) No 73/2009, the implementation of the measure will be relatively easy to achieve.

Is this measure regulated in legislation? **Yes** If "Yes"; national or regional rules

Reference(s) to legislation: The Minister of Environment regulation dated on 23 December 2002 on detailed requirements to be met by action programs aimed at reducing nitrogen runoff from agricultural sources. (Journal of Laws 03.4.44 dated 15 January 2003)

Comments: The appropriate regulation of the Minister of Agriculture will be created at country level.

Is this measure entitled to economic subsidy? **Yes** If "Yes"; national or regional subsidy rules

Reference(s) to subsidy rules: Rural Development Programme 2007-2013. Ministry of Agriculture and Rural Development, Warsaw, July 2007 p. 400

Comments:

DRAFT

List of used words

Agricultural land (also **agricultural area**) denotes the land suitable for agricultural production, both crops and livestock.

Arable land is land under temporary agricultural crops, temporary meadows for mowing or pasture, land under market and kitchen gardens and land temporarily fallow (less than five years). The abandoned land resulting from shifting cultivation is not included in this category.

Permanent crops - land cultivated with long-term crops which do not have to be replanted for several years; land under trees and shrubs producing flowers, such as roses and jasmine; and nurseries (except those for forest trees, which should be classified under "forest")

Permanent meadows and pastures - land used permanently (five years or more) to grow herbaceous forage crops, either cultivated or growing wild (wild prairie or grazing land).

References

Pain B. and Menzi H., 2003: Glossary of terms on livestock manure management 2003. RAMIRAN Network, 59 pp. Copies available from: H. Menzi, Swiss College of Agriculture, Laenggasse 85, CH-3052, Zollikofen, Switzerland.
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Definitions of agricultural words can be found in the FAO glossary
<http://faostat.fao.org/>

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