AARHUS UNIVERSITET
DCA - NATIONALT CENTER FOR FØDEVARER OG JORDBRUG

Til NaturErhvervstyrelsen

Vedr. bestillingen 'Hvilken effekt har Landbrugsreformens indførsel af de 3 grønne krav haft på erhvervet i praksis og har det givet de jordbunds- og miljømæssige effekter som beskrevet i forordningen?'

DCA - Nationalt Center for Fødevarer og Jordbrug

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Specialkonsulent

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NaturErhvervstyrelsen har i en bestilling dateret d. 11. marts 2016 bedt DCA – Nationalt Center for Fødevarer og Jordbrug – om at vurdere effekten til Landbrugsreformens indførsel af de 3 grønne krav på erhvervet i praksis og hvorvidt det givet de jordbunds- og miljømæssige effekter som beskrevet i forordningen.

Ifølge aftale er besvarelsen opdelt, således at der d. 9. maj 2016 blev fremsendt besvarelse omhandlende pkt 2 i bestillingen, mens den resterende del skulle fremsendes dags dato. Nedenstående notat er således en samlet besvarelse på alle spørgsmål i bestillingen. Besvarelsen er udarbejdet af Professor MSO Tommy Dalgaard, Lektor Goswin Heckrath, Seniorforsker Ib Sillebak Kristensen, Seniorforsker Troels Kristensen, Seniorforsker Lars Munkholm, Post Doc Arezoo Taghizadeh-Toosi alle fra Institut for Agroøkologi, Aarhus Universitet samt Seniorrådgiver Jesper Fredshavn fra Nationalt Center for Miljø og Energi (DCE), Aarhus Universitet.

Besvarelsen er udarbejdet som led i "Aftale mellem Aarhus Universitet og Fødevareministeriet om udførelse af forskningsbaseret myndighedsbetjening m.v. ved Aarhus Universitet, DCA – Nationalt Center for Fødevarer og Jordbrug, 2016-2019 (punkt FN-205 i Aftalens bilag 2)".

Venlig hilsen

Klaus Horsted

Kopi til Innovation

DCA – Nationalt Center for Jordbrug og Fødevarer
3. juni 2016

Effects of green measures in the EU 2015 agricultural reform including crop diversification, permanent grassland management and the related impacts on climate and environment in Denmark

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Abstract

The present paper reviews effects of green measures in the EU 2015 agricultural reform, including crop diversification, permanent grasslands management and the related environmental impacts on carbon accumulation, greenhouse gas emissions, nitrogen leaching, biodiversity and soil protection in Denmark.

The study indicates that the demands for crop diversification have resulted in a significantly increased reduction in the number of small farms in the category below 30 ha. The number of farms with only 1 or 2 types of crops was reduced, whereas the summed farm area for applicants with 3 to 6 different crop types increased significantly. In contrast, the summed farm area for applicants with 7 or more crop types only increased slightly. Measured per ha, the large farms are less crop diverse than the smaller farms, and while the number of crop types increased from 2.5 to 2.8 at farms in the size class 10-30 ha, it increased from 4.7 to 4.9 for farms with >30 ha rotational area. In general, greater cropping system diversity improves soil quality.

Both permanent grasslands and grass in rotation contribute to soil carbon accumulation. For common, productive grassland fields in Denmark the accumulation is estimated to around 0.6 t C/ha/yr, both for permanent and rotational grasslands, and with significantly higher accumulations than for cereals. In addition, grasslands at low fertilizer levels have low GHG emissions of nitrous oxide, and the summed GHG effect of conversion from cereals to grassland is significant. If measured per area, the highest GHG effect is for conversion to grass-clover at low fertilizer levels, whereas the GHG effect per ha of conversion from cereals to grass is reduced at high grassland fertilizer levels. However, the nitrogen leaching is relatively independent of the fertilizer level, and there are significant positive trade-offs between fertilization and yields. For biodiversity, especially extensive permanent grasslands have positive effects, whereas there is no significant difference between the biodiversity effect of intensively farmed grassland and cereal fields, unless the grassland is grown in a more extensive production system than the cereals, for example as permanent grass or in systems with no or only little fertilizer or pesticides input. With regard to soil protection, the establishment of grassland can be a useful option to mitigate erosion risks. Moreover, grasslands can facilitate sediment deposition and as a preferred cover on riparian buffer zones prevent runoff to surface waters. Experimental evidence shows a high vulnerability of winter cereals and maize to water erosion. In contrast, well established grassland provides very good protection from erosion, but due to the short period with bare soil, restricting ploughing of permanent grassland would not noticeably improve soil protection against soil erosion in the relatively flat landscapes of Denmark. Finally, especially permanent grassland is expected to reduce risk of subsoil compaction; a main threat to soil quality under Danish conditions.

Introduction

The EU 2015 agricultural reform introduced three types of green measures (crop diversification, permanent grasslands and ecological focus areas), which based on the EU regulation number 1307/2013 (Official Journal of the European Union, 2013) are implemented in Denmark to mitigate the effect of agriculture on climate and the environment.

Based on a request from The Danish Agrifish Agency under The Danish Ministry of Environment and Food the present note reviews the effects of

1) The crop diversification measure (section 1), including the impact on the number of small farms (section 1.1.) and the overall effect on soil quality in Denmark (section 1.2), and
2) The effects of permanent grassland preservation (section 2), including a background section on grassland management in Denmark (Section 2.1), and three sections on the environmental impacts in the form of carbon accumulation and nutrient losses to the environment (section 2.2), biodiversity (section 2.3) and soil protection (section 2.4). The environmental impacts are assessed both for conversion from cereals to grassland rotations, and for the conversion of regularly ploughed and renewed permanent grasslands to permanent grasslands without renewal via ploughing. However, the effect of the ecological focus area designation is not included in the present analyses.

1. The demand for crop diversification

From 2015, to receive EU green measure subsidies, applicants for 10 ha or more in rotation are required to grow two crop categories (see list in appendix), and the area of the largest of these crop categories must not sum to more than 75% of the area in rotation.

Moreover, if the farm apply for green measure subsidies to more than 30 ha in rotation, three crop categories are required, and the two crop categories with the largest area must not sum to more than 95% of the total area in rotation.

Organic farms automatically fulfill the demand for green measure subsidies, and do not have to document a certain number of crop categories grown. In addition, some farms with more than 75% of the area in permanent grassland, grassland set-aside or rotational grassland maybe exempted from the crop diversification demand.

The following two sections reviews the effect of this regulation, based on data for the crops grown in Denmark 2011-2015.

1.1. Effect on the number of small farms

To investigate whether the number of applicant farms in the category 10-30 ha have been reduced after the 2015 EU regulation reform, the developments from 2011-2014 as compared to the development from 2014 to 2015 have been analyzed (Figure 1).

In conclusion, for both categories there has been a significant linear reduction in the number of applicant farms per year in the period 2011-2014. However, from 2014 to 2015 a considerable additional reduction has been seen in the number of farms in the 10-30 ha category (12-13% extra reduction as compared to the reduction according to the linear trend expected). Also in the category of farms with >30 ha land in rotation a small extra reduction of 2-3% has been seen, but this corresponds to the general acceleration in farm structural development, as is assessed to be within the uncertainty. Finally, it can be noted that also the number of farm in the category <10 ha area in rotation is reduced considerably from 2014-2015. For the category 5-10 ha this corresponds to a 15-16% further reduction in comparison to the expected linear reduction trend from 2011-2014. The statistics for farms <5 ha shows the same trend, but is much more uncertain, and most of these farms are also not included in the official statistics. All these results indicate that the 2015 reform have contributed to an extra reduction in the number of small farm applicants in Denmark, probably because they have dropped out of the application scheme or rented the land out to larger farms.

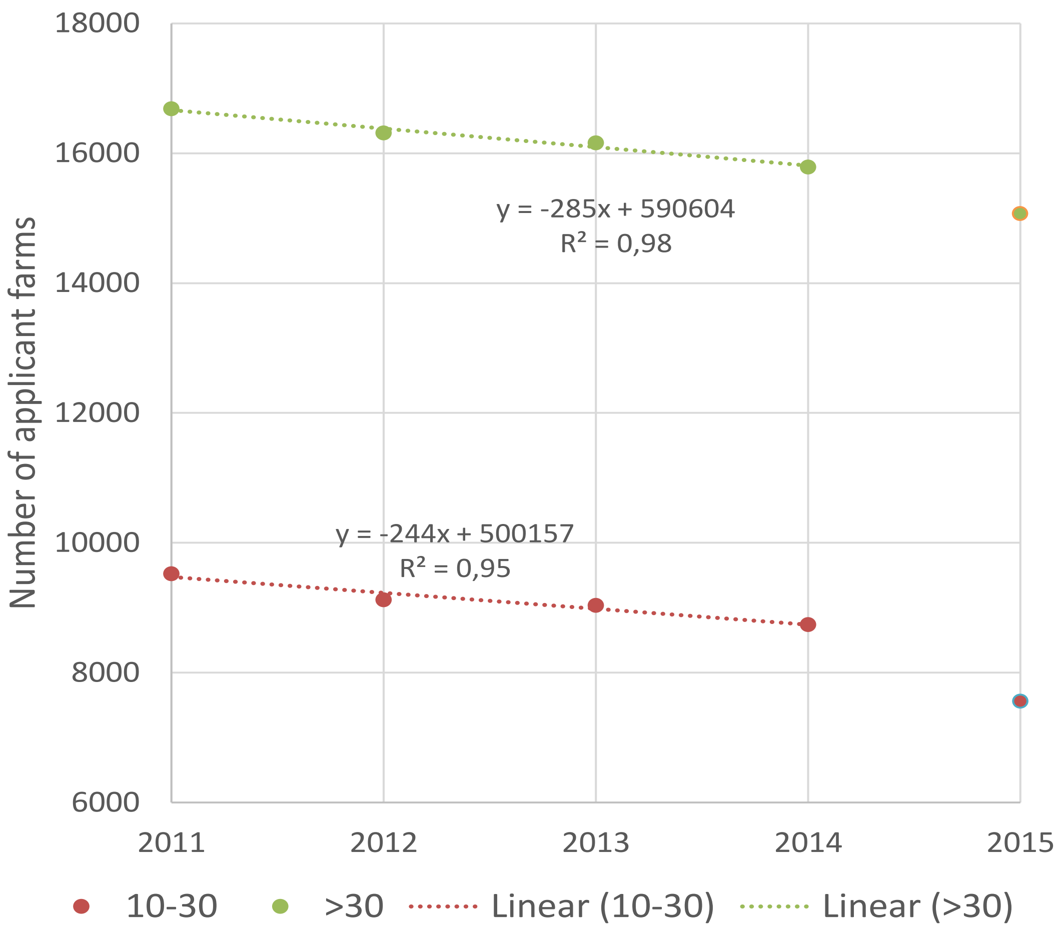

Figure 1. Developments in the number for applicants with 10-30 ha in rotation compared to the number of applicants with more than 30 ha in rotation, from year 2011 to 2015. For both categories, the linear reductions are illustrated over the years 2011-2014, in comparison to the 2015 situation.

1.2. Effect on crop diversity, farm management and soil quality

In total, the average number of crop categories grown per farm (i.e. the non-organic farm applicants with >5 ha rotational area) increased from 3.1 in 2014 to 3.7 in 2015, whereas the average number of crop categories per farm increased from 1.1 to 1.2 over the same period. However, the effect differs between farm sizes (Table 1).

Table 1. Development in the number of crop categories measured per total rotational area per applicant farm, for the three farm size classes affected differently by the 2015 EU reform (Excluding the organic farms, which *per se* fulfill the demand to receive green measure subsidies, and does not have to document a certain number of crop categories grown).

	Average number of crop categories per farm		Average number of crop categories per 10 ha	
Farm size	2014	2015	2014	2015
5-10 ha	1.7	1.7	2.3	2.3
10-30 ha	2.5	2.8	1.4	1.6
>30 ha	4.7	4.9	0.5	0.6
Total	3.1	3.7	1.1	1.2

The smallest farms (<10 ha) are per definition not effected by the regulation and this corresponds to what the statistical figures show (the average number of crop categories per farm <10 ha are 1.7 in both years, and consequently the average number of crop categories per 10 ha is unaffected (Table 1).

In comparison, the number of crop categories increased from 2.5 to 2.8 at farms in the size class 10-30 ha, and from 4.7 to 4.9 for farms with >30 ha rotational area. The reason why the number of crop categories does not increase more in the category >30 ha is that the larger the farm is, the more crop types were typically grown in 2014, and thereby the largest farms are affected relatively less affected by the new demand for diversification. In addition, measured per ha of land these farms are less crop diverse than the smaller farms as reflected in the measured number of crop categories per 10 ha of declared rotational area by the applicant (right column in Table 1).

The same pattern appeared when the numbers of crop categories per farm in 2014 and 2015 were compared to the distributions of applicant farm rotational areas (Figure 2). From this it is clear that the areas at farms with only 1 or 2 crop categories was reduced significantly, whereas the summed farm area for applicants with 3 to 6 different crop categories increased the most. In contrast, the summed farm area for applicants with 7 or more crop categories only increased slightly.

In summary, there is a clear effect of the crop diversification measure on the farms with an applied rotational area of more than 10 ha. The relatively largest effect were noted for the farm category 10-30 ha, which may correspond to the fact that this is the category where most farmers chose to drop out of the application scheme (Figure 1). This may be problematical since it is at the smaller farms that the relatively highest crop diversity measured per area of land is registered (Table 1, right column), and may be caused by the relatively high extra administration and management costs imposed for this category. However, measured with the total number of crop categories per farm, the larger farms have the most diverse *portfolio* of crops (Table 1, left column), and maybe therefore the smallest relative change in crop category numbers from 2014 to 2015. Moreover, larger farms have more room and potentials for more complex crop rotations than smaller farms. This is important to note, because the effect of the crop diversity including the effect on soil quality for crop growth need to be evaluated based on the effect of whole crop rotations (Taghizadeh-Toosi and Olesen 2016). Consequently, to evaluate fully the effect of changed crop pattern after the 2015 reform, information on the crop sequences for the period following 2015 will be needed.

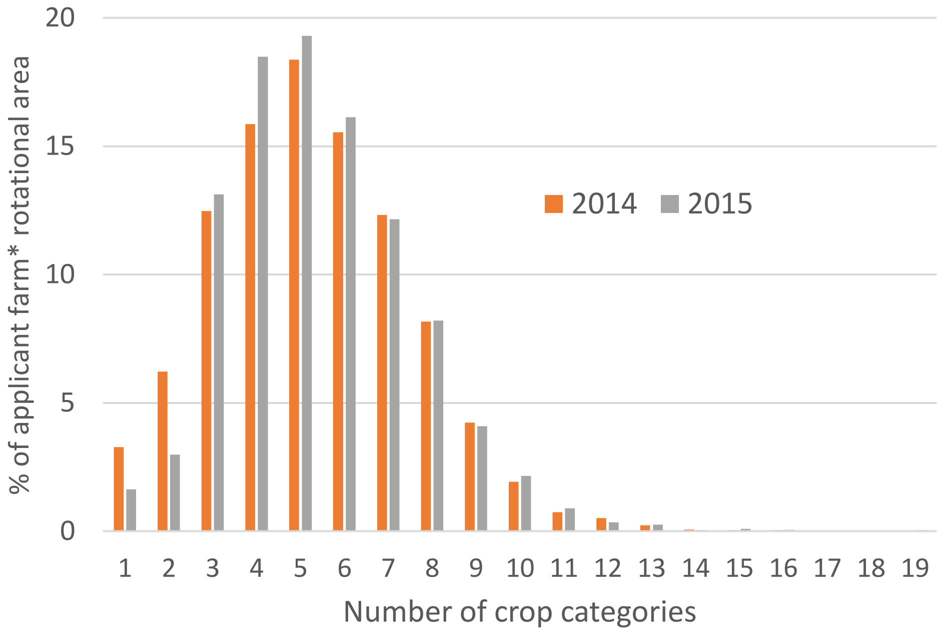

Figure 2. Distribution of applicant farm rotational area (in %) compared to the number of crop categories per farm in 2014 and 2015. *) Excluding the organic farms, which *per se* fulfill the demand to receive green measure subsidies, and does not have to document a certain number of crop categories grown.

Crop diversity and soil quality

In general, greater cropping system diversity is expected to improve soil quality (Lal, 2015) and the overall stability of the production system (Davis et al., 2012). However, the effect depends on the types of crops grown and the management of these crops (e.g. the use of cover crops, manure, and heavy machinery). Especially, more grassland can help to increase soil carbon accumulation (Taghizadeh-Toosi and Olesen, 2016) with subsequent positive effects on soil quality (Ball and Douglas, 2003; Schjønning et al., 2007). Inclusion of cover crops in a cereal-based rotation is an alternative measure to increase soil carbon (Taghizadeh-Toosi and Olesen, 2016) and improve soil quality under Danish conditions (Abdollahi and Munkholm, 2014; Abdollahi et al., 2014a).

2. The preservation of permanent grasslands

Preservation of permanent grasslands is one of the green measures implemented in the 2015 EU agricultural reform. In Denmark, applicants with permanent grasslands within designated environmental sensitive areas thereby are, among other obligations, demanded to maintain this area with permanent grass out of the crop rotation and with no ploughing. The only permission is for light harrowing.

According to the EU Commission (2013), the demand for permanent grasslands is implemented for environmental protection reasons, and as mentioned in the text because of the contribution to securing carbon storage. In the EU Commission (2014) regulation no. 639, this is targeted further as those permanent grassland areas with the highest contribution to the environmental protection, in particular focusing on carbon accumulation, biodiversity and soil protection. Therefore, these issues are reviewed in separate sections (2.2-2.4), after a section 2.1 on the background for grassland management in Denmark.

2.1 Background for grassland management in Denmark

Danish agriculture has a long tradition for grassland, often growing grass-clover mixtures, or as pure grass in a short-term rotation. In general, intensive Danish grasslands are ploughed after 2-3 year of production, whereas other EU-countries normally maintain N-fertilized grassland for 5-20 years (permanent) before renewing. In 2015, an area of 206,690 ha was registered as permanent grasslands in Denmark[1], accounting to about 8-9% of the 2,432,797 ha total agricultural area, included in the Ministry of Environment and Food subsidy database[2]. The 11,249 ha of these permanent grasslands were located within designated environmental sensitive areas[3]. For comparison, around 333,000 ha of Danish grasslands are in rotation (Statistics Denmark 2012).

The reason for having short-term grass-clover in Denmark is to 1) Increase productivity, 2) Utilize residual N for subsequent N-demanding cash crops – for e.g. barley, and 3) Control weeds and pests (e.g. *Pseudocercosporella herpotrichoides* (wheats eyespot) and *Aphanomyces cochlioides* (root rot)). The effect of renewing grass-clover is a higher yield in the first year after renewal as compared to the following years. In the fifth year, grass-clover in cutting trials only gives 50-70 % of the first year yield (Søegaard et al. 2002). In Denmark, nearby 100 kg extra mineral-N per ha can be expected in the first year after ploughing which can be utilized by the subsequent crop. Because of this, and to safely establish the grass field while also producing a cereal crop, grass-clover is most often established by undersowing in cereals in Denmark, which also avoids the 2-3 months that will be “wasted” with very low growth while the new-sown grasses establish. In other countries, grasslands are mainly renewed by ploughing followed by immediate reseeding. This method does not make effective use of the accumulated soil-N during grass production for N demanding cash crops.

2.2 Carbon accumulation and nutrient losses to the environment

The present review on the effects of grasslands in comparison to cereal rotations is primarily based on the results presented in Olesen et al. (2016, note in Danish), and additional calculations with the www.farm-N.dk tool related to national land use data on crop types, farm management, soil types etc. This includes an

[1] Permanent grass is defined as grass fields which have been out of rotation in 5 years or more (Danish Ministry of Environment and Food 2016, p. 191). See also the list of crops in appendix.
[2] According to Statistics Denmark the total agricultural farmland area in Denmark was 2,632,947 ha in 2015.
[3] The so-called MSO areas, defined as peatland soils (SINKS) or wet soils (FOT data) within Natura 2000 areas (Danish Ministry of Environment and Food 2016).

assessment of the effect on carbon accumulation as well as the related overall effect on greenhouse gas emissions and other environmental effects in the form of nitrogen leaching.

2.2.1 Carbon accumulation and greenhouse gas emissions

Conversion from cereal rotations to grassland results in a quick accumulation of carbon in the soil, especially the first couple of years, with a subsequent decline in the accumulation rate, which after some years will be more constant. The reason for this is the large build-up of carbon via the first years' rapid establishment of the grass field root system. Taghizadeh-Toosi and Olesen (2016) calculated the annual carbon accumulation in the total soil profile under highly productive grassland to be around 2 t C/ha/yr in the first two years after the grassland establishment, and a reduction in the annual accumulation rate to be about 0.6 t C/ha/yr in the following decades. The large pool of carbon build-up during the first couple of years primarily consists of the more reactive types of carbon compounds, and is therefore not permanent. The carbon accumulation in common, productive grassland fields can therefore be estimated to 0.6 t C/ha/yr. In the in the paper (Taghizadeh-Toosi and Olesen 2016) this figure was compared to a typical Danish cereal based rotation system fertilized by mineral fertilizers. The annual carbon accumulation in grassland will carry on for a long period of more than at least a century, and the measures total carbon content in long-term grasslands is typically measures to be 50% to 100% larger than for annual crops in rotation (Soussana et al. 2004).

There is limited knowledge about the effect of grassland management in the form of fertilization, harvest intensity and composition of grass-species on carbon accumulation. The above-mentioned values are probably valid for grass-clover, independent on the fertilization level (because the clover can fix nitrogen for crop growth from the air, and thereby is more independent of the fertilization level). In contrast, the soil carbon accumulation is assessed to be lower at a low fertilization level (maybe about the half for fertilizer levels of 150 kg N/ha or lower), as compared to a high fertilization level, and thereby the return of carbon in organic matter to the soil will also be lower (Table 2). Remark, the assessed effects for the first couple of years, and for low fertilizer levels to pure grass have a high uncertainty, and for the first couple of years the accumulation maybe significantly higher than for the period after.

Table 2. Estimated, permanent carbon accumulation in grassland fields (t C/ha/yr) as a response to the nitrogen fertilizer level and the age of the grass fields Olesen et al. (2016). *) The assessed effects for the first couple of years and for low fertilizer levels to pure grass have a high uncertainty.

	Fertilizer (kg N/ha/yr)	Year 1-2*	Year 3-8
Clover-grass	0	0.6	0.6
	240	0.6	0.6
Pure grass (ryegrass)	150*	0.3	0.3
	300	0.6	0.6
	450	0.6	0.6
	575	0.6	0.6

Conversion from cereal rotation to grasslands and the management of grasslands thereby significantly effects the net greenhouse gas emissions from agriculture. However, the effect of grasslands on greenhouse gas emission is not caused by carbon accumulation alone (and thereby the reduction in emissions of the major greenhouse gas carbon dioxide CO_2). Another major greenhouse gas is nitrous oxide (N_2O), where agriculture contributes with about 90% of the total Danish emissions (Nielsen et al. 2015). The turnover of crop residues is in this context an important source for emissions, and grasslands in rotation builds up significantly more root biomass than cereals in rotation (in the first couple of years after sowing, as mentioned above). In contrast, permanent grasslands will have a lower contribution.

Based on the IPCC (2006) methodology and the crop residues figures from Table 11.7 by Mikkelsen et al. (2014), the nitrous oxide emissions from different types of grassland management has been accounted by Olesen et al. (2016) and compared to the emission from cereal crops (Table 5). This shows a significantly lower nitrous oxide emission from young grass fields at low fertilizer levels, as compared to cereal crops, older grassland fields and grasslands at a higher fertilizer level.

Table 5. Estimated emissions of nitrous oxide from different crops at different fertilization levels and soil types, and converted to carbon dioxide equivalents. *) Total nitrogen in animal manure. Olesen et al. (2016).

Crop		Fertilizer (kg N/ha/yr)	kg N_2O-N/ha/yr	kg CO_2-eq/ha/yr
Winter Wheat	Irrigate sandy soil	93+140*	2,9	1367
	Loamy soil	109+140*	3,0	1417
Silage Maize	Irrigated sandy soil	69+140*	2,7	1264
	Loamy soil	44+140*	2,3	1092
Grass-clover	1-2 years	0	0,3	160
		240	2,8	1296
	3-8 years	0	0,1	68
		240	2,6	1230
Ryegrass	1-2 years	150	1,8	862
		300	3,4	1577
		450	4,9	2292
		575	6,3	2952
	3-8 years	150	1,6	771
		300	3,2	1511
		450	4,8	2225
		575	6,2	2898

The total net greenhouse gas emission from both soil carbon accumulation and nitrous oxide emissions were accounted by Olesen et al. (2016), showing a general pattern with lower emissions from grasslands in comparison to the cereal crops, but as more diffuse correspondence between the different grassland management strategies and total emission (Table 6). Notice the general positive effect on greenhouse gas emission indicated with the negative values for changes in emissions, but at the same time also with negative effects on the yield measured in dry matter. In general, there is a high effect of conversion to grass-clover, and for pure grass the highest greenhouse gas effect is for the lowest fertilization levels.

Table 6. Estimated net effects from carbon accumulation and nitrous oxide emissions on the total greenhouse gas (GHG) emission from conversion from cereals (silage maize) to different types of grassland management on sandy soils. Moreover, fertilization levels and the estimated effect on dry matter yield and nitrogen leaching is included (Olesen et al. 2016).

Crop		Fertilizer (kg N/ha/yr)	Change in dry matter yield (ton/ha/yr)	Change in N leaching (kg N/ha/yr)	Change in GHG emission (t CO_2-eq/ha/yr)
Grass-clover	1-2 yrs	0	-4.3	-88	-3.3
		240	-1.7	-83	-2.1
	3-8 yrs	0	-6.3	-88	-3.4
		240	-3.7	-83	-2.2
Ryegrass	1-2 yrs	150	-4.1	-88	-1.5
		300	-2.1	-83	-1.9
		450	-0.7	-78	-1.2
		575	-0.2	-48	-0.5
	3-8 yrs	150	-6.1	-88	-1.6
		300	-4.1	-73	-2.0
		450	-2.7	-68	-1.2
		575	-2.2	-33	-0.6

2.2.2 Nitrogen leaching and other environmental impacts

The results in Table 6 show a general reduction in nitrate leaching when the cereal system is converted to grassland, with the highest effects from conversion to grass-clover, or conversion to ryegrass at a relatively low fertilizer level. These results are based on simulations with the NLES4 model using the methods in Jensen et al. (2016). According to this, the annual N-leaching from winter wheat on irrigated sandy soils and loamy soils is estimated at 79 kg N/ha/yr and 69 kg N/ha/yr, respectively. In comparison, silage maize show an estimated leaching of 103 kg N/ha/yr and 81 kg N/ha/yr for the same soils types, and the levels of fertilizer and nitrous oxide emissions defined in Table 5. The N leaching from grassland is much lower. For grass-clover the leaching is in the order of 15-20 kg N/ha/yr, and is relatively independent of grassland age (Eriksen et al. 2004). In comparison the leaching from a 4-5 year old ryegrass field fertilized with 300 kg mineral N/ha/yr was 12-20 kg N/ha (Eriksen et al. 2004), but with a tendency to higher leaching with higher grassland age (in the same experiment, leaching from the 6-8 year old averaged 38 kg N/ha/yr). With no fertilization a non-significant leaching of less than 5 kg N/ha/yr has been reported, and at economic optimal N fertilizer rate the leaching was still low. Even at a fertilizer level of 500 kg N/ha/yr the N leaching apparently did not increase significantly for ryegrass (Whitehead 1995). However result from long term permanent grassland in for instance Ireland indicate that over time high fertilizer levels will lead to a higher leaching (Gibbons et al. 2006); maybe 150 kg N/ha/yr (Ryan et al. 2006, 2011; Richards et al. 1998). Similar marginal effects can be assumed for grass-clover (at high N levels grass-clover will over time turn to pure grass as the clover is outcompeted). Even for levels below economic optimum the effect of fertilization on N-leaching is limited for grass-clover (in the order of 2-3 kg N/ha/yr according to Eriksen et al 2015;

Wachendorf et al. 2004), leading to the estimated relations between grassland type, fertilization level and age shown in Table 7 (Olesen et al. 2016).

Table 7. Estimated nitrogen leaching (kg N/ha/yr) from harvested fields with pure grass and grass-clover at different fertilizer levels and age (Olesen et al. 2016).

Pure grass			Grass-clover		
N-fertilizer	1-2 years	3-8 years	N-fertilizer	1-2 years	3-8 years
0	5	5	0	15	15
150	15	15	120	20	20
300	20	30	240	20	30
450	25	35			
575	55	70			

Impacts of the present grassland use

Much of the former permanent grassland in Denmark have been ploughed and included as part of the rotational areal. This change has been promoted by decades of agricultural subsidies to arable production, a legislation that incites the farmers to plough grasslands if they should not risk them to grow into biodiversity protected (§3) areas, and also other factors like the development of a large pig production sector and high demands for cereals have incentivized the change. Only little of the current permanent grasslands in Denmark can potentially be converted into arable land, since these grassland areas are often very difficult to cultivate because of water logging and steep areas. Consequently, it can be assumed that the present area of around 150,000 ha permanent grassland registered with a crop yield will remain as permanent grasslands, also in the future. Around 100,000 ha of these permanent grasslands are used by “non cattle” farms. Some of this area is used for “hobby farming”, for example grazed with horses on areas that could potentially be turned to cash crop production if the incentive is high and/or if the administration costs are low.

On dairy cattle farms, the permanent grassland covers approximately 19 % of the total grassland area and have a grazing utilized yield around 2 ton DM/ha (Kristensen, 2015). The group of “full time cattle farmers” includes 93% of dairy cows and 21% of suckler cows, in total 67 % of Danish ruminant livestock units. Consequently, the remaining 33% of the ruminant livestock units uses the 82 % permanent grassland, indicating a very low utilization of the grassland production on “non cattle”-permanent grassland. This skewed distribution of the utilization of grasslands in Denmark needs to be taken into account when assessing the effects of grassland measures.

2.3 Biodiversity

In particular permanent grasslands has a number of potential biodiversity benefits, for example for soil microorganisms, insects like soil dwelling bees, and species which live from the native wild flora in the permanent grasslands and/or with overwintering larvae dependent on this vegetation. If a field is ploughed and sown with grass-clover mixtures including red clover (*Trifolium pratense*) or birdsfoot (*Lotus corniculatus*) it can negatively impact endangered, red-listed species like five-spotted or six-spotted burnet

(*Zygaena filipendulae*) or mazarine blue butterflies (*Cyaniris semiargus*), and as mentioned destruct nesting places for soil-living bees (Strandberg and Ejrnæs 2015).

In relation to the flora biodiversity, the number of species on “natural grassland” is reported to around 10-25 (Fredshavn et al. 2009, Table 9), in comparison to a level of around 17 species in spring barley on conventional dairy farms (Bennett 2004). In unsprayed organic spring barley around 25 plant species were observed per field, corresponding to a low or only a small reduction in flora biodiversity as compared to grasslands. In short, it is important to understand the dynamics between farmland management, the weed flora and biodiversity (Andreasen and Stryhn 2008), and the general conclusion is that:

- There is no significant difference between the biodiversity effect of intensively farmed grassland or cereal fields, unless the grassland is grown a more extensive production system than the cereals, for example as permanent grass and/or in systems with no or only little fertilizer or pesticides.
- There is a potential positive effect from not ploughing grassland, mainly because continuity in land cover benefits the colonialization of more species to the farmed ecosystem, and because of a better contribution to the build-up of a natural soil structure and soil fauna. The positive effect depends on how extensive the land has been farmed during the previous generations. Areas that may be perceived marginal in a modern agricultural context, for example dry sandy soils or wet meadows, will typically show much higher biodiversity effects from an extensive management, including permanent grassland management, than the highly productive and more intensively farmed areas.

2.4 Soil protection

2.4.1 Soil erosion

Effects of permanent grasslands

Denmark as a country is ranked as moderately vulnerable to water erosion (e.g. Veihe et al., 2003; Schjønning et al., 2009; Cerdan et al., 2010) with strong local and temporal variations. Topography, climate, soil properties and crop management are the four main factors that interact to determine the extent and pattern of water erosion and deposition in the landscape. Topography controls the redistribution of water by surface runoff in landscapes and thereby has a dominant effect on the spatial pattern of water erosion. In any landscape position erosion risk increases with upslope contributing area and slope gradient. Hence, flat lowland areas are hardly affected; however, parts of it may act as depositional area. Rainfall provides the initial erosive agent and causes variability beyond the field scale. Soil type determines a soil’s resistance to erosion and influences the extent of erosion events. Importantly, soil and crop management strongly affects the magnitude of erosion events and spatial erosion patterns when cropping markedly varies along the flow path. Small variations of individual factors can result in very variable erosion events over time at the same location (Heckrath and Olsen, 2014).

Dense plant and crop residue cover protects the soil from raindrop impact, while root networks contribute to the mechanical strength of soils. Dense soil cover also dissipates the erosive energy of running water. In the long term, crop management affects soil structure and hence both soil strength and water infiltration, which, in turn, have a feedback effect on water erosion (Govers et al., 2004). Soil structural stability is improved by growing grass as compared to arable crops (Watts and Dexter, 1997). The authors found that structural stability decreased in the order permanent grassland>arable ley>arable>bare fallow. Short-term grass as part of an arable rotation has also been shown to increase soil structural stability under Danish conditions (Schjønning et al., 2007). Accordingly, a large international body of experimental evidence shows the comparatively high vulnerability of winter cereals and maize to water erosion. In contrast, well established grassland provides very good protection from erosion. Grassland combines a dense canopy and soil cover, extensive root network and typically good water infiltrability. These general relations were also confirmed by studies in Denmark (Schjønning et al., 1995; Djurhuus et al., 2007). Therefore, the establishment of grassland is seen as a key option for mitigating erosion risk. In certain landscape positions grassland may also facilitate sediment deposition attenuating runoff energy and straining particles from runoff. This is why grass is the preferred cover on riparian buffer zones (Stutter et al., 2012).

Obviously, whether permanent grassland will have an effect on water erosion risk depends on a given area's vulnerability to erosion. A substantial proportion of permanent grassland is found on lowlands where erosion risk would be low. The role of permanent grassland for erosion protection in Denmark has not yet been assessed spatially explicitly. Therefore, its protective effect with respect to erosion can currently not be quantified.

Aarhus University has in collaboration with Université Catholique de Louvain, UCL, modelled water erosion risk in Denmark at 10 m grid resolution. The modelled data are currently being analyzed and prepared for publication. Information on land use was taken from BASEMAP (Levin et al., 2012) and combined with the Land Parcel Identification System (LPIS) reference parcels (2014) to represent agricultural land. The erosion model input on cropping was based on crop proportions within reference parcels averaged over a period of ten years. Therefore, areas covered by permanent grassland are not explicitly and consistently represented in the model and the current model output cannot be used to assess the effect of permanent grassland on water erosion and deposition in Denmark. However, it would be possible to parameterize the model to account for permanent grassland and, hence, evaluate its role in the context of erosion protection specifically.

Apart from water erosion two other forms of soil erosion are important in Denmark - wind and tillage erosion. Historically, wind erosion has been a severe threat to soil quality in western parts of Denmark. A combination of sandy soils and cropping of spring cereals in an open landscape made soils vulnerable (Kuhlman, 1986). The massive introduction of wind breaks and in recent years a larger proportion of winter cereals have substantially reduced wind erosion risk. Likewise, permanent grassland offers an effective protection against wind erosion.

Tillage erosion always occurs when hummocky terrain is ploughed or otherwise intensively tilled. Tillage erosion effectively acts as conveyor belt moving soil from hilltops to low-lying parts in the field and thus poses a clear threat to soil quality (Schjønning et al., 2009). Recent studies have shown that soil redistribution by tillage in Denmark is at least in the same order as water erosion or more severe, increasing with tillage intensity (Heckrath et al., 2005). Therefore, permanent grassland that is rarely ploughed is an effective way to avoid this form of erosion.

Effect of periodical ploughing of permanent grassland on soil erosion risk

It is not uncommon in Denmark that permanent grassland is ploughed up and reseeded with grass. For a relatively short period until reestablishment of a dense grass cover this would render a soil more vulnerable to water and wind erosion. However, considering a return period of several years and the limited proportion of permanent grassland found on erosion-vulnerable land, the effect of ploughing grassland on long-term erosion risk is expected to be low. Similarly, the adverse effects of soil redistribution due to occasional ploughing would be compensated for by the long-term positive effects of permanent grassland on soil quality. Conversely, restricting ploughing of permanent grassland would not noticeably improve protection against soil erosion in Denmark.

2.4.2 Soil compaction

Permanent grassland is also expected to reduce risk of subsoil compaction, which is considered as a main threat to soil quality under Danish conditions (Schjønning et al., 2009). In arable farming, subsoil compaction is primarily caused by heavy traffic under moist or wet condition (e.g. slurry application and harvest operations (Schjønning et al., 2015)). Strongly reduced compaction risk is expected for permanent grasslands as they are typically extensively used. Furthermore, increased content of organic matter under grass is also expected to help the soil to better cope with effects of heavy traffic as outlined by (Abdollahi et al., 2014b). Reseeding of the grass is not expected to markedly influence the risk of subsoil compaction.

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Appendix

Table 8. Crop types and categories registered in Denmark 2016.

Crop code	Crop name	Crop category	In rotation	Notes
1	Vårbyg	vårbyg	ja	
2	Vårhvede	vårhvede	ja	
3	VårHavre	vårhavre	ja	
4	Blanding af vårsåede kornarter	vårsået blanding	ja	
5	Majs til modenhed	majs	ja	
6	Vårhvede, brødhvede	vårhvede	ja	
7	Korn + bælgsæd under 50% bælgsæd	vårsået blanding	ja	
10	Vinterbyg	vinterbyg	ja	
11	Vinterhvede	vinterhvede	ja	
13	Vinterhvede, brødhvede	vinterhvede	ja	
14	Vinterrug	vinterrug	ja	
15	Vinterhybridrug	vinterrug	ja	
16	Vintertriticale	vintertriticale	ja	
17	Blanding af efterårssåede kornarter	vintersået blanding	ja	
21	Vårraps	vårraps	ja	
22	Vinterraps	vinterraps	ja	
23	Rybs	ager-kål	ja	
24	Solsikke	solsikke	ja	
25	Sojabønner	Soja	ja	
30	Ærter	Ært	ja	
31	Hestebønner	hestebønne	ja	
32	Sødlupin	lupin	ja	
35	Bælgsæd, flerårig blanding	vårsået blanding	ja	
36	Bælgsæd, andre typer til modenhed blanding	vårsået blanding	ja	
40	Oliehør	Hør	ja	
41	Spindhør	hør	ja	
42	Hamp	hamp	ja	
51	Blanding bredbladet afgrøde, frø/kerne	vårsået blanding	ja	
52	Quinoa	quinoa	ja	
53	Boghvede	boghvede	ja	
54	Bælgsæd blanding	vårsået blanding	ja	
55	Vårrug	vårrug	ja	

Crop code	Crop name	Crop category	In rotation	Notes
56	Vårtriticale	vårtriticale	ja	
57	Vinterhavre	vinterhavre	ja	
58	Sorghum	Sorghum	ja	
101	Rajgræsfrø, alm.	Vårsået rajgræsfrø	ja	
102	Rajgræsfrø, alm. 1. år, efterårsudlagt	Efterårssået rajgræsfrø	ja	
103	Rajgræsfrø, ital.	Vårsået rajgræsfrø	ja	
104	Rajgræsfrø, ital. 1. år efterårsudlagt	Efterårssået rajgræsfrø	ja	
105	Timothefrø	Timothefrø	ja	
106	Hundegræsfrø	Hundegræsfrø	ja	
107	Engsvingelfrø	Svingelfrø	ja	
108	Rødsvingelfrø	Svingelfrø	ja	
109	Rajsvingelfrø	Vårsået rajsvingelfrø	ja	
110	Svingelfrø, stivbladet	Svingelfrø	ja	
111	Svingelfrø, strand-	Svingelfrø	ja	
112	Engrapgræsfrø (marktype)	Eng- og rapgræsfrø	ja	
113	Engrapsgræsfrø (plænetype)	Eng- og rapgræsfrø	ja	
114	Rapgræsfrø, alm.	Eng- og rapgræsfrø	ja	
115	Hvenefrø, alm. og krybende	Hvenefrø	ja	
116	Rajgræs, hybrid	Vårsået rajgræsfrø	ja	
117	Rajgræs, efterårsudl. hybrid	Efterårssået rajgræsfrø	ja	
118	Rajsvingelfrø, efterårsudlagt	Efterårssået rajsvingelfrø	ja	
120	Kløverfrø	Kløver	ja	
121	Græsmarksbælgplanter	græs eller andet grøntfoder	ja	
122	Kommenfrø	kommen	ja	
123	Valmuefrø	valmue	ja	
124	Spinatfrø	spinat	ja	
125	Bederoefrø	beder	ja	
126	Blanding af markfrø til udsæd	vårsået blanding	ja	
150	Kartofler, lægge-	kartoffel	ja	
151	Kartofler, stivelses-	kartoffel	ja	
152	Kartofler, spise-	kartoffel	ja	

Crop code	Crop name	Crop category	In rotation	Notes
153	Kartofler, andre	kartoffel	ja	
160	Sukerroer til fabrik	beder	ja	
161	Cikorierødder	cikorie	ja	
162	Blanding, andre industriafgr.	vintersået blanding	ja	
170	Græs til fabrik (omdrift)	græs eller andet grøntfoder	ja	
171	Lucerne, slæt	Lucerne	ja	
172	Lucernegræs, over 25% græs til slæt inkl. eget foder	græs eller andet grøntfoder	ja	
173	Kløver til slæt	Kløver	ja	
174	Kløvergræs til fabrik	græs eller andet grøntfoder	ja	
180	Gul sennep	sennep	ja	
182	Blanding af oliearter	vårsået blanding	ja	
210	Vårbyg, helsæd	vårbyg	ja	
211	Vårhvede, helsæd	vårhvede	ja	
212	Vårhavre, helsæd	vårhavre	ja	
213	Blandkorn, vårsået, helsæd	vårsået blanding	ja	
214	Korn og bælgsæd, helsæd, under 50% bælgsæd	vårsået blanding	ja	
215	Ærtehelsæd	ært	ja	
216	Silomajs	majs	ja	
220	Vinterbyg, helsæd	vinterbyg	ja	
221	Vinterhvede, helsæd	vinterhvede	ja	
222	Vinterrug, helsæd	vinterrug	ja	
223	Vintertriticale, helsæd	vintertriticale	ja	
224	Blandkorn, efterårssået helsæd	vintersået blanding	ja	
230	Blanding af vårkorn, grønkorn	vårsået blanding	ja	
234	Korn og bælgsæd, grønkorn, under 50% bælgsæd	vårsået blanding	ja	
235	Blanding af vinterkorn, grønkorn	vintersået blanding	ja	
247	Miljøgræs MVJ-tilsagn (0 N), omdrift	græs eller andet grøntfoder	ja	
248	Permanent græs ved vandboring	(afgrøden har ingen kategori)	nej	
249	Udnyttet græs ved vandboring	græs eller andet grøntfoder	ja	

Crop code	Crop name	Crop category	In rotation	Notes
250	Permanent græs, meget lavt udbytte	(afgrøden har ingen kategori)	nej	
251	Permanent græs, lavt udbytte	(afgrøden har ingen kategori)	nej	
252	Permanent græs, normalt udbytte	(afgrøden har ingen kategori)	nej	
253	Miljøgræs MVJ-tilsagn (80 N), omdrift	græs eller andet grøntfoder	ja	
254	Miljøgræs MVJ-tilsagn (0 N), permanent	(afgrøden har ingen kategori)	nej	
255	Permanent græs, under 50% kløver/lucerne	(afgrøden har ingen kategori)	nej	
256	Permanent kløvergræs, over 50% kløver/lucerne	(afgrøden har ingen kategori)	nej	
257	Permanent græs, uden kløver	(afgrøden har ingen kategori)	nej	
258	Permanent græs, ø-støtte	(afgrøden har ingen kategori)	nej	
259	Permanent græs, fabrik, over 6 tons	(afgrøden har ingen kategori)	nej	
260	Græs med kløver/lucerne, under 50 % bælgpl. (omdrift)	græs eller andet grøntfoder	ja	
261	Kløvergræs, over 50% kløver (omdrift)	græs eller andet grøntfoder	ja	
262	Lucerne, lucernegræs, over 50% lucerne (omdrift)	græs eller andet grøntfoder	ja	
263	Græs uden kløvergræs (omdrift)	græs eller andet grøntfoder	ja	
264	Græs og kløvergræs uden norm, under 50 % kløver (omdrift)	græs eller andet grøntfoder	ja	
265	Græs, slæt før vårsået afgrøde	græs eller andet grøntfoder	ja	
266	Græs under 50% kløver/lucerne, ekstremt lavt udbytte (omdrift)	græs eller andet grøntfoder	ja	
267	Græs under 50% kløver/lucerne, meget lavt udbytte (omdrift)	græs eller andet grøntfoder	ja	
268	Græs under 50% kløver/lucerne, lavt udbytte (omdrift)	græs eller andet grøntfoder	ja	
269	Græs, rullegræs	vårsået blanding	ja	

Crop code	Crop name	Crop category	In rotation	Notes
270	Græs til udegrise, omdrift	græs eller andet grøntfoder	ja	
271	Rekreative formål	(afgrøden har ingen kategori)	nej	
272	Permanent græs til fabrik	(afgrøden har ingen kategori)	nej	
273	Permanent lucerne til fabrik	(afgrøden har ingen kategori)	nej	
274	Permanent lucernegræs over 25% græs, til fabrik	(afgrøden har ingen kategori)	nej	
276	Permanent græs og kløvergræs uden norm, under 50 % kløver	(afgrøden har ingen kategori)	nej	
277	Permanent kløver til fabrik	(afgrøden har ingen kategori)	nej	
278	Permanent lucerne og lucernegræs over 50% lucerne	(afgrøden har ingen kategori)	nej	
279	Permanent græs til fabrik	(afgrøden har ingen kategori)	nej	
280	Fodersukkerroer	beder	ja	
281	Kålroer	vårraps	ja	
282	Fodermarvkål	kål	ja	
283	Foderguleødder	gulerod	ja	
284	Græs med vikke og andre bælgplanter, under 50 % bælgpl.	græs eller andet grøntfoder	ja	
285	Græs og kløvergræs uden norm, over 50 % kløver (omdrift)	græs eller andet grøntfoder	ja	
286	Permanent græs og kløvergræs uden norm, over 50 % kløver	(afgrøden har ingen kategori)	nej	
287	Græs til udegrise, permanent	(afgrøden har ingen kategori)	nej	
305	Permanent græs, uden udbetaling af økologi-tilskud	(afgrøden har ingen kategori)	nej	
306	Græs i omdrift, uden udbetaling af økologi-tilskud	græs eller andet grøntfoder	ja	
308	MFO-Slåningsbrak	brak	ja	
309	Udyrket areal ved vandboring	brak	ja	
310	Slåningsbrak	brak	ja	
311	Skovrejsning på tidl.	(afgrøden har	nej	

Crop code	Crop name	Crop category	In rotation	Notes
	landbrugsjord 1	ingen kategori)		
312	20-årig udtagning	brak	ja	
313	20-årig udtagning af agerjord med frivillig skovrejsning	(afgrøden har ingen kategori)	nej	Afgrødekoden er som udgangspunkt ikke defineret som omdriftsafgrøde. Hvis du søger om grundbetaling på arealet og samtidigt bruger denne afgrødekode, vil arealet alligevel tælle med som omdrift i beregningen af de grønne krav i fællesskemaet.
314	20-årig udtagning med tilsagn om skovrejsning fra NST	(afgrøden har ingen kategori)	nej	
316	Vådområder eller lavbundsjorde med udtagning	(afgrøden har ingen kategori)	nej	Afgrødekoden er som udgangspunkt ikke defineret som omdriftsafgrøde. Hvis du søger om grundbetaling på arealet og samtidigt bruger denne afgrødekode, vil arealet alligevel tælle med som omdrift i beregningen af de grønne krav i fællesskemaet.
317	Vådområder med udtagning	brak	ja	
318	MVJ ej udtagning, ej landbrugsjord	(afgrøden har ingen kategori)	nej	
319	MFO Vådområder eller lavbundsjorde med udtagning	(afgrøden har ingen kategori)	nej	Afgrødekoden er som udgangspunkt ikke defineret som omdriftsafgrøde. Hvis du søger om grundbetaling på arealet og samtidigt bruger denne afgrødekode, vil arealet alligevel tælle med som omdrift i beregningen af de grønne krav i fællesskemaet.
320	Braklagte randzoner	brak	ja	
321	Miljøtiltag, ej landbrugsarealer	(afgrøden har ingen kategori)	nej	
323	MFO-udyrket areal ved vandboring	brak	ja	
324	Blomsterbrak	brak	ja	
325	MFO-Blomsterbrak	brak	ja	
326	Permanent græs i MSO omlagt til ikke-landbrug	(afgrøden har ingen kategori)	nej	
360	Vildtafgrøder	(afgrøden har ingen kategori)	nej	
361	Ikke støtteberettiget landbrugsareal	(afgrøden har ingen kategori)	nej	
400	Asier	agurk	ja	
401	Asparges	(afgrøden har	nej	

Crop code	Crop name	Crop category	In rotation	Notes
		ingen kategori)		
402	Bladselleri	selleri	ja	
403	Blomkål	kål	ja	
404	Broccoli	kål	ja	
405	Courgette, squash	mandelgræskar	ja	
406	Grønkål	kål	ja	
407	Gulerod	gulerod	ja	
408	Hvidkål	kål	ja	
409	Kinakål	ager-kål	ja	
410	Knoldselleri	selleri	ja	
411	Løg	løg	ja	
412	Pastinak	pastinak	ja	
413	Rodpersille	persille	ja	
415	Porre	løg	ja	
416	Rosenkål	kål	ja	
417	Rødbede	beder	ja	
418	Rødkål	kål	ja	
420	Salat (friland)	salat	ja	
421	Savoykål, spidskål	kål	ja	
422	Spinat	spinat	ja	
423	Sukkermajs	majs	ja	
424	Ærter, konsum	ært	ja	
429	Jordskokker, konsum	sosikke	ja	
430	Bladpersille	persille	ja	
431	Purløg	løg	ja	
432	Krydderurter (undtagen persille og purløg)	planteskolekultur	ja	
434	Grøntsager, andre (friland)	planteskolekultur	ja	
440	Solhat	solhat	ja	
448	Medicinpl., en- og toårige	planteskolekultur	ja	
449	Medicinpl., stauder	planteskolekultur	ja	
450	Grøntsager, blandinger	vårsået blanding	ja	
487	Skovlandbrug	(afgrøden har ingen kategori)	nej	
488	Hønsegård, permanent græs	(afgrøden har ingen kategori)	nej	
489	Havtorn	(afgrøden har ingen kategori)	nej	
491	Storfrugtet tranebær	(afgrøden har	nej	

Crop code	Crop name	Crop category	In rotation	Notes
		ingen kategori)		
492	Tyttebær	(afgrøden har ingen kategori)	nej	
493	Surbær	(afgrøden har ingen kategori)	nej	
494	Japan kvæde	(afgrøden har ingen kategori)	nej	
495	Morbær	(afgrøden har ingen kategori)	nej	
496	Medicinpl., vedplanter	(afgrøden har ingen kategori)	nej	
497	Planteskolekulturer, vedplanter, til videresalg	(afgrøden har ingen kategori)	nej	
498	Containerplads 4, vedplanter	(afgrøden har ingen kategori)	nej	
499	Lukket system 3, vedplanter	(afgrøden har ingen kategori)	nej	
501	Stauder	planteskolekultur	ja	
502	Blomsterløg	planteskolekultur	ja	
503	En- og to-årige planter	planteskolekultur	ja	
504	Solbær, stiklingeopformering	(afgrøden har ingen kategori)	nej	
505	Ribs, stiklingeopformering	(afgrøden har ingen kategori)	nej	
506	Stikkelsbær, stiklingeopformering	(afgrøden har ingen kategori)	nej	
507	Hindbær, stiklingeopformering	(afgrøden har ingen kategori)	nej	
508	Andre af slægten Vaccinium	(afgrøden har ingen kategori)	nej	
509	Trækvæde	(afgrøden har ingen kategori)	nej	
510	Melon	melon	ja	
512	Rabarber	(afgrøden har ingen kategori)	nej	
513	Jordbær	jordbær	ja	
514	Solbær	(afgrøden har ingen kategori)	nej	
515	Ribs	(afgrøden har ingen kategori)	nej	
516	Stikkelsbær	(afgrøden har ingen kategori)	nej	

Crop code	Crop name	Crop category	In rotation	Notes
517	Brombær	(afgrøden har ingen kategori)	nej	
518	Hindbær	(afgrøden har ingen kategori)	nej	
519	Blåbær	(afgrøden har ingen kategori)	nej	
520	Surkirsebær uden undervækst af græs	(afgrøden har ingen kategori)	nej	
521	Surkirsebær med undervækst af græs	(afgrøden har ingen kategori)	nej	
522	Blomme uden undervækst af græs	(afgrøden har ingen kategori)	nej	
523	Blomme med undervækst af græs	(afgrøden har ingen kategori)	nej	
524	Sødkirsebær uden undervækst af græs	(afgrøden har ingen kategori)	nej	
525	Sødkirsebær med undervækst af græs	(afgrøden har ingen kategori)	nej	
526	Hyld	(afgrøden har ingen kategori)	nej	
527	Hassel	(afgrøden har ingen kategori)	nej	
528	Æbler	(afgrøden har ingen kategori)	nej	
529	Pærer	(afgrøden har ingen kategori)	nej	
530	Vindrue	(afgrøden har ingen kategori)	nej	
531	Anden træfrugt	(afgrøden har ingen kategori)	nej	
532	Anden buskfrugt	(afgrøden har ingen kategori)	nej	
533	Rønnebær	(afgrøden har ingen kategori)	nej	
534	Hyben	(afgrøden har ingen kategori)	nej	
535	Bærmispel	(afgrøden har ingen kategori)	nej	
536	Spisedruer	(afgrøden har ingen kategori)	nej	
539	Blandet frugt	(afgrøden har ingen kategori)	nej	

Crop code	Crop name	Crop category	In rotation	Notes
540	Tomater	tomat	ja	
541	Agurker	agurk	ja	
542	Salat (drivhus)	salat	ja	
543	Grøntsager, andre (drivhus)	planteskolekultur	ja	
544	Snitblomster og snitgrønt	planteskolekultur	ja	
545	Potteplanter	planteskolekultur	ja	
547	Planteskolekulturer, stauder	planteskolekultur	ja	
548	Småplanter, en-årige	planteskolekultur	ja	
549	Lukket system 1, en-årige	(afgrøden har ingen kategori)	nej	
550	Lukket system 2, stauder	(afgrøden har ingen kategori)	nej	
551	Moskusgræskar	moskusgræskar	ja	
552	Mandelgræskar	mandelgræskar	ja	
553	Centnergræskar	centnergræskar	ja	
560	Containerplads 1, frugtbuske	(afgrøden har ingen kategori)	nej	
561	Containerplads 2, en-årige	(afgrøden har ingen kategori)	nej	
562	Containerplads 3, stauder	(afgrøden har ingen kategori)	nej	
563	Svampe, champignon	(afgrøden har ingen kategori)	nej	
570	Humle	(afgrøden har ingen kategori)	nej	
579	Tagetes, sygdomssanerende plante	tagetes	ja	
580	Skovdrift, alm.	(afgrøden har ingen kategori)	nej	
581	Nyplantning i skov med træhøjde under 3 m	(afgrøden har ingen kategori)	nej	
582	Pyntegrønt, økologisk jordbrug	(afgrøden har ingen kategori)	nej	
583	Juletræer og pyntegrønt på landbrugsjord	(afgrøden har ingen kategori)	nej	
585	Skovrejsning i projektområde, som ikke er omfattet af tilsagn	(afgrøden har ingen kategori)	nej	
586	Offentlig skovrejsning	(afgrøden har ingen kategori)	nej	
587	Skovrejsning på tidl. landbrugsjord 3	(afgrøden har ingen kategori)	nej	

Crop code	Crop name	Crop category	In rotation	Notes
588	Statslig skovrejsning	(afgrøden har ingen kategori)	nej	
589	Bæredygtig skovdrift	(afgrøden har ingen kategori)	nej	
590	Bæredygtig skovdrift i Natura 2000-område	(afgrøden har ingen kategori)	nej	
591	Lavskov	(afgrøden har ingen kategori)	nej	
592	Pil	(afgrøden har ingen kategori)	nej	
593	Poppel	(afgrøden har ingen kategori)	nej	
594	El	(afgrøden har ingen kategori)	nej	
596	Elefantgræs	(afgrøden har ingen kategori)	nej	
597	Rørgræs	(afgrøden har ingen kategori)	nej	
598	Sorrel	Sorrel	ja	
602	MFO - Pil	(afgrøden har ingen kategori)	nej	
603	MFO - Poppel	(afgrøden har ingen kategori)	nej	
604	MFO - El	(afgrøden har ingen kategori)	nej	
605	MFO - Lavskov	(afgrøden har ingen kategori)	nej	
650	Chrysanthemum Garland, frø	chrysanthemum	ja	
651	Dildfrø	dild	ja	
652	Kinesisk kålfrø	ager-kål	ja	
653	Karsefrø	karse	ja	
654	Rucolafrø	rucola	ja	
655	Radisefrø (inklusiv olierædikefrø)	radise	ja	
656	Bladbedefrø, rødbedefrø	beder	ja	
657	Grønkålfrø	kål	ja	
658	Gulerodsfrø	gulerod	ja	
659	Kålfrø (hvid- og rødkål)	kål	ja	
660	Persillefrø	persille	ja	
661	Kørvelfrø	kørvel	ja	
662	Majroefrø	ager-kål	ja	

Crop code	Crop name	Crop category	In rotation	Notes
663	Pastinakfrø	pastinak	ja	
664	Skorzonerrodfrø	skorzonerrod	ja	
665	Havrerodfrø	havrerod	ja	
666	Purløgsfrø	løg	ja	
667	Timianfrø	timian	ja	
668	Blomsterfrø	planteskolekultur	ja	
701	Grønkorn af vårbyg	vårbyg	ja	
702	Grønkron af vårhvede	vårhvede	ja	
703	Grønkorn af vårhavre	vårhavre	ja	
704	Grønkorn af vårrug	vårrug	ja	
705	Grønkorn af vårtriticale	vårtriticale	ja	
706	Grønkorn af vinterbyg	vinterbyg	ja	
707	Grønkorn af vinterhvede	vinterhvede	ja	
708	Grønkorn af vinterhavre	vinterhavre	ja	
709	Grønkorn af vinterrug	vinterrug	ja	
710	Grønkorn af hybridrug	vinterrug	ja	
711	Grønkorn af vintertriticale	vintertriticale	ja	
888	Nye tilsagn uden råderet v. ansøgningsfristen	(afgrøden har ingen kategori)	nej	
900	Øvrige afgrøder	(afgrøden har ingen kategori)	nej	
903	Lysåbne arealer i skov	(afgrøden har ingen kategori)	nej	
905	Anden anvendelse på tilsagnsarealer	(afgrøden har ingen kategori)	nej	
907	Naturarealer, økologisk jordbrug	(afgrøden har ingen kategori)	nej	
908	Naturarealer, ansøgning om miljøtilsagn	(afgrøden har ingen kategori)	nej	
920	Økologisk sommerbrak	brak	ja	
921	Bar jord	brak	ja	
943	Kløvergræs med over 50% kløver, udlæg /efterslæt efter grønkorn o.l. høstet i maj/juni	(afgrøden har ingen kategori)	nej	
944	Kløvergræs med over 50% kløver, udlæg/efterslæt efter helsæd høstet senest 1. august	(afgrøden har ingen kategori)	nej	
945	Kløvergræs med over 50% kløver, udlæg/efterslæt efter korn o.l.	(afgrøden har ingen kategori)	nej	

Crop code	Crop name	Crop category	In rotation	Notes
946	Græs/kløvergræs med over 50% kløver til fabrik, efterslæt efter grønkorn o.l. høstet i maj/juni	(afgrøden har ingen kategori)	nej	
960	Græs, udlæg/efterslæt efter grønkorn o.l. høstet i maj/juni	(afgrøden har ingen kategori)	nej	
961	Græs, udlæg/efterslæt efter helsæd/tidl. frøgræs eller vinterbyg høstet senest 1. august	(afgrøden har ingen kategori)	nej	
962	Græs, udlæg/efterslæt efter korn/sildig frøgræs	(afgrøden har ingen kategori)	nej	
963	Kløvergræs med under 50% kløver, udlæg /efterslæt efter grønkorn o.l. høstet i maj/juni	(afgrøden har ingen kategori)	nej	
964	Kløvergræs med under 50% kløver, udlæg/efterslæt efter helsæd høstet senest 1. august	(afgrøden har ingen kategori)	nej	
965	Kløvergræs med under 50% kløver, udlæg/efterslæt efter korn o.l.	(afgrøden har ingen kategori)	nej	
966	Græs/kløvergræs med under 50% kløver til fabrik, efterslæt efter grønkorn o.l. høstet i maj/juni	(afgrøden har ingen kategori)	nej	
968	Pligtige efterafgrøder	(afgrøden har ingen kategori)	nej	
970	Udlæg og efterafgrøder til grøngødning	(afgrøden har ingen kategori)	nej	
972	Mellemafgrøder	(afgrøden har ingen kategori)	nej	
998	Ukendt afgrøde	(afgrøden har ingen kategori)	nej	
999	Ugyldig afgrødekode	(afgrøden har ingen kategori)	nej	