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Effectiveness of Greening in Poland

Under the latest reform of the Common Agricultural Policy, 2015 was the first year when greening requirements were implemented. Legal rules obliged farmers to move towards more environmentally-friendly land use practices. The aim of this paper is to present the first effects of the implementation of greening in Poland. The paper is based on an FADN panel of 7.4 thousand private farms participated in the Single Area Payment Scheme in Poland. The sample also enabled to identify organisational changes in agricultural production after greening. Results suggest that Polish farms have adapted well to greening requirements and the new system has not caused productivity and profitability of Polish farms to decrease in 2015.

Keywords: Greening, Common Agricultural Policy, Effectiveness, FADN farms, Poland

JEL classification: Q18

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Introduction

The European Union has as an aim the sustainable development of agriculture and rural areas, an objective which is reflected in design of the Common Agricultural Policy (CAP) instruments (Kociszewski, 2014; Krzyżanowski, 2015). The CAP has come under increasing criticism for not doing enough to limit the negative effect that certain farming practices have on the environment and climate, the acknowledgement of which recently justified setting a new direction for agriculture development and support (European Court of Auditors, 2017a:10).

Under the new direct payment scheme, an obligation has been introduced since 2015 to apply agricultural practices deemed favourable for the climate and the environment, the so-called greening requirements. Greening is a major innovation brought in under the 2013 CAP reform, making the system of direct payments more environmentally friendly. Mandatory green standards connected to direct payments of the first pillar of the CAP were defined as a novel approach (Matthews, 2013). "It was designed to reward farmers for having a positive impact on the environment which would otherwise not be rewarded by the market" (European Court of Auditors, 2017b: 1). The introduction of the new greening measures within Pillar 1 of the CAP was a significant but controversial aspect of this reform (Hart *et al.*, 2016:57).

All farmers entitled to the Single Area Payment Scheme in 2015 are obliged to implement greening, the extent depending on agricultural surface and structure. Currently, 30% of the national financial envelope is connected with greening. In 2015, the rate of greening payment in Poland amounted to about 70 EUR/ha (MRiRW, 2015).

Depending on the area of arable land used and the share of permanent grassland, farmers are required to follow one, two or three greening practices. Greening practices include: diversification of crops (applicable to farms with an arable land area of 10 ha or more), (b) maintenance of permanent grassland¹ (the ratio of grassland to total agricultural area

may not decrease by more than 5% compared to the reference ratio) (MRiRW, 2015), (c) maintenance of Ecological Focus Areas (EFA) on at least 5% of arable land (this applies to farms with an arable land area of 15 ha or more).

The greening mechanism involves many equivalent pro-environmental practices, the selection of which is left to the individual farmer (Hart, 2015). Such a mechanism has allowed farmers to choose practices that are relevant to the specific character of their farms, including their location and the landscape (including valuable landscape elements within the farm), and the mode of agricultural production.

The requirement of crop diversification binds farmers to grow at least 2-3 different crops on arable land (depending on its area) and defines their percentage in the cropping pattern. Crops may also be diversified by using an equivalent practice applied as part of the agri-environment and climate measure under the RDP 2014-2020 (MRiRW, 2017b). As regards the EFA maintenance requirement, its fulfilment entails the maintenance of landscape, forest and agricultural features. Agricultural features include fallow land and the cultivation of plants that favourably affect soil condition, including the cultivation of nitrogen-fixing plants in the main crop, also in the form of catch crops and companion crops².

EU regulations also provide for a number of exemptions from the greening obligation. Farms where over 75% of agricultural land is permanent grassland or farms with a high percentage (over 75%) of arable land used for production of grass or other green fodder crops or fallowed due to the favourable environmental impact are exempted from the crop diversification obligation or the obligation to maintain ecological focus areas³. Farms that participate in the small farms scheme are allowed to receive the greening payment despite the exemption from the greening obligation. The greening payments are automatically granted to farmers who

² The selection of specific EFA-eligible elements is to be made by individual Member States (EC, 2017d).

EFA elements in Poland: EFA1. fallow land, EFA2. hedges, EFA3. single trees, EFA4. trees in line, EFA5. trees in group, EFA6. field margins, EFA7. ponds, EFA8. ditches, EFA9. buffer strips, EFA10. land strips without production along forest, EFA11. land strips qualified for the payment, located along forest edges, EFA12. short-rotation coppice, EFA13. afforested areas, EFA14a. stubble catch crops, EFA14b. winter catch crops, EFA14c. undersown grasses, EFA15. nitrogen-fixing crops, see: (ARiMR, 2015a).

³ Provided that the arable land area does not exceed 30 ha.

¹ The reference ratio is calculated as a ratio of the permanent grassland area (declared in 2012 and new permanent grassland area, not included in 2012 but declared in 2015) to the total agricultural land declared in 2015 (ARiMR, 2015b). As indicated in the announcement of the Minister of Agriculture and Rural Development (Dz. U. of 30/11/2015, item 1163), the reference ratio was 18.75%.

operate their farms in line with organic farming principles (ARiMR, 2015a; DPB, 2016; MRiRW, 2015).

In general, greening requirements have allowed farmers to get total support within the framework of direct payments. Farmers who use farmland in more sustainable way and care for natural resources benefit financially. As the European Commission (EC) justifies “Greening supports action to adopt and maintain farming practices that help meet environment and climate goals. Market prices do not reflect the effort involved in providing these public goods” (EC, 2017b). Changing agri-environmental practices as a condition of obtaining additional support helped spread the “provider gets principle” (Mauerhofer *et al.*, 2013). According to the instrument’s underlying assumption, the majority of farmers were entitled to green payments, a fact which guaranteed the popularisation of those practices on the majority of EU agricultural land.

The aim of this paper is to present the first effects of greening implementation in FADN farms in Poland, in the context of requirements concerning crop production organisation and the maintenance of ecological focus area (EFA). The paper presents the organisation and outcomes of farms before and after greening introduction, both those entities that were obliged to comply, and those that were exempted from new requirements. The popularisation of greening practices indicates the efficiency of agricultural policy implementation.

The paper is structured as follows. The first section after introduction gives an overview of the existing literature on the topic, followed by the presentation of the research methodology. The fourth section presents the main results, while the last section concludes.

Literature review

The European Commission has assessed implementation and effectiveness of the various greening measures in 2015 and 2016. The first review was focused on issues such as the implementation of greening measures and whether they created a level-playing field, as well as their production potential (EC, 2017b). In 2015, agricultural land subject to at least one green direct payment obligation amounted to 72% of the total EU agricultural area. In the case of Poland, this indicator amounted to over 80%. This area demonstrates the potential of green direct payments in delivering of environmental and climate benefits on a large share of the EU farmland. “The proportion of farmers under at least one greening obligation stands at around 36% of direct payment beneficiaries” (EC, 2016: 5). In 2015, the most frequently declared EFA types were those linked to productive or potentially productive agricultural areas: nitrogen-fixing crops and catch crops that reached 54% of the total weighted EFAs (39% and 15% respectively, after applying the weighting factors), and fallow land. This was 5.4 % of the arable land under the EFA obligation (EC, 2017a: 8). In 2016, in the second year of greening implementation, the data suggested little change in comparison to 2015. Conversely, if one takes into account the level of difficulty for fulfilling specific greening requirements – the actual environmental improvement depends on

the environmental ambition of the measures taken, which vary across EU Member States⁴.

The evaluation based on international research (carried out after only two years of implementation of the greening measures, looking at the effects of the greening measures compared with the situation in 2014) indicated, that overall the greening measures have led to only small changes in management practices, with the exception of a few specific areas. The greening mechanism made only a low contribution towards promoting more sustainable farming practices and had a negligible effect on production or the economic viability of farms (EC, 2017a). “As currently implemented, it is unlikely to enhance the CAP’s environmental and climate performance significantly” (European Court of Auditors, 2017a:1). Research based on modelling echoed this argument, indicating that in present form, the environmental impacts are rather limited and will not contribute much to improving the CAP provision of public goods (e.g. Solazzo *et al.*, 2015; Cortignani *et al.*, 2017; Gocht *et al.*, 2017). There are indications that the CAP greening needs to be redefined and regionalised to ensure the transition towards ‘greener’ agriculture (Galán-Martín *et al.*, 2015). “However, the proponents of CAP greening argue that the inclusion of such measures is first political step to ‘open the door’ for the future adoption of novel agricultural policy measures promoting a better environmental performance of the EU farming sector” (Louhichi *et al.*, 2018).

Another important strand of the literature in this topic analyses the relationship between greening and the production potential of agriculture. Preliminary studies indicated that the effect of green direct payments on land use and agricultural production is generally projected to remain very low over the medium term, with the noticeable exception of a slight increase in the share of permanent grassland, fallow land and protein grain production compared with a situation without green direct payments (EC, 2016:15). This is the basis for the claim that at present there is no competitive relationship between the environmental and production purposes of the greening mechanism. However, first models in this regard indicated the reduction of agricultural outcomes in the short run and the increase of production costs in the long run as side effects of greening (Matthews, 2011). Scenario modelling approach showed a reduction of production and an increase in the prices of agricultural products (Cantore, 2012), while the CAPRI model results indicated a slight reduction in farm productivity (Gocht *et al.*, 2016).

An assessment of likely CAP greening effects in Poland was already undertaken at the stage of preliminary administrative proposals (Czekaj *et al.*, 2012; Czekaj *et al.*, 2014). The analysed greening scenarios indicated that the environmental restrictions concerned only a minor part of farms and they would have little impact on their operation and outcomes. There have also been scientific papers based on the public statistics data in order to identify the effects of greening in Poland (Wąs and Jaroszewska, 2017; Wąs and Jaroszewska 2017b), although applied methodology so far have not been able to separate external factors affecting Polish farms after greening.

On the whole, the majority of international research concerning the effects of greening is very general (EC, 2016;

⁴ See (EC, 2017d).

EC 2017; Hart, 2015; Hart *et al.*, 2016), with these comprising changes in the agricultural sector, at both the country and the EU levels. Studies taking into account the performance of farms generally were based on model solutions, since the available data did not allow an assessment of the actual effects of greening (Galán-Martín *et al.*, 2015; Louhichi *et al.*, 2018).

The results of studies commissioned by the European Commission, which involve international comparison, highlight the problem of the effectiveness of greening⁵. Therefore, this also underlines the need to precisely examine practices related to the implementation of greening in individual Member States, taking account of the organisation of agricultural production both on farms under the greening obligation and farms exempted from it, and factors that have determined it, also prior to the introduction of this mechanism⁶. The evaluation of the effectiveness of greening is the basic determinant for the continuation and possible modification of this mechanism in the next Common Agricultural Policy programming period.

Methodology

Concerning the above, there is high need for accurate selection of groups of farms which were obliged directly to implement the greening requirements, in order to identify the actual first effects of greening. Agricultural accounting data have made it possible to conduct such research, with the selection of targeted farms, to monitor organisational, production and economic effects of the analysed legal rules. From 2015, Polish agricultural accountancy data resources have provided detailed identification of farmers' actions covered by the mechanism of greening⁷. The proposed research approach presented in the paper is an example of agricultural accounting data used in the context of greening, which can be developed on the basis of other EU countries data sources.

The paper is based on the panel of 7.4 thousand private farms included in the Farm Accountancy Data Network (FADN), both in 2014, and 2015. FADN data allow an analysis of agricultural holdings situation, both in terms of organisation and production, as well as economic performance. Individual agricultural accounting data allow researchers to recognise the actual situation of agricultural holdings, selected according to the adopted justified criteria. In contrast to the model approach, the actual FADN data enable the farms' state in the studied range to be represented with high precision.

From 2015 Polish FADN has introduced an additional questionnaire survey on the effects of the greening mechanism, which has been in force since the introduction of the new legal rules connected with agro-environmental practices (EC, 2016b). In accordance with the Commission Implementing Regulation, there was a transitional period between 2015 and 2017 for detailed information on greening (EFA elements), (Official Journal of the European Union L. 46/1,

2015). In the case of the Polish FADN, detailed information has been already collected since 2015, enabling detailed analysis of greening in the first year of its implementation. Polish FADN took into account both formal greening requirements, including individual practices of this mechanism and exemptions (FADN, 2018). There was the same agricultural holdings' panel (and farms' groups panel) chosen for the research, taking part in agricultural accounting in the year before the introduction of greening (2014) and in a year when greening was already formally in force (2015). Additionally, as recent studies have indicated (MRiRW, 2016; Kowalski, 2018) natural, institutional and market conditions as expected did not diversify the production situation in Polish agriculture in 2015, as compared to 2014. National legislation on agriculture in 2015, was also not a factor differentiating the farmers' production decisions, as compared to 2014. Therefore, thanks to the deliberate choice of agricultural holdings in accordance with the greening requirements, the changes that have occurred in these farms, with high probability, can be identified as correlating and/or caused by the new greening mechanism based on deduction reasoning.

All analysed farms participated in Single Area Payment Scheme. The study omitted agricultural holdings exempted from greening on the basis of general principles (e.g. organic farms, farms with high share of permanent grassland, etc.) and those applying the equivalent practices. Greening mechanism focuses on production organisation on arable land, hence the studied farms' population does not include entities lacking this land type.

The farms' panel selection made it possible to identify organisational changes in agricultural production after the introduction of greening in 2015, compared with 2014, that is the year when the greening mechanism was not in force. The farms' panel was divided into two groups, namely: small farms, not obliged to greening fulfilment (below 10 ha of arable land) and those farms, obliged to greening (with an area of at least 10 ha of arable land). The second group was additionally divided into two sub-groups, namely smaller farms (10-15 ha), which are required to crop diversification, as well as larger farms (15 ha or more), which in addition to diversification of crops, should also ensure adequate surface of EFA.

Classifying the analysed farms' panel in this way made it possible to indicate agricultural production changes, which were mainly organisational, depending on the scope of the existing administrative requirements related to the mechanism of greening. Both farms obliged to greening and those exempted from the obligation (the control group) were analysed in the scope of agricultural production organisation to identify the actual impact of the administrative instrument and symptoms of those changes, beyond the formal requirements. Identification of agricultural production organisation in farms exempted from greening makes it possible to assign observed changes (or the maintenance of *the status quo*) to other conditions of farms' operation, beyond the administrative mechanism of greening. As a complement to the study, there were illustrated the production and economic results of analysed farms' groups. Precise evaluation of farms' results requires further analysis based on the data from subsequent years.

Due to the fact that since 2015, the FADN system has been registering the practices that are applied on farms under

⁵ Comparison of greening effects in different European countries is presented in: (EC 2016; EC, 2017d; Hart *et al.*, 2016).

⁶ Papers that concern the implementation of greening in Poland in 2015, see e.g. (Wrzaszcz 2017a, Wrzaszcz 2017b).

⁷ See: (EC, 2016b).

the greening mechanism in order to identify actual farming practices related to EFA maintenance, a population of farms with at least 15 ha of arable land that are covered with this requirement has been singled out. The 2015 population of farms with EFA area amounted to 4,700, while the population of farms keeping agricultural accounts consisted of 12,105 private farms.

Farms' number and land use

The studied population of 7,392 farms was dominated by those that were under the greening obligation (77%, Figure 1, left). The population of farms under the greening requirements amounted to 5,705, and the majority of these farms were larger farms, i.e. farms with the minimum of 15 ha of arable land. Larger farms are obliged to comply with the greening requirements in regard to both crop diversification and maintenance of ecological focus areas. The importance of this group of farms results from their total area. In the case of the studied panel, the farms with at least 15 ha of arable land held over 90% of area.

The greening requirements basically refer to the manner of arable land use but also involve monitoring related to the maintenance of permanent grassland. Therefore, this study has focused on both the classification of land in the identified groups of farms and on the changes in this regard (Table 1).

The arable land area in farms under the greening obligation was comparable in the analysed years. In the case of

smaller farms (10-15 ha), the fallow land area and change to it was small in physical terms and resulted in a small reduction in crop area. However, the larger farms (15 ha or more) increased their arable land area, including the fallow land (by nearly 50%)⁸. In the latter group, the additional land was put to use in 2015. The increase in this area was related to the adjustment of the larger farms in order to comply with the EFA maintenance. Driven by the aim of increasing the area of ecological focus, the farmers increased the farm area by including additional fallow land and at the same time maintained the area used for crop production⁹. The farmers purchased or leased the land that had not previously been used for agricultural purposes.

In the case of farms exempted from greening (ones with less than 10 ha), the area of arable land in use and permanent grassland was comparable in the analysed years. The fallow land area was a minor portion of their area. Their area increased to an extent that is definitely smaller than in the case of farms obliged to maintain EFAs.

What needs to be emphasised is the fact that the farms exempted from greening strongly differed from the larger ones in terms of land use. In the former group, permanent grassland took as much as a third of the agricultural land area, which determines their significance in terms of the carbon sequestration capacity, soil production potential and biodiversity. On the other hand, among farms under greening obligation, the percentage of permanent grasslands was significantly lower (21% for farms with 10–15 ha, and 9% for farms with 15 ha or more). These figures show that it

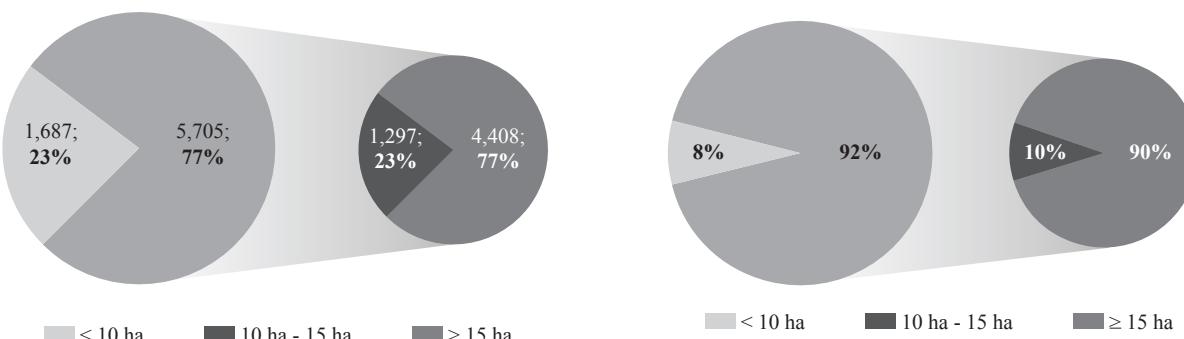


Figure 1: Structure of farms' number (left) and agricultural land (right) by area farms' groups in 2015.

Source: own composition based on FADN data 2015.

Table 1: Land use in not obliged and obliged farms to greening (in ha).

No.	Specification	2014		Change (in ha)	2014		Change (in ha)	2014		Change (in ha)
		≤10 ha	2015		10-15 ha	2015		≥15 ha	2015	
1	Arable land	14,168	13,870	-298	19,491	19,286	-205	205,904	208,570	2,666
2	Fallow land	229	274	45	145	170	25	985	1,472	487
3	Orchards	1,565	1,597	32	308	322	14	705	701	-4
4	Permanent grassland	7,667	7,786	119	5,192	5,186	-6	20,131	19,457	-674
5	Agricultural land	23,400	23,253	-147	24,990	24,794	-196	226,739	228,729	1,990

Source: own composition based on FADN data for 2014-2015.

⁸ In physical terms, however, this area was small and amounted to mere 0.7% of arable land area.

⁹ Compare with results for farms population in Poland, presented in: (Wąs and Jaroszewska, 2017).

is reasonable to vary the greening requirements depending on the farm's area and structure of agricultural land because on the smaller farms, the percentage of grassland is higher (on average) – it is a particularly important natural habitat for both the preservation of species and the continuity of natural processes. From this perspective, larger farms, where larger area is used for crop production through arable land use, should ensure its organisation so that it is favourable for generating environmental benefits resulting from the agricultural practice. However, the substitution scale of permanent grassland maintenance and proper management of arable land is an open question.

Arable land use

The fulfilment of the crop diversification and EFA requirements correlates to a specific cropping pattern. Therefore, analysis of the cropping patterns on arable land has to pay attention to the varieties and groups of main crops and catch crops.

In accordance with the greening requirements, farms under the crop diversification obligation should grow at least two crop species. According to the legal rules, spring and winter crops are treated as separate species. As shown in Table 2, inclusion of spring and winter varieties to a large extent allowed the crop diversification requirement to be satisfied, particularly in the case of farms with 10–15 ha. The high value of winter cover ratio makes it possible to state that the organisation of crop production to a large extent had complied with the crop diversification requirement a year before it was introduced. The observed cropping pattern in regard to winter cover on arable land was more favourable on large farms than on smaller farms (in 2015, the percentage of area under winter crops in these two groups was 57% and

40% respectively). Farmers had numerous options allowing them to ensure the required number of cultivated crop species, which shows the great flexibility of the greening instruments. The farmers' selection in this regard was determined primarily by the organisation of crop production in 2014, i.e. just before the imposition of greening. The maintenance of cropping patterns that take account of the relevant proportion of spring and winter crop varieties in 2015 resulted in the exemption of farmers from the obligation to introduce significant organisational changes to crop production. It can be stated that greening contributed to the continuation of the favourable status quo regarding the winter vegetation cover. In this respect, greening can be considered effective.

In the case of the smallest farms exempted from the greening obligation (below 10 ha), the winter crop area was definitely lower compared to the farms under the obligation because these crops took as little as a third of the crop area on arable land. Also, when comparing 2015 to 2014, there is no favourable change in this regard. Farmers utilising a small arable land area are not legally bound to diversify their crops, and they are also not motivated to increase the winter crop area.

The cropping patterns of farms under greening obligation were dominated by cereals (as of 2015, in the case of the 10–15 ha farms, the percentage of cereals was 69%, while in the case of farms with 15 ha or more it was 65%). The percentage of cereals slightly dropped, when comparing 2015 to 2014 (about 2 percentage points). When assessing the cropping patterns of an average farm under greening obligation, it can be stated that the proportion of other crops, including soil-improving crops, i.e. pulses and papilionaceous crops is negligible – in total, they amount to just a few per cent. However, pulses and papilionaceous crops, both edible species grown for grain and fodder crops, are an important element of the cropping pattern, which has favourable impact on the

Table 2: Crops in not obliged and obliged farms to greening (in ha, change in %).

No.	Specification	2014		Change (in %)	2014		Change (in %)	2014		Change (in %)
		≤10 ha	2015		10-15 ha	2015		≥15 ha	2015	
1	Winter crops (for the next year)	4,525	4,654	103	7,791	7,739	99	113,782	117,858	104
2	Catch crops	266	198	74	386	318	82	5318	11,343	213
3	Cereals	9,133	8,753	96	13,581	13,177	97	136,619	134,087	98
4	Pulses for grain	350	542	155	396	683	172	6,305	11,456	182
5	Pulses for grain: edible	32	46	144	40	112	280	436	1,333	306
6	Pulses for grain: fodder	199	372	187	197	413	210	2,975	7,488	252
7	Fodder: field pea	22	28	127	47	71	151	383	1,154	301
8	Fodder: horse bean	10	30	300	22	49	223	234	801	342
9	Fodder: sweet lupine	105	204	194	87	229	263	2,058	4,931	240
10	Pulses for grain: pulse mixes with others	119	124	104	158	158	100	2893	2,635	91
11	Industrial crops	542	522	96	1,202	1,150	96	37,825	36,800	97
12	Potatoes	447	411	92	620	548	88	3,387	3,434	101
13	Fodder crops	2,614	2,669	102	3,069	3,206	104	17,260	18,931	110
14	Fodder crops: Grasses	611	663	109	508	612	120	2,380	2,834	119
15	Fodder crops: Pulses	11	31	282	27	20	74	99	200	202
16	Fodder crops: papilionaceous	99	119	120	144	196	136	839	1,383	165
17	Fodder crops: papilionaceous mixes with grasses	746	662	89	451	344	76	2,757	2,311	84

Source: own comparison based on FADN data 2014-2015.

Table 3: The main EFA elements (in 2015).

Elements	Farms			Surface EFA		
	Number	%	Converted (ha)	Weighed (ha)	Converted (%)	Weighted (%)
EFA14a: stubble catch crops	2,707	57.1	16,749	5,025	54.2	34.2
EFA15: nitrogen-fixing crops	2,229	47.0	11,173	7,821	36.1	53.2
EFA14b: winter catch crops	275	5.8	1,610	483	5.2	3.3
EFA1: fallow land	228	4.8	804	804	2.6	5.5
EFA in total	4,744	n.a.	30,910	14,699	100	100

Source: own composition based on 2015 FADN data.

soil organic matter, and in turn on the soil productivity. This is a reason for considering the papilionaceous crops as an ecological focus area. When comparing 2015 to 2014, there is a need to observe that the area of soil-improving crops significantly increased, which was particularly observable on larger farms¹⁰. These changes occurred both on smaller farms, which selected pulses for the sake of crop diversification, and the larger ones, which were in addition obliged to ensure EFA. In the case of larger farms – 15 ha or more – the area of edible and fodder pulses for grain grew 3 and 2.5 times respectively.

Another important element of the cropping pattern were fodder crops, particularly papilionaceous crops and pulses for green fodder and grasses on arable land. In the case of the farms under greening obligation, their area on average increased over 1.5 times. Operators of larger farms, i.e. farms with 15 ha of arable land or more, were more active in this regard. These results show the impact of legal regulations related to greening, including ones concerning the maintenance of EFAs, on decisions made by farmers in regard to the area of soil-improving crops.

The cropping patterns of farms exempted from greening were also dominated by cereals (65% in 2015). In the case of these farms, a relatively larger crop area was under fodder crops (particularly fodder maize, field grass and papilionaceous mixes and multi-species mixes). The smaller farms tend to combine crop and livestock production, which also determines the manner of arable land use. The dynamic of changes in pulses area, however, did not equal the ones observed in the case of farms under greening obligation.

As shown by the presented figures, the farms not legally obliged to diversify their crops and maintain EFAs also follow the same course in the reorganisation of crop production, but they differ in its dynamic. The increase in the area of pulses and papilionaceous crops can surely be attributed to greening, but it is not the sole determinant. In this context, there is a need to stress the importance of other instruments, such as the agri-environmental programmes, or direct support for soil-improving crop production, which have been encouraging farmers to cultivate crops in a symbiosis with natural environment¹¹. The additional incentive in the form

¹⁰ See (Was and Jaroszewska 2017a). The same direction of changes was observed for population of farms in Poland. The different influences of soil improving crops on biodiversity need to be outlined (Hart *et al.*, 2016).

¹¹ The observed direction of the sown area change in Poland, indicated the influence of the CAP instruments, that support the production of protein crops in recent years. The increase in surface of these plants from 2010, was associated with the area direct payments (Was and Jaroszewska 2017b). The more dynamic growth of this surface took place in 2015. The presented figures indicated that, in addition to area direct payment for the protein crops, greening had the essential importance in farmers' production decisions, which provided an extra boost to the increase of soil improving crop cultivation.

of the greening payment surely incentivised farmers to make the desired and more dynamic changes to their farms.

Apart from the change to the area of main crops, there was also a change to the area of catch crops. Catch crops are one of the most important elements forming the agricultural EFA. Their importance results from the soil-improving and protective properties, but they can also be used as fodder. As shown by the data, catch crops supplemented the cropping patterns in farms under the greening obligation, but their area significantly grew in 2015 in the case of the larger farms (obliged to ensure EFAs). In the case of those farms, the percentage of catch crops increased from 2.6% to 5.5%, when comparing 2014 and 2015. On the smaller farms, however, this area dropped, which indicates the significance of the greening mechanism. In the case of farms exempted from greening, catch crops were grown on an even smaller area, which significantly dropped in 2015 compared to 2014 – by 25%. Thus, the percentage of catch crops in the cropping patterns dropped from 1.9% in 2014 to 1.5% in 2015. Presented changes in the cropping patterns and the catch crop area (growth on the larger farms and drop on the smaller farms) indicated that the greening effectively encourages farmers to maintain EFAs through agricultural practices. Farmers not legally obliged to grow catch crops didn't introduce organisational changes aimed at increasing this crop area.

EFA specification¹²

The applicable legislation specified many different elements of EFA, that are related to agriculture, forests and landscape¹³. In accordance with the specification, most of these elements concern landscape, while some of them are related to the organisation of plant production, i.e. the use of catch crops and companion crops, as well as the cultivation of nitrogen-fixing plants. The farmer can decide which elements are to be used to comply with the EFA requirement. In 2015, total EFA in farms keeping agricultural accounting was 15,000 ha¹⁴, which accounted for 6.5% of arable land (tab. 3). This number shows that the analysed farms fully complied with the requirement to maintain EFA (taking into account the result for the entire analysed farms' group).

As indicated in Table 3, farmers concentrated on suitable plant production, adjusted to environmental requirements,

¹² See (Wrzaszcz, 2017a).

¹³ See footnote No. 5.

¹⁴ This area refers to the weighted area. Due to different environmental significance of the various EFA elements (agricultural and landscape ones), an EFA weighted area is given (MRIRW, 2016).

Table 4: Outcomes, subsidies and their relation*.

No.	Specification	2014		2015	Change (in %)	2014		2015	Change (in %)	2014		2015	Change (in %)
		≤10 ha				10-15 ha				≥15 ha			
1	Total output (1000 euro/ha)	1,93	1,99	103		1,73	1,65	95		1,57	1,47	94	
2	Total output (1000 euro/AWU)	14,69	15,30	104		18,48	17,62	95		39,16	37,14	95	
3	Gross farm income (1000 euro/ha)	1,00	1,14	114		0,85	0,87	102		0,78	0,76	97	
4	Gross farm income (1000 euro/AWU)	7,66	8,72	114		9,08	9,27	102		19,38	19,31	100	
5	Income (1000 euro/ha)	0,67	0,79	118		0,59	0,60	102		0,56	0,54	96	
6	Income (1000 euro/FWU)	5,08	6,08	120		6,29	6,40	102		14,08	13,74	98	
7	Direct Payments/Subsidies (%)	65	70	5 p.p.		69	75	6 p.p.		63	71	9 p.p.	
8	Single Area Payments/Subsidies (%)	52	57	5 p.p.		57	61	4 p.p.		56	61	5 p.p.	
9	Subsidies/Output (%)	16	17	1 p.p.		15	19	3 p.p.		17	21	4 p.p.	
10	Subsidies/Income (%)	54	49	-5 p.p.		50	57	7 p.p.		53	65	12 p.p.	
11	Balance Subsidies and Taxes/Income (%)	38	37	-1 p.p.		38	46	8 p.p.		38	49	11 p.p.	

* 1 AWU/FWU is the equivalent of the full-time labour of all workers/only farming family members. All production and economic categories in current prices; p.p.– in percentage points.

Source: own studies based on FADN data 2014-2015.

and only few of them selected landscape and forest elements (these accounted for just a few per cent of the total EFA). A total of 87% of the weighted ecological area was used for stubble catch crops and the cultivation of nitrogen-fixing crops. Farmers did not diversify EFA – one or two EFA types were selected most often on the farm level (which was done by 94% of farms). Farmers' choices related to meeting the EFA requirement by plants cultivation in the main crop and secondary crop translated into a change in the cropping pattern in their farms, thus improving water and soil conditions.

These results demonstrate the importance of the agricultural elements of EFA in the context of compliance with this requirement of the EU law. The farmers' selection of specific EFA elements could have been imposed to a large extent by the administrative requirements related to specific elements of ecological focus area. Particular difficulties that a farmer faced were related with keeping the registration of specific landscape elements. Pursuant to the administrative requirements, there is an obligation to measure and illustrate the size of each EFA element, which also involves its presentation on the maps. An important issue is the preparation of an up-to-date record of valuable natural resources in Poland, including their location on farms under the EFA obligation. The results can indirectly indicate a small proportion of valuable landscape and forest features compared to the utilised area on larger farms.

Farms' outcomes¹⁵

Analysing the impact of greening on the farms' organisation, there is a need to mention their production and economic outcomes. The results of the analysed farms have been illustrated both through the factor productivity and profitability indicators and the subsidies absorption

(Table 4)¹⁶. The data presented should be regarded as a recognition that farms' production and economic situation differ according to the scope of their greening requirement implementation. Due to administrative decisions related to the earlier payment of advances on direct payments in 2015, it is not possible to quantify precisely the economic effects in the first year of the greening implementation. Detailed diagnosis also requires additional price analysis of agricultural products variety. It should be underlined that greening was not associated with higher subsidy value for farmers, but was a necessary condition to get a part of direct support. However, organisational changes associated with greening can also have an impact on the agricultural production volume, its sort structure and final value. Thus, greening's influence on the farms' outcomes can be assessed indirectly. As indicated by the figures in Table 4, the final economic outcome of the agricultural producer to a comparable extent depended on the value of agricultural production and the size of the support in the form of subsidies.

With farms under the greening obligation, the productivity of production factors slightly dropped, while their profitability was comparable in the analysed years, both in the case of the smaller (10–15 ha) and the larger ones (15 ha or more). The amount of the granted subsidies has to be seen otherwise – this value grew significantly in 2015 compared to 2014 – by 18%. The increase in the subsidy transfer should be attributed primarily to the administration decision (scope of and criteria for the granting of subsidies, and the introduction of advance payments related to direct payments) and then to the farmer (their greater activity). It has to be remembered that in 2015, the first year when greening was implemented, only a small percentage of the beneficiaries actually received the related payment. The role of the administrative decision that granted advances of direct payments to farmers in late 2015 (MRiRW, 2015) also needs to be acknowledged: i.e. it took place much earlier than in the previous years. Subsidy

¹⁵ According to FADN data, the average exchange rate in 2015 was EUR 1 = PLN 4.18.

¹⁶ Categories and definitions of standard results of farms were presented in: (Floriańczyk *et al.*, 2017).

transfers for the preceding years were basically made in the following year¹⁷.

When comparing 2015 to 2014, it can be stated that the role of subsidies contributing to the economic situation of farms under the greening obligation increased, which is shown e.g. by the higher ratio of payments to farm production value. In 2015, nearly half of the farm income came from that source, while in 2014, its share was 38%¹⁸. The presented figures indicate that the funds in the form of subsidies now exert an increasing impact on the economic condition of farms, particularly in the case of larger farms. In addition, this phenomenon has recently become more visible.

Productivity of production factors on the farms exempted from greening was comparable in the analysed years, and the profitability ratios grew significantly (from a dozen or so per cent for added value to 20% in the case of income when comparing 2015 to 2014), which has not been observed in the case of farms under the greening obligation. The subsidy to production ratio indicated that the economic situation of the farms exempted from greening was less dependent on the cash flows from subsidies compared to the farms under the greening obligation. The studied years also saw a decline in the importance of such subsidies for the economic performance of farms below 10 ha.

Main conclusions

This paper has discussed the effectiveness of greening scheme in Poland. The changes that occurred on farms after new requirements introduction were evaluated on the bases of 2014-2015 Polish FADN data. The first year of analysis presented the farms' state before the implementation of greening, while the next year showed the situation when the requirements came into force. This analysis has been supplemented by a parallel analysis of farms exempted from that obligation, which were used as a control group. Comparison of results for farms under the greening obligation (at least 10 ha of arable land) and exempted from it (below 10 ha of arable land) enabled the identification of organisational changes to farms that were introduced as a consequence of the new administrative solutions.

The main conclusions from the study, which refer to the analysed group of Polish FADN farms and legal regulations related to greening that have been binding on farmers since 2015:

1. Greening requirements related to land use had no adverse impact on the production potential of farms.
2. The different structure of agricultural land in use has indicated that it is reasonable to diversify the environmental requirements imposed on smaller and larger farms.
3. Farms with at least 15 ha of arable land took the most organisational measures to adjust to the new administrative requirements. This state of affairs corresponds to

the assumed impact of the greening mechanism, which confirms its effectiveness.

4. The environmentally friendly organisation of Polish farms before the introduction of the greening requirement allowed them to adjust smoothly in 2015.
5. Maintaining the status quo on farms (as regards winter crop) or the introduction of desired organisational changes to crop production is the quintessence of the measures related to the meeting of the greening requirements. In this aspect, greening can be considered effective.
6. In the context of pulse and papilionaceous crop areas increasing, there is a need to stress the importance of greening, but also the agri-environmental programmes and direct support for soil-improving crops, which have been encouraging farmers to cultivate crops in a "symbiosis" with the environment.
7. The farms not legally obliged to diversify their crops and maintain EFAs also follow the same course in the reorganisation of crop production, but they differ in terms of its dynamic. The more favourable dynamic of such changes on farms under the greening obligation demonstrates the effectiveness of the mechanism.
8. Maintenance of EFAs on farms requires basically an appropriate crop production organisation. It is reasonable to carry out administrative work aimed at simplifying the procedures related to the listing of landscape and forest elements, to encourage farmers to preserve them.
9. Another issue that should be considered important is the determination of substitutability of different agricultural practices in terms of the environmental impact and maintenance of natural resources at the farmers' disposal.
10. The extent to which the "desired" agri-environmental practices are implemented should serve as a basis for assessing the environmental effectiveness of greening. As indicated in the discussion presented in the academic literature, the environmental effects of greening are deemed insufficient due to the adopted greening requirements.
11. In the first year of the implementation of greening, these requirements did not adversely impact the production and economic performance because the area allocated to the ecological focus areas amounted to mere several per cent of the area in use and the crop diversification criteria did not force any significant organisational change in crop production.

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¹⁷ In 2015, the advances of direct payments were paid for the first time. These advance payments, at 50% of the total payment, were paid in advance of: the Single Area Payment, additional payment, protein crop payment, and the soft fruit payment. In total, about 80% of the direct payment beneficiaries received such advances (MRiRW, 2016).

¹⁸ Also including tax liabilities.

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