

Assessment carbon farming practices in Poland

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Introduction

Various practices related to carbon farming offer a great opportunity to sequester CO₂ in agricultural soils while improving soil health and productivity. Since 2023, Poland has had a Strategic Plan for Agriculture in place that directly supports carbon farming and other measures aimed at achieving climate neutrality. Based on data published by government agencies, we analysed the progress of implementing specific carbon farming practices over the last three years (2023-2025). We assessed the actual area of implementation of the practices [ha], their effectiveness [t C_{org}], cost effectiveness of chosen intervention [Eur/tonC], as well as several relevant indicators of agricultural policy in terms of carbon offset. The aim of the work was to identify the most successful governmental interventions in terms of soil organic carbon accumulation as well as to assess contribution of Agroforestry and Organic Farming practices in carbon offset in Poland.

Methods

Potential offset of organic carbon for each supported agricultural practice was calculated based on JRC-Farming-Practices dataset (Schievano et al. 2023). Designed interventions were not exactly identical to practices mentioned in JRC data set, forcing us to modify some values, to match them to intervention requirements and local climatic conditions. Other interventions were directly assigned to individual practices provided by JRC. For example, values for organic farming were sourced directly from the data set, choosing average value [450 kg C_{org}/ha/year]. In other case Integrated plant production was matched to Crop rotation category [150kg C_{org}/ha/year], as well as Diversified crop structure.

Data on interventions (2023-2025) was obtained from already published reports and online resources of Polish governmental agencies: Ministry of Agriculture and Rural Development (MRiRW), Agency for Restructuring and Modernisation of Agriculture (ARiMR), Agricultural Advisory Centre (CDR) and Institute of Soil Science and Plant Cultivation (IUNG-PIB).

Schievano, Andrea; Perez-Soba, Marta; Bosco, Simona; Montero-Castano, Ana; Catarino, Rui; Chen, Mathilde; Tamburini, Giovanni; Landoni, Beatrice; Mantegazza, Otho; Guerrero Fernandez, Irene; Bielza, Maria; Assouline, Michael; Koebel, Renate; Dentener, Frank; Van der Velde, Marijn; Rega, Carlo; Furlan, Andrea; Paracchini, Maria Luisa; Weiss, Franz; Angileri, Vincenzo; Terres, Jean-Michel; Makowski, David (2026): JRC-Farming-Practices dataset (version 2023) – An evidence library of the effects of Farming Practices on the environment and the climate. European Commission, Joint Research Centre [Dataset] doi: 10.2905/JRC.MH3RZJG PID: <http://data.europa.eu/89h/4c3c371a-bc72-4e90-aa0b-45f8cda206c>

Results

- ✓ Agroforestry and planting trees (Trees outside Forest) on arable lands are considered one of the most beneficial practises for increasing organic carbon content in the soils, accounting for approximately 850 kg of C_{org} per hectare annually. Another important practices are use of solid manure [750 kgC], water retention on grasslands [750 kgC], extensive use of grasslands with animal grazing [720 kgC], and excluding land from production for a year [720 kgC]. The least relevant practice is Basic fertilizer plan application, helping to preserve 50 kg of C, due to limitation of nitrogen use by microbiome.
- ✓ Most commonly used practice was Reduced tillage system, covering 2,6 mln ha in 2023, 3,4 mln ha in 2024 and 3,8 mln ha in 2025, respectively. Mixing straw with the soil was also very popular practice, covering over 2,1 mln hectares in 2023 and 1,8 mln ha 2024. However, the area of this practice has shrunk significantly in 2025, probably because lower payments, preference of no-till systems and to much of straw cumulation in the soil. Nearly 1,5 mln ha was covered by Fertilization plans and Diversification of the crops in 2023, with significantly increasing trend in next two years. Organic farming covered about 0,6-0,7 mln ha of total cultivated land in 2023-2025 period. Agroforestry practices were reported only on 100 ha in consecutive years.
- ✓ Reduced tillage and Organic fertilization assured the highest amount of carbon offset, over 2,3 and 1,7 mln ton of organic carbon. The third most productive practice was Organic farming [0,9 mln tonC], followed by Diversification of crops [0,8 mln tonC], mixing straw with soil [0,7 mln tonC], and Winter catch crops [0,6 mln tonC]. The role of agroforestry was marginal due to very small area of the implementation.
- ✓ Governmental support for carbon farming practices was diverse. Best paid practices were agroforestry (about 2000 EUR per ha) and organic farming (448 EUR per ha on average). Development of fertilisation plan, Use of manure and straw were the least paid (20-40 EUR per ha), yet still very popular, probably due to low requirements. Some payments decreased in following years, first due to excessive popularity (exceeding of planned budget) and drop of the EURO value.
- ✓ From the perspective of governmental agencies, support of Organic farming and Reduced tillage systems was the most expensive, accounting between 200 and 340 million EUR in different years. However, the cost of one tone of offset organic carbon was the cheapest for the use of manure. It was It must be addressed, that agencies pay for covering manure with soil in the time up to 12 h, not for use itself. Still this intervention helped to register use of organic fertilisation in the scale of country and hopefully encouraged farmers to buy manure instead of mineral fertilizers. Water retention on grassland, extensive use of grasslands and excluding land from production were also relatively cheap ways to preserve carbon in the soil. Agroforestry, Organic farming and Integrated plant production are the most expensive measures for carbon farming.
- ✓ For more data please check the table 1.

Table 1. Assessment of chosen carbon farming practices supported in the period of 2023-2025 in Poland

Agricultural practice	JRC value [kg/ha/year]	Area in 2023 [1000xha]	Carbon offset in 2023 [1000xtC]	Payment in 2023 [EUR/ha]	Cost of int. in 2023 [mlnEUR]	Area in 2024 [1000xha]	Carbon offset in 2024 [1000xMgC]	Payment in 2024 [EUR/ha]	Cost of int. in 2024 [mlnEUR]	Area in 2025 [1000xha]	Carbon offset in 2025 [1000xMgC]	Payment in 2025 [EUR/ha]	Cost of int. in 2025 [mlnEUR]	Total carbon offset [1000xtC]	Total cost of int. [mlnEUR]	Cost of offset [EUR/tonC]
Mixing straw with soil	150	2155	323	45	98	1855	278	31	58	860	129	20	18	731	174	238
Winter catch crops or intercrops	210	1059	222	113	120	1080	227	102	110	1020	214	102	105	663	334	504
Mixing manure into soil	750	798	599	45	36	817	613	41	33	752	564	41	31	1775	100	56
Reduced tillage systems	240	2670	641	91	242	3415	820	59	201	3827	919	61	235	2379	678	285
Diversified crop structure	150	1476	221	68	100	2087	313	53	110	1928	289	55	105	824	315	383
Application of natural liquid fertilisers	120	736	88	68	50	1222	147	61	75	1535	184	61	94	419	219	522
Extensive use of permanent grassland	720	154	111	113	17	146	105	102	15	122	88	102	13	304	45	147
Water retention in grasslands	750	117	88	63	7,4	61	46	57	3,5	77	58	63	4,9	191	16	82
Integretated plant production	150	164	25	295	48	419	63	191	80	576	86,5	215	124	174	253	1453
Development of fertilisation plan	50	1477	74	23	33	1775	89	20	36	1302	65,1	20	27	228	96	423
Fertilisation plan – option with liming	135	141	19	68	10	144	19	61	8,8	140	18,9	61	8,6	57	27	470
Areas with honey plants	210	15	3,2	272	4,1	25	5,2	210	5,2	21	4,3	254	5,2	12,7	15	1144
Land excluded from production	720	0	0	0	0	31	22	99	3,1	30	22	102	3,1	44	6,1	140
Organic farming	450	636	286	448	285	691	311	485	335	700	315	486	340	912	960	1052
Afforestation	850	0,01	0,01	2270	0,02	0,01	0,01	2456	0,02	0,01	0,01	2461	0,02	0,03	0,07	2818
In-field tree planting	850	0,01	0,01	2550	0,03	0,02	0,01	2758	0,04	0,02	0,01	2764	0,04	0,04	0,12	3173
Agroforestry systems	850	0,09	0,07	1080	0,09	0,10	0,09	701	0,07	0,10	0,09	703	0,07	0,24	0,23	960
Sum		11598	2700	91	1052	13769	3058	78	1074	12890	2956	86	1113	8715	3239	815
Average value	433			91				78				86				815

Additional data:

- ✓ Agricultural area in Poland reported to direct payments is about 15 mln ha, of which 11-13 mln ha were under some kind of carbon farming. It must be highlighted, that multiple practices can be reported from the same field, so the actual area of carbon farming could cover between 6 and 9 mln ha, about of 50% of cultivated area in Poland. An amount of captured organic carbon is the same or higher when practices are combined. On other hand government pays for several different practices at the same fields, when rest of area is not supported.
- ✓ In Poland there is about 1,3 mln of agricultural producers (one farmer per farm). Number of farmers engaged in carbon farming practices was difficult to estimate. Information on area and number of applying farmers was provided, however one farmer can apply for support related to many different practices, so one producer can be counted several Times. There is nearly 25 000 of organic farmers in Poland, accounting for about 2% of all farmers. Only between 50 and 150 farmers applied for support of agroforestry systems. Over 0,4 mln farmers applied for Eco schemes, which is about 32% of their population.
- ✓ Average farm size in Poland is about 13 ha, but farms applying carbon farming practices are on average of 22 ha. Organic farms are on average of 28 ha. Relatively small proportion of farmers (0,4 mln) operating within the area of carbon farming (up to 9 mln ha) can be explained by the fact that bigger farms are more willing to look for the additional income. On the other hand, farms with area up to 5 ha were not required to implement Eco schemes in order to able to receive direct payments.

Conclusions

- ✓ Agroforestry, organic fertilization and water retention on grasslands has the biggest potential of carbon storage in agricultural soils.
- ✓ Annual agricultural practices like Eco schemes were most popular among the farmers in compare to long-term practices like organic farming and agroforestry.
- ✓ Simple practices contribute the most to carbon offset, examples are reduced tillage and organic fertilisation.
- ✓ Organic farming is a big contributor for carbon farming, agroforestry has marginal level of implementation.
- ✓ Most costs is allocated into organic farming and reduced tillage systems.
- ✓ Agroforestry and organic farming are the best paid practices.
- ✓ The cheapest mechanism of carbon farming are: use of manure, water retention on grassland, extensive grassland use and exclusion land from production.

