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Finnish Farmers Feel They Have Succeeded in Adopting Cover Crops but Need Down-to-Earth Support from Research

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Abstract: In Finland, there is an ongoing adoption and learning process considering the cultivation of cover crops (CCs). The primary aim is to claim the benefits of CCs for agricultural production and ecosystems, which are both appreciated by Finnish farmers. A farmer survey with 1130 respondents was carried out to build an up-to-date understanding of how farmers have succeeded with CCs and whether they intend to continue with the use of CCs and to collect farmers' views on knowledge gaps that should be filled by research or better knowledge sharing. The studied groups were farmers who had selected CCs as a registered measure in 2020 to receive agricultural payments. Data came from the Finnish Food Authority. Organic farmers were slightly more positive: they have had longer experience with CCs, but organic production is also more dependent on the ecosystem services provided by CCs. A high share of respondents agreed that their experiences with CCs have improved over time and were confident that CCs had become a permanent element of their production systems. Most of the farmers also agreed that the area under CCs would expand significantly in Finland and considered the cultivation of CCs as an effective measure to improve soil conditions. They often considered that challenges in adopting CCs were exaggerated and disagreed that bad experiences prevented them from expanding or continuing the use of CCs. The agricultural payment available for Finnish farmers to support the cultivation of CCs is quite reasonable (EUR 97 + EUR 50 per hectare) to compensate for any economic risks of CCs. Free word answers from the farmers highlighted research needs (in descending order) in the following areas: crop protection, sowing practices, the use of diverse CCs and their mixtures, and impacts on yield and profitability. Many of these are universal, i.e., have been reported elsewhere. Younger farmers (≤50 years) highlighted profitability, which is, in many European countries, a key barrier to the deployment of CCs. Farmers from the east and north regions, where the growing season is short, highlighted alternative CC choices as a knowledge gap.

Keywords: adoption; cover crop; management; experience; farmer survey; knowledge gap

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1. Introduction

Interest and need for cultivation of multifunctional cover crops (CCs) has increased markedly around the world. In the future, large-scale implementation is needed to support the transition towards green, year-round soil cover and achieve the numerous ecosystem services that CCs may provide [1]. The potential advantages for crop production include higher yields [2,3], nutrient cycling [4,5], weed control [6,7], improved soil health [8–10], and adaptation to climate change [11]. On the other hand, ecosystem services provided by CCs include reduced nutrient leaching and erosion [12,13], pesticide acquisition [14], and carbon sequestration [15,16]. Monitoring the impacts on farms may be challenging because the required follow-up period to manifest changes might be long and complicated by variable weather. Furthermore, the performance and impacts of CCs may vary greatly depending on regional and local conditions, farming systems, land use in the past, and many other farm characteristics [17,18]. Farmers can control these with context-specific, tailored management

options [19,20]. Due to the multidimensional implications of integrating CCs into crop production systems [21], successful adoption calls for systems thinking [22]. In Finland, there is an ongoing learning and implementation period concerning the cultivation of CCs with the primary aim of gaining various benefits for both agricultural production and the ecosystem that Finnish farmers often appreciate [23].

It is important to understand whether farmers feel that they have succeeded or failed in implementing CCs as part of their production system and to identify the key knowledge gaps that might paralyze the adoption intensity of CCs. For example, according to researchers and organic farmers, the key knowledge gaps that may limit the adoption of CCs-based no-tillage technique in Europe were selection of CCs choices, sowing methods, measures to increase biomass but prevent competition, and termination methods of CCs stands [24,25]. The farmers' community, per se, represents a large-scale living lab for the use of CCs. Research should fill in the current, locally relevant knowledge gaps with new, verified experimental results, implement the existing public but missed data and understanding, and thereby support a transition towards rewarding and encouraging the use of multifunctional CCs [19]. Furthermore, discussion forums and close dialogue between researchers, advisors, and farmers are needed in addition to the development of decision support systems to address farmers' key knowledge gaps in a region and to give additional certainty for the deployment of CCs [26–29].

According to the farm surveys carried out in EU regions, policy has been so far the strongest determinant of the adoption rates and intensity in the use of CCs, and the adoption measures have been largely shaped by the Nitrates Directive and the Common Agricultural Policy's greening requirements [30]. Finnish farmers can get an agricultural payment of EUR 97 per hectare for the cultivation of CCs, and if the cover stand is left to overwinter, an additional EUR 50 per hectare, at most, on 30% of the field area of a farm. The primary target is to support the expansion of the field area allocated for CCs and the provision of services provided by CCs for the ecosystem and simultaneously reduce the risk that the economic costs may slow down adoption [31]. Thereby, the agricultural payment can be considered as a security measure for a farmer to cover costs when purchasing CC seeds, making changes to crop protection and management, and investing in machinery to facilitate the successful sowing and establishment of CCs [32]. Such agricultural payments are often crucial at the early stages of a green transition to push operators to become familiar with novel practices, learn by doing, and find the best practices that promote success to avoid early failure. The need for financial support is highlighted in many farmer surveys [33–35] because CCs affect whole farm profitability in various ways, not only through establishment and termination costs [21].

This study was carried out in the form of a farmer survey with the aim of gathering up-to-date knowledge on the success of Finnish farmers with the cultivation of CCs, their intentions to continue the use of CCs, and whether and how this varies depending on the farm conditions. To support the permanent transition towards the use of CCs in Finland, we collected farmers' views on knowledge gaps that should be filled either by research or knowledge sharing based on already published literature on comparable growing conditions.

2. Materials and Methods

2.1. Implementation of the Farmer Survey and Utilized Background Data

The farmer survey was carried out in Finland in the spring of 2021. In total, the details of 7025 farms (16% of Finnish farms in 2021) were requested and received from the registry of the Finnish Food Authority (FFA). These included the farm identification number, farm type, location, parcel identification number with CCs, and the farmer's email address. The farmers whose data was sought from the FFA were organic and conventional farms that applied for agricultural payments for CCs in 2020. Agricultural payments were registered on the field parcel scale. With these definitions, the FFA provided requested data on 5593 conventional farms and 1432 organic farms. As the farmers were contacted

by email, only those whose email addresses were available in the registry of the FAA were surveyed. The total number of invitees was 6493.

The survey started on 16 March 2021 and ended on 11 April 2021. One reminder message was sent on 30 March 2021. In addition to 13 statements under the title "Your success with CCs?" analyzed in this paper, the survey included other main themes with 51 statements, all dealing with CCs [23,32,36,37]. The farmers had five answer choices for each of the 13 statements: 1 = fully disagree, 2 = agree, 3 = neither disagree nor agree, 4 = agree, and 5 = fully agree. Statements of the whole survey were formulated based on findings reported in recent peer-reviewed papers [11,12,15,38,39]. The questionnaire was test run with four farmer-researchers who had long-term experience of CCs in Finland. Based on dialogue and comments, the questionnaire was finalized, and clarity was improved when needed. In addition to the statements, farmers were given an opportunity to freely list the future research needs that they considered important to support the cultivation, success, and further expansion of CCs.

The median of the respondent's answering time was some 15 min and 42 s (lower quartile 11 min and 31 s; upper quartile 24 min and 10 s). The farmers could save the answers and continue answering later. In total, 1130 farmers answered the survey, which corresponded to a 17.4% response rate of the farmers contacted. An additional 362 viewed or started to fill in the survey without completing and returning it by the deadline. Thereby, there were N = 1130 for 13 statements on success with CCs, while 244 farmers freely listed from one to ten future research needs. The most frequently used keywords were selected from the farmers' free word sentences, harmonized, and presented as a word cloud with the share of respondents who used each of the most common words or compound words.

Only the farmer's age ($\leq$50 and >50 years) and education (basic, vocational, college level, and university) were given by the farmers as background information used in the survey. None of these were found to markedly contribute to the farmers' views on their success with CCs. The rest of the background information was available for 2020 in the registry of the FFA by using the farm identity number. After merging the datasets, the respondents were grouped for statistical analyses according to (1) the farming system (organic and conventional) they operated, (2) the farm type they operated (cereal, special crop, horticulture, cattle, pig, poultry and horse/sheep farm), (3) the farm size (<40, 40–79, 80–119 and $\geq$120 ha), and (4) the geographical region their farms were located in (merging 16 Centers for Economic Development, Transport and the Environment (ELY Centers) to form four main regions: South-, West-, East/North Finland and the inland region). Furthermore, for each responding farm, the share of land devoted to cereals, grassland, special crops, peas (*Pisum sativum* L.), faba beans (*Vicia faba* L.), spring and winter oilseed rape (*Brassica napa* L.), and turnip rape (*B. rapa* L.), caraway (*Carum carvi* L.) and other crops, e.g., potatoes (*Solanum tuberosum* L.) and sugar beets (*Beta vulgaris* var. *altissima*), were assembled from the registry of the FFA and grouped as <25%, 25–50%, and $\geq$50% for cereals, grasslands and other crops, and as 0%, <10%, and $\geq$10% for special crops (lower cultivation areas). In addition to the land use for cash crops, the number of CCs (1–5, 5–10, and >10) that a farmer had cultivation experience with was used as background data [32]. Furthermore, the responding farmers were asked to select species they had used as CCs and to indicate the degree of experience with each species: 1 = none, 2 = very little, 3 = somewhat, 4 = a lot, and 5 = very much.

2.2. Statistical Analyses

The non-response bias was assessed by comparing the characteristics of the respondents who returned the survey to those of non-respondents (Table S1). The compared characteristics were the region, farming system, farm type, farm size, farm cereal area, grassland area, special crop area, and other crop area. In such cases, weights were used to bring the sample and the population more in line. This non-response weighting was considered in the statistical analysis. However, such weights were needed only for a few respondents, and hence, the total effect remained marginal, if any, and therefore this pro-

cedure was not used. No significant distortions of representativeness were found. The response rate was close to that of the contacted farmers (i.e., 17.4% ± ~2%) for the regions, farm sizes, the shares of land devoted to different crop groups on a farm, or for organic and conventional farms (232 and 898 responses, respectively). Considering the farm types, cattle and pig farms were slightly, but not significantly, under-represented [23]. Based on a preliminary examination of the data, the answers of all the 1130 respondents were considered acceptable and were used for statistical analyses.

The relationship between row and column variables was tested using the Cochran–Mantel–Haenszel (CMH) test. The row variables were formed from ten characteristics of the respondents (e.g., the region, farming system, farm type, farm size, and farmer's education), and the column variables were the results of the farmers' views on their success with CCs based on 13 survey statements (Figure 1) indicated with a 5-point Likert scale. This scale was used because it offers a range of options, provides valid data, enables cross-tabulation of respondents' answers to statements in different sections of the questionnaire, and helps to reduce bias and ambiguity. Typically, both variables were ordinal scales, and the correlation statistic of the CMH with 1 degree of freedom was used. If a row variable was not on an ordinal scale, as in the case of the region and farm type, ANOVA (Row Mean Scores, RMS) statistics for the CMH were used. ANOVA (RMS) tests were used for all pairwise comparisons. All analyses were performed using the SAS software, FREQ, and GLM procedures. The statistical analyses on the number of CCs that farmers had experience with (grouped as 1–5, 6–10, and >10) were also based on the CMH and ANOVA tests.

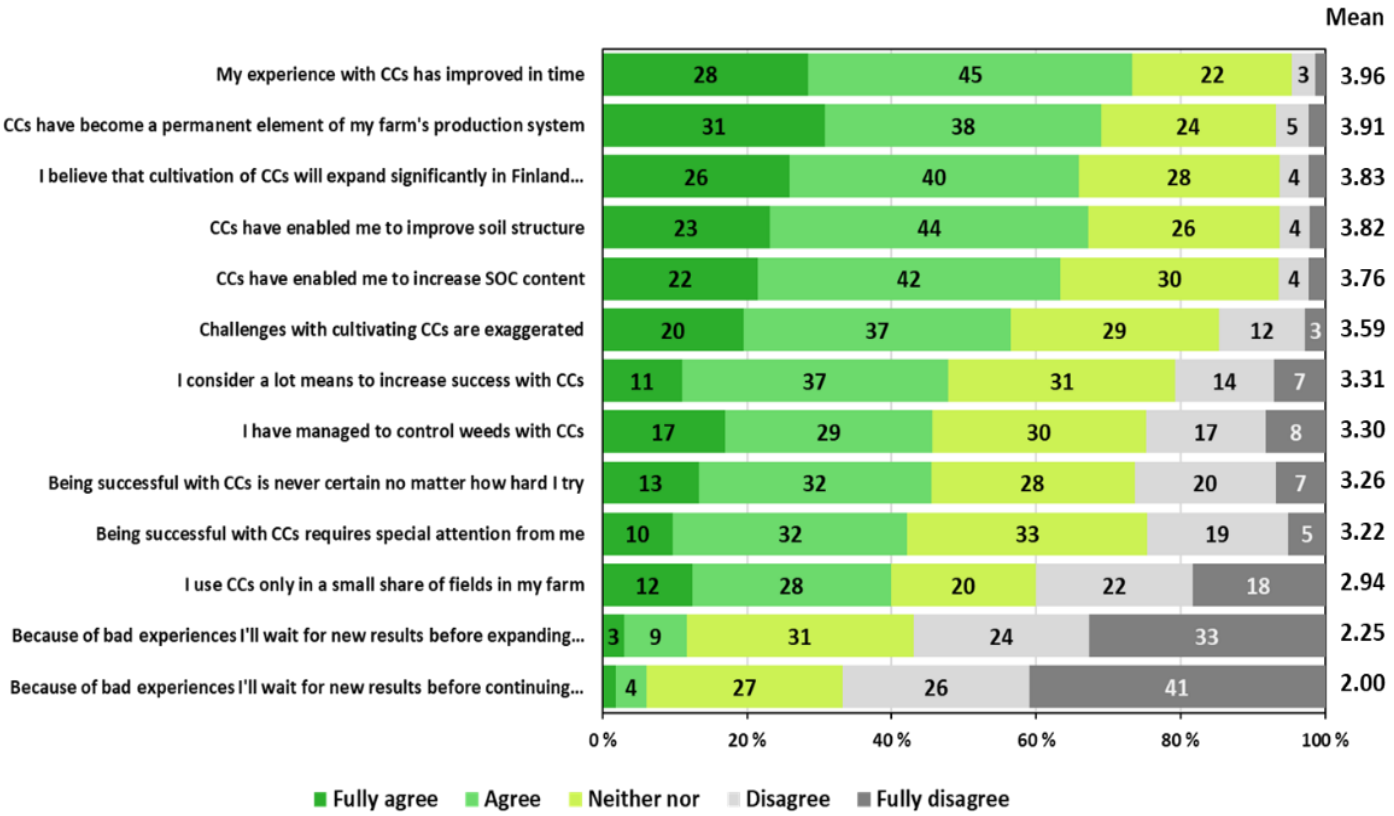

Figure 1. The distribution and means (in order of decreasing value) of the farmers' answers (N = 1130) to the statements concerning success with the cultivation of cover crops (CCs). The answer choices were: 1 = fully disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = fully agree. The share of each answer choice is shown within each bar except in the case of being <3%.

The relationship between farmers' experiences with different groups of CCs was demonstrated by a graphical method. Groups were grasses, legumes, and special CCs. The experience with different groups did not vary greatly from each other when considering

responses to statements on success with CCs, and this was presented by smoothing techniques, cubic spline, using the SAS/GRAPH. In addition, the Spearman rank-correlation coefficients were calculated for all groups.

3. Results

3.1. Farmers' Success with Cover Crops Based on 13 Survey Statements

The farmers were most positive on the statement that their experiences with CCs had improved over time (Figure 1). They also largely considered that CCs had become a permanent element of their farming systems and believed that the cultivation of CCs would expand significantly in Finland in the future, along with gained experiences. In total, 67% of farmers agreed that they had already been successful in improving the soil structure. In total, 64% considered that the SOC content had increased with the use of CCs, while 46% also had good experiences of controlling weeds with CCs.

The majority of farmers agreed that challenges with the cultivation of CCs were exaggerated, while 45% felt that success with CCs was never certain, no matter how much they tried (Figure 1). In total, 48% of the respondents had considered a variety of means to increase their success with CCs, and 42% responded that CCs required special attention to manage them successfully. In total, 40% of farmers have, so far, used CCs only on a small share of fields. In total, 12% of respondents considered that due to their bad experiences, they would wait for new results before expanding the cultivation of CCs on their farms, while only 6% said that they would wait for further understanding before continuing the use of CCs.

3.2. Success Depending on Number and Variety of Cover Crops

Based on the survey statements, the farmers were found to be more successful with CCs when they cultivated a higher number of CCs on a farm (Figure 2). The differences were significant depending on the numbers of CCs used by farmers for statements such as the experience with CCs has improved over time, CCs have become a permanent element of the farming system, CCs have improved the soil conditions, challenges with CCs are exaggerated, I consider means to increase success with CCs, and the cultivation of CCs will expand along with gained experience. On the other hand, farmers with experience with a number of CCs were those who most frequently agreed that they used CCs only on a small share of fields on the farm and would wait before expanding or continuing the cultivation of CCs on their farms (Figure 2).

When CCs were assessed in more detail by grouping them into categories of grasses, legumes, and special CCs, it was found that, in general, the experience with different CC species groups did not vary greatly from each other when considering the response to statements on success with CCs (Figure 3). However, the degree of experience with winter types of CCs did not correlate with the farmer's responses to any of the statements. The correlation between the farmer's experiences with grasses and legumes as CCs and their response was significant ($p < 0.0001$) for nine statements but quite identical. The correlations were positive for all three CC species groups for statements on the persistent and expanding role of CCs in the farming system, improved soil conditions, and weed control, while the correlations were significant only for grasses and legumes as CCs for the statement on exaggerated challenges. On the other hand, such correlations were always negative ($p < 0.0001$) for statements about the use of CCs on small shares of fields only and the expansion and continuation of cultivation due to bad experiences.

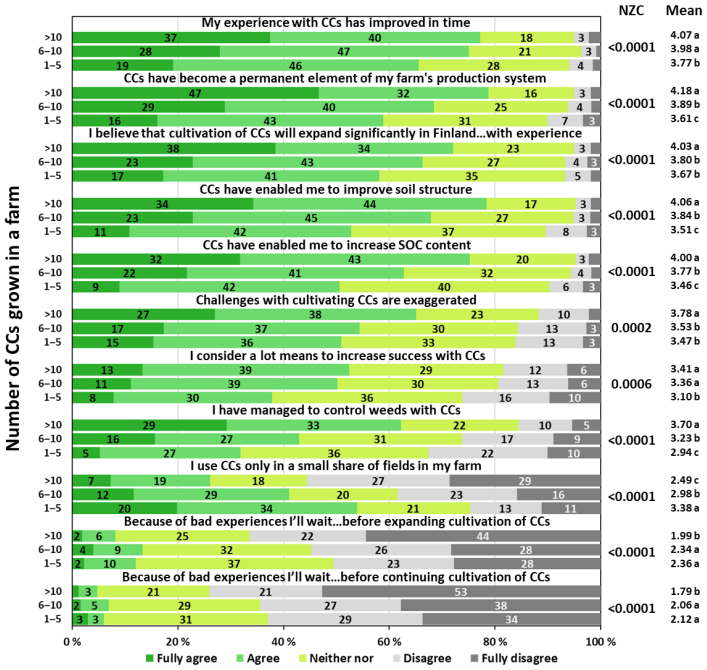

Figure 2. The shares and mean values of the farmers' answers (1 = fully disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = fully agree) to statements on success with cover crops (CCs) depending on their number (1–5, 6–10, and >10) on a farm (NZC, nonzero correlation). Pairwise comparisons are shown next to the means: means with the same letter for each statement do not differ significantly. The shares of answers are shown within each bar except in the case of being <3.

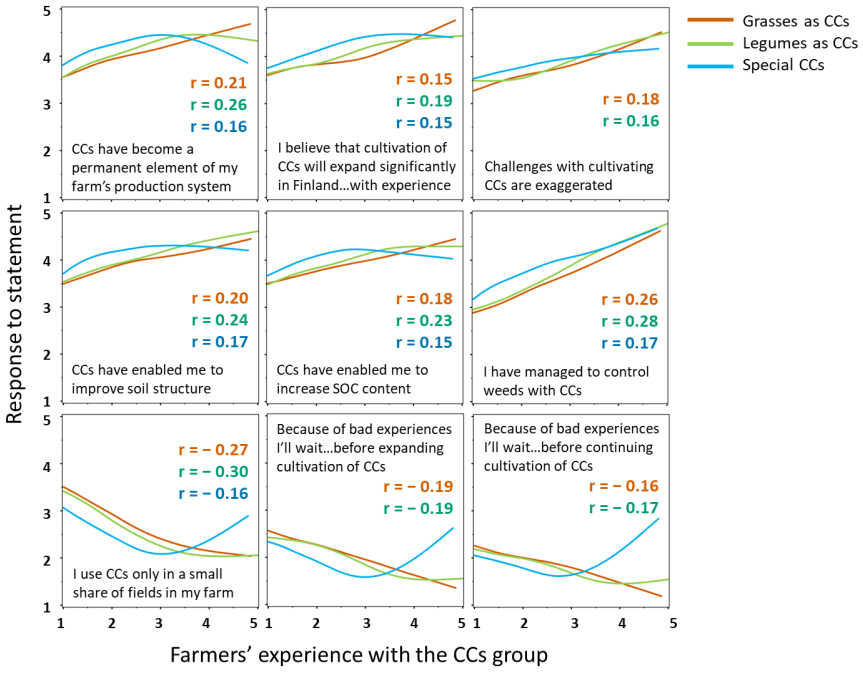

Figure 3. Correlations ($p < 0.0001$) between farmers experiences (1 = none, 2 = very little, 3 = somewhat, 4 = a lot, and 5 = very much) with different groups of cover crops (CCs) and responses to statements on success with CCs (1 = fully disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = fully agree). Correlation coefficients (r) are shown for each CC group.

3.3. Success Depending on Farm and Farmer Characteristics

Organic farmers were more positive concerning their success with CCs compared to conventional farmers (Figure 4). For example, only 1–3% of organic producers disagreed that their experiences had improved in time, CCs had become a permanent element of the production system, the cultivation of CCs would expand significantly in Finland, and the use of CCs had improved the soil conditions. The share of conventional farmers who disagreed was 6–8%. While 84% of organic farmers agreed that they had managed to control weeds with CCs, the corresponding share of conventional farmers was only 36%. In total, 9% of organic and 48% of conventional farmers agreed that they used CCs only on a small share of field parcels. The differences between farming systems were smallest for statements that one can never be certain about the success of CCs and that CCs require special attention when incorporated into the cropping system. Only 3% of organic farmers agreed that due to bad experiences, they would wait for new results before expanding or continuing the cultivation of CCs, while the shares were 14% for expanding and 7% for continuing in the case of conventional farmers (Figure 4).

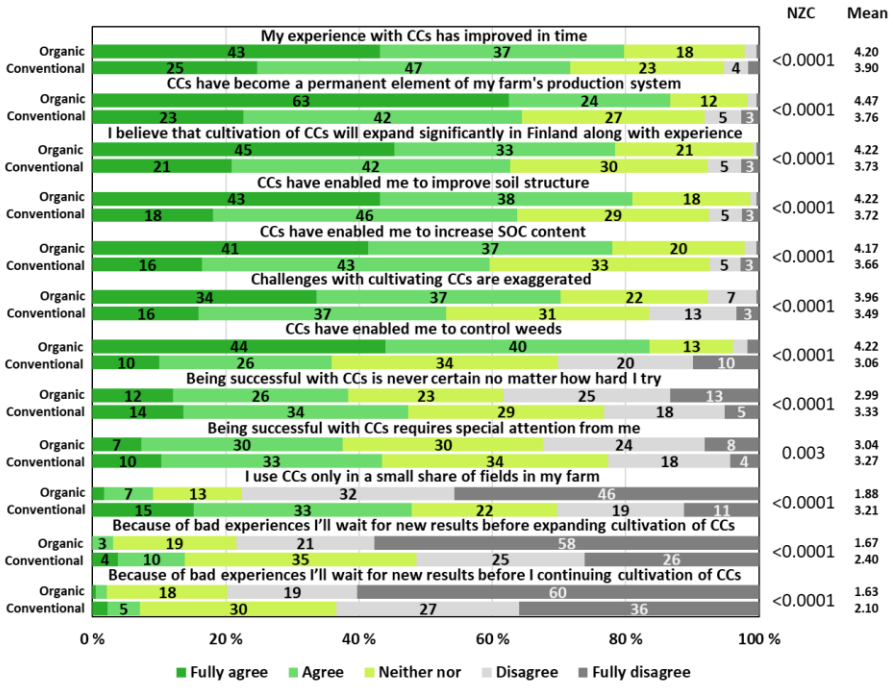

Figure 4. The shares and mean values of the farmers' answers (1 = fully disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = fully agree) to statements on success with cover crops (CCs) depending on the farming system (NZC, nonzero correlation). The shares of answers are shown within each bar except in the case of being <3.

Farmers with larger farms tended to more frequently consider means to increase success with CCs, while farmers with small farms used CCs more often only on a small share of fields (Figure 5). On large farms, the farmers had been less successful in controlling weeds with CCs, and when the farm size exceeded 120 hectares, farmers were less certain about their success with CCs no matter how hard they tried.

When considering differences between farm types, farmers with cereal, special crop, and pig farms tended to differ, especially from those with cattle farms (Figure 6). Farmers on cattle farms agreed less frequently that being successful with CCs required special attention and was never certain, as well as often considering multiple means to increase success with CCs. On the other hand, they were more positive than farmers with cereal, special crops, and pig farms about the success of controlling weeds with CCs. Farmers were more positive about their success as well as the impacts, role, and future of CCs on their farms when they had a lower share of cereal area on the farm when compared to >50% land

area (Figure 7). The case was opposite to grassland areas. Farmers who cultivated special crops on their farms paid special attention to CCs and more often considered various means to improve their success with CCs but were also more uncertain about their success (Figure S1). Farmers who had higher shares of arable land (>50%) for other types of crops (potatoes and sugar beet) on their farms tended to be more positive on the role, impacts, and future of CCs on their farms than those with a <25% share (Figure S2).

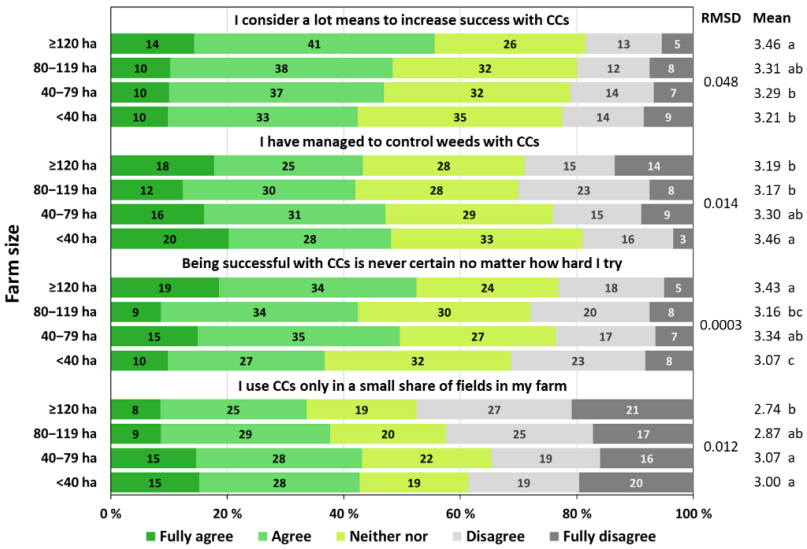

Figure 5. The shares and mean values of the farmers' answers (1 = fully disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = fully agree) to statements on success with cover crops (CCs) depending on the farm size (RMSD, row mean scores difference). Means with the same letter for each statement do not differ significantly.

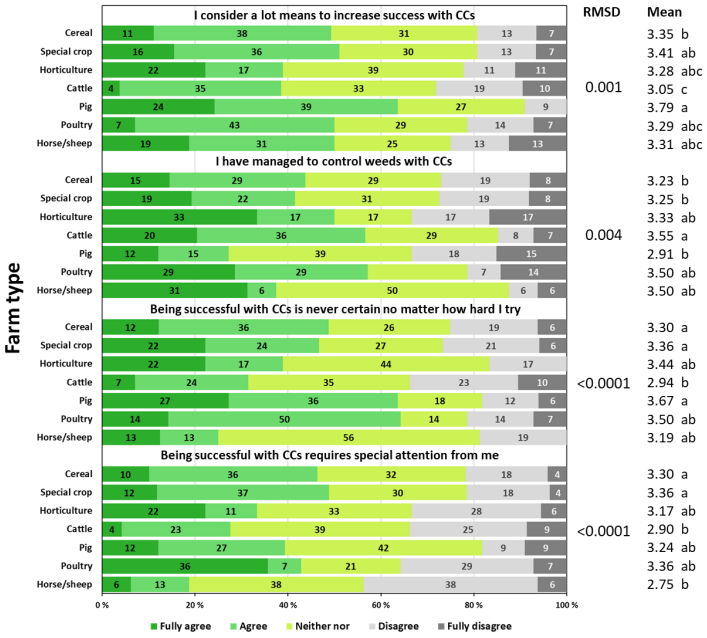

Figure 6. The shares and mean values of the farmers' answers (1 = fully disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = fully agree) to statements on success with cover crops (CCs) depending on the farm type (RMSD, row mean scores difference). Means with the same letter for each statement do not differ significantly.

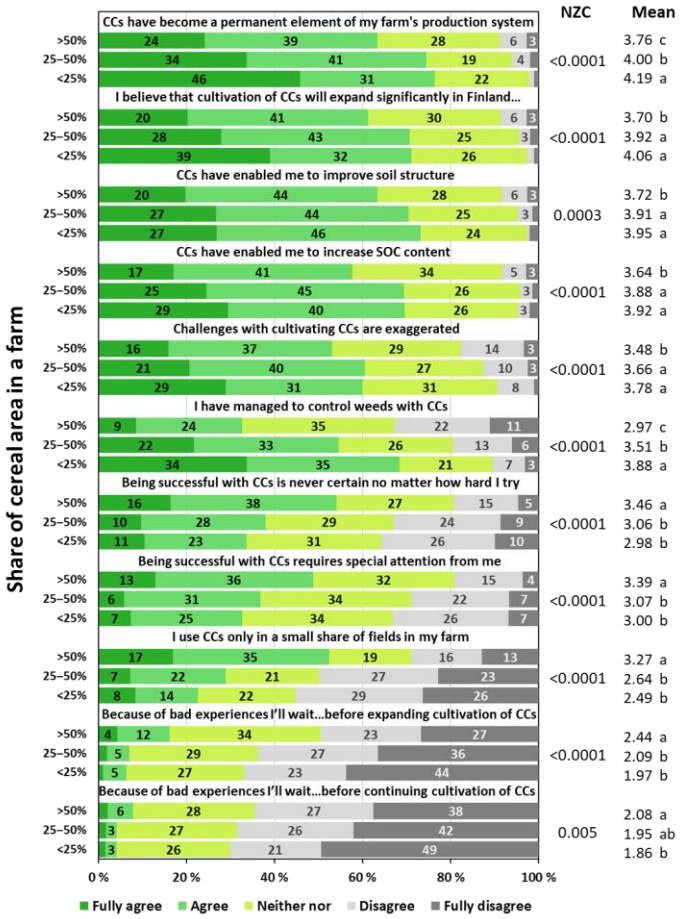

Figure 7. The shares and mean values of the farmers' answers (1 = fully disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = fully agree) to statements on success with cover crops (CCs) depending on the cereal area on a farm (NZC, nonzero correlation). Means with the same letter for each statement do not differ significantly. The shares of the answers are shown within each bar except in the case of being <3.

Despite the many differences found in the farmers' views on their success with CCs depending on the farm characteristics, the farmer's education and age did not seem to have any major impacts on how successful they considered to be with CCs. The only exception was that university-educated farmers most frequently considered that CCs had become a permanent element of their production system.

3.4. Farmers' Wishes for Research to Support Success in the Cultivation of Cover Crops

In total, 22% of the respondents brought up topics on CCs that require additional research in Finnish growing conditions. The number of topics varied from one to ten depending on the respondent. Most frequently (17%), the farmers indicated that crop protection was a topic deserving more research attention (Figure 8). In some cases, they expressed this more precisely to concern weed control, the use of pesticides, the herbicide tolerance of CCs, as well as the impacts on disease pressure and weed infestation. Topics such as the timing of sowing (13%) as well as sowing methods, the use of CC mixtures, and different CC species were all highlighted by 11% of the respondents. In total, 10% of farmers mentioned the impacts of CCs on yields, and 9% mentioned the impact on profitability, while 7% highlighted themes such as differences in the growth performance of CCs, impacts on weed control and nutrients, harvesting methods, support for implementation, and subsidies. The rest of the topics shown in Figure 8 were brought up by less than 7% of the respondents.

Figure 8. Word cloud showing the research topics that were most frequently expressed by the farmers (N = 244) in their free word answers. The share of farmers who mentioned the topic (if ≥7%) is shown next to the expressed research need (two in the case it crosses both topics).

Only some differences were found between farm and farmer characteristics concerning their views on supportive research needs. Organic farmers more frequently emphasized than conventional farmers the need to better share gained experiences and research outcomes, as did those who had low cereal areas (<25%) on their farms and/or experience with special crops (Table 1). Younger farmers (≤50 years) were especially interested in results on the profitability of CC cultivation. Furthermore, farmers in East- and North Finland needed more information about the use of different CC species and sowing methods than those in South Finland. Farmers having very large farms (>120 ha) tended to highlight knowledge gaps on the impacts of CCs on weeds more frequently than those with smaller farms (Table 1).

Table 1. Odds ratios (OR) with 95% confidence limits (CL) showing the significant impacts of the farm characteristics on the probability that a farmer indicated the specific research need in his/her free word answer. When the odds ratio is <1.00, a farmer proposed this research topic significantly less frequently, and when it is >1.00, significantly more frequently than the reference group (following "vs."), provided that the CL did not include the value 1.00.

Characteristics	*p*-Value	OR	95% CL	
Sowing methods:				
West Finland vs. South Finland		2.74	0.75	10.01
Inland vs. South Finland	0.06	0.43	0.04	4.27
East/North Finland vs. South Finland		5.51	1.11	27.29
CC species and mixtures:				
West Finland vs. South Finland		0.73	0.26	2.07
Inland vs. South Finland	0.02	0.35	0.07	1.78
East/North Finland vs. South Finland		3.83	1.10	13.29
Impacts of CCs on weeds:				
Farm size <40 ha vs. >120 ha		0.32	0.10	1.06
Farm size 40–79 ha vs. >120 ha	0.05	0.34	0.11	1.03
Farm size 80–119 ha vs. >120 ha		0.20	0.04	0.94
Profitability of CC use:				
Respondent's age ≤50 years vs. >50 years	0.05	2.53	1.00	6.38
Knowledge sharing between farmers:				
Conventional vs. organic	0.04	0.38	0.15	0.98
Cereal area <25% vs. >50%	0.09	2.99	1.02	8.77
Cereal area 25–50% vs. >50%		1.09	0.33	3.57
Special crop area 0% vs. >10%	0.07	0.32	0.12	0.85
Special crop area <10% vs. >10%		0.55	0.11	2.69

4. Discussion

The cultivation area of CCs has substantially increased in Finland during the last ten years, from about one percent of the agricultural land area (23,000 hectares) [12] to 138,000 hectares in 2020 when the farmer survey was carried out. The area has only slightly increased for the next two years. When considering the cultivation area of field crops by excluding grasslands and environmental fallows, the current area under CCs could be increased tenfold. Ongoing and potential future expansion is likely to face challenges. Hence, the transition requires targeted support provided by research and extension services to fill in the knowledge gaps by involving the farmers in the dialogue [27,29,33,40,41]. The exchange of experiences and knowledge sharing within the farmer community is also very valuable, as was highlighted by the respondents of this survey (Figure 8) and especially by organic producers, those with low areas on cereals while high in special crops (Table 1).

4.1. Successes and Positive Prospects for Cover Crops Coupled with Uncertainties and Feeling of Demandingness

Farmer's perceptions about the likely pros and cons of CCs impact whether they implement CCs into their cropping systems [21], i.e., perceptions roughly divide farmers into adopters and non-adopters. Depending on the survey, adopters were characterized to be, e.g., environmentally more conscious, inquisitive, and receptive, acknowledge potential benefits of CCs, and have available machinery, while non-adopters had, e.g., perceptions about barriers (economic, management), and more rented land [29,40,42,43]. This survey was focused on the experiences of CC adopters only. This likely explains why responses to various statements on success with the cultivation of CCs were, in general, positive (Figure 1), while they differed systematically depending on the farming system (Figure 4). Statements highlighting the success and positive prospects for CCs were agreed with more frequently by organic than conventional farmers, while the situation was the opposite for statements that indicated uncertainties and the demands of CC use. Organic farmers indicated "fully agreed" choices, while conventional farmers "agreed" and made "neither nor" choices more frequently on the positively worded statements. Organic and conventional farmers differed in terms of their rationales for the cultivation of CCs: organic farmers especially valued multifunctionality and various ecosystem services from CCs [44]. Farmers use CCs to increase soil health, decrease soil disturbance, control weeds, and improve nutrient cycling [5,6,8,9,20,45] and, thereby, promote crop yields [2]. Organic farmers usually had more experience with CCs than conventional farmers. Failures may, however, limit the further adoption of CCs [19,24], especially in conventional production. Only a very low share of respondents agreed that they waited for new results before expanding (12%) or continuing (6%) the use of CCs on their farms (Figure 1). In this light, the positiveness of conventional farmers was a surprise, knowing the shorter history of CCs as part of the production systems and that the yield benefits gained with CCs vary greatly depending on climate, management, and soil properties [2]. In Finland, agricultural payments for the cultivation of CCs (EUR 97 per hectare) balance the risks related to the benefits and profitability of their use. This is important during the transition towards regenerative crop production systems [1,30]. Not least, because in recent surveys lack of financial support was found to be a key barrier for deployment of CCs [33–35]. Interestingly, in another study, the majority of subsidized farmers said that they continue to grow CCs even if the incentive is ceased [46].

Farmers seemed to do better with CCs in the case that their land use was not cereal-dominated (Figure 7), which may be attributable to limited experience in cultivating special, diversifying crops [32]. On the other hand, CCs were used especially on cereal farms with the likely aim of restoring the soil structure and condition [23]. Respondents were altogether more positive toward CCs when they were familiar with a high number of CC species (Figure 2), although their experiences did not vary greatly depending on CC groups: grasses, legumes, and special CCs (Figure 3). A higher diversity of CC species and the use of CC mixtures may reinforce success when adopting CCs on Finnish farms,

not least due to the variable weather, which is typical for high-latitude conditions [47]. Acknowledging differences in the functional traits of CCs supports the provision of different services for food production and the ecosystem and enables win-win solutions [48–50]. Organic production leans on various ecosystem services provided by CCs [17,38], and hence, farmers often have more experience with the cultivation of CCs. These may have further supported the shift toward the use of more diverse CC species and their mixtures compared to conventional farming [51]. The difference between farming systems was most striking in how successful farmers were in controlling weeds with CCs (Figure 4). In organic production, CCs act as an important biological tool, but their weed suppression capacity varies depending on the properties of the CCs, as well as the conditions and used crop management [6,7,52–54]. Successes with CCs did not greatly differ depending on the farm size—nor in terms of controlling weeds—but farmers with larger farms agreed more frequently that they considered the means to increase success with CCs a lot (Figure 5).

4.2. Farmers' To-Do List for Research to Support Success with Cover Crops

The farmers indicated a high number of diverse, down-to-earth topics around CCs that require near-future research activities. The knowledge gaps did not strongly vary according to the farm characteristics (Table 1). Crop protection was the most frequently mentioned management practice that would require further know-how (Figure 8), with more precise expressions on growth, suppression, and control of weeds, herbicide tolerance of CCs, impacts of CCs on disease pressure, and pesticide use. Cover crops may either ease, strengthen, or have no effect on biotic risks [55–58]. Concern about crop protection risks was found to be one of the major barriers to the large-scale adoption of CCs in many regions of Europe [33]. In particular, farmers with larger field areas tended to highlight the need for a better understanding of crop protection in the presence of CCs (Table 1).

Many of the knowledge gaps highlighted by Finnish farmers to be relevant in high-latitude conditions were also indicated by farmers from more southern regions of Europe [24,25]. For example, farmers indicated the need for more research on the sowing time and methods. The successful establishment of both crop and CC stands is critical, especially in the case of under-sowing. Early summer drought is common in Finland [59] and may interfere with the growth performance of both crops and CCs and alter the competition between them [37] depending on the sowing method and CC species [60]. Farmers in East- and North Finland needed more information about sowing methods than those in South Finland, which is likely attributable to the lower share of field parcels with CCs and, hence, less experience with cultivation methods for both CCs and special crops due to limitations caused by the northern climate [61,62]. Likely for the same reasons, farmers in East- and North Finland (Table 1) more frequently expressed the need for locally relevant results on the use of different CC species and their mixtures to support the adoption of diverse CCs. Some 10% of the farmers mentioned the impacts of CCs on yield and specified these as yield losses caused by competition with CCs as well as elevation of crop yields in the short term (e.g., nitrogen effects of leguminous CCs) and long term (e.g., through impacts on soil quality). In total, 9% of farmers highlighted profitability. Younger farmers ($\leq$50 years) were especially interested in having more results on the profitability of the cultivation of CCs, i.e., costs compared to benefits and consideration of the monetary value of the short- and long-term impacts on yields and ecosystem services [3,7]. The benefits of CCs tend to accumulate over time; therefore, many surveys have indicated that economic barriers prevent deployment [33–35]. Localized economic information is essential to promote adoption [29]. Even though many farmers are, in general, very interested in using satellite and drone images to aid decision-making [63–65], they did not highlight remote sensing in their free word answers despite the potential.

5. Conclusions

A high share of survey respondents felt that their experiences with CCs had improved in time and were confident that CCs have become a permanent element on their farms

and that the area under CCs will expand significantly in Finland. They also felt that CCs had been an effective measure to improve the soil structure and increase the SOC content, though they felt they had managed to use CCs to control weeds to a lesser extent. Weed control has been perceived as a challenge for the deployment of CCs, as well as in many other regions. The Finnish farmers also felt that the challenges to adopting CCs were exaggerated. The majority of the respondents disagreed that because of bad experiences, they would wait for new results before expanding or continuing the use of CCs. Overall, organic farmers were more positive, which is attributable to more experience with CCs but also their dependence on various ecosystem services that CCs provide as a regenerative practice. Nonetheless, conventional farmers were also confident in their success with CCs. Financial compensation available for Finnish farmers might explain the positive views on adopting CCs when compared to surveys conducted elsewhere. Such a payment compensates for the economic costs and risks of the introduction of CCs. Therefore, the current subsidies offer a good opportunity for a powerful learning-by-doing method to support the adoption of CCs. Therefore, subsidies sound justified as long as the transition towards regenerative agriculture proceeds. The Finnish farmers' free word answers highlighted research needs on topics that were also highlighted in surveys from very different production systems and conditions. They especially listed crop protection, sowing practices, the use of CC mixtures, and a wider choice of CC species, as well as the potential impacts on yield and profitability. The research needs were not widely divided. Younger farmers ($\leq$50 years) who are often more educated highlighted studies on profitability, while farmers from East- and North Finland indicated they would be interested in experiments on diverse CC choices. Dialogue among farmers' community and researchers is needed 1) to share good management practices, as encouraged by organic farmers, and 2) to focus on the highlighted knowledge gaps, e.g., on crop protection and CCs establishment. The response rate was, in general, high (17.4%), but it is possible that positive experiences with CCs encouraged farmers to answer the survey.

Supplementary Materials: The following supporting information can be downloaded at https://www.mdpi.com/article/10.3390/agronomy13092326/s1, Table S1: Results of sampling bias analysis comparing respondents to non-respondents of the survey with total of 6493 invited farmers (17.4% response rate) and in parenthesis respondents to non-respondents of 1354 invited organic farmers (17.1% response rate); Figure S1: The shares and mean values of the farmers' answers (1 = fully disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = fully agree) to statements on success with cover crops (CCs) depending on the area under special crops (e.g., rapeseed, grain legumes) on a farm. Pairwise comparisons are shown next to the mean.; Figure S2: The shares and mean values of the farmers' answers (1 = fully disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = fully agree) to statements on success with cover crops (CCs) depending on the area under other types of crops (potatoes and sugar beet) on a farm. Pairwise comparisons are shown next to the mean. The shares of the answers are shown within each bar except in the case of being <3. Reference [23] is cited in the Supplementary Materials.

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