



Stories to preserve soil quality by using cover cropping in a more post-growth farming approach in Drenthe.

Thesis BSC spatial planning & design Nick Schipper S3784428

Supervisor Lamker, C.

University of Groningen, faculty of spatial sciences

Photo by author: Schipper, N.K. (2021).

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Abstract

The potential of cover cropping for soil quality preservation in post-growth farming in Drenthe is analysed, using the research question: *How can cover cropping be used to preserve soil quality on a municipal spatial scale in a more post-growth farming approach in Drenthe?* In order to examine this, a combination between in-depth interviews with farmers alongside a systematic literature review of relevant literature and in-depth content analysis of relevant case studies, is applied.

Throughout this study differences emerge between arable farmers on the one hand, indicating improved soil quality through improved drainage, better rooting and the need to use less artificial fertilizers. And dairy, beef and cattle raising farmers on the other hand, who consider cover cropping as an obstruction which decreases their potential harvest. Application on a municipal spatial scale can be achieved by aiming at the arable farmers, as these use more cover cropping and are already aiming at improving the application-scale. Important here is a location-specific, tailor made and target group-oriented approach, due to soil conditions being different at each individual plot of land. Furthermore, financial support managed by the municipality is considered a highly convincing method to involve these arable farmers as the costs of extra labour and finances are often very risky, especially when the cover crop fails.

Keywords

agriculture, soil quality, environmental planning, post-growth, cover cropping.

Introduction

With increasing ecological and environmental awareness, combined with social and economic crises, the idea of continuing economic growth as a form of welfare is increasingly being questioned (Harangozo et al., 2017; Koch, 2020; Sparrow et al., 2008; Todaro & Smith, 2014). Postgrowth, where the focus is no longer on continuing growth but on sustainable economic functioning and planning, is increasing subject to studies (Lamker & Schulze Dieckhoff, 2020; Ferreira & von Schönfeld, 2020; Jackson, 2009; Jackson, 2018; Todaro & Smith, 2014). Farming involves similar issues, farmers in Drenthe were stimulated to increase the scale at which they operated. This can be seen through land consolidation, aimed at continuing growth of farms and increasing production levels (Brussaard, 1992). However, recently a new development commenced in Drenthe, environmental concerns and impacts (DVHN, 2019; Knijff, 2018). Studies have already indicated that long lasting intensive agricultural usage of a land plot can decrease soil quality (Beretta-Blanco et al., 2019; Lal, 2013). Simultaneously cover cropping has positive effects on preserving soil quality, however these are on individual land plots (Soltangheisi et al., 2020). In order to achieve larger municipal scale benefits of cover cropping, municipal spatial planning is required. Here is a problem, no literature is available on this and no practical larger scale examples are available. Furthermore no literature is available on how municipal spatial planners can apply cover cropping on a municipal spatial scale. Cover cropping has the potential to contribute to a sustainable approach in agriculture, this due to soil improvement capabilities and the capacity for CO₂ uptake throughout the year. This supports the current aim to have many people doing smaller individual interventions in order to reduce emissions and to have a more sustainable society. Thus not only resulting in scientific, but also societal relevance.

Preserving soil quality is a major challenge in agriculture in Drenthe. Excess nutrient usage with phosphorus (P), potassium (K) and nitrogen (N), pesticides, other plant protective products, natural nutrient removal and erosion are matters of concern (DVHN, 2019; Marshak, 2018). Unfortunately another research gap exists here, post-growth studies are mostly related to either spatial planning or economics (Lamker & Schulz Dieckhoff, 2020; Jackson, 2018). The combination with agriculture does not explicitly exist yet and no studies have been conducted into the relation between these and cover cropping in post-growth farming, this is the scientific relevance of this study. On the other hand, societal relevance can be found in little available literature in the province of Drenthe along with a lack of knowledge on how to apply municipal scale cover cropping. Furthermore, soil quality is a growing concern in the municipalities in Drenthe and few practical solutions have been created yet (DVHN, 2019). Based on this the following main research questions and subquestions are created:

Research question:

How can cover cropping be used to preserve soil quality on a municipal spatial scale in a more post-growth farming approach in Drenthe?

Sub Questions:

- 1:How are post-growth farming and cover cropping related?
- 2:What are the advantages and disadvantages of cover cropping?
- 3:How can cover cropping preserve soil quality?
- 4:How can municipal spatial planning play a role in preserving soil quality?

The thesis is structured as follows, after the summary and introduction the theoretical framework is discussed. There, the most important concepts are mentioned and explained. Along with this, expectations from the author. Afterwards the methodology is explained. Choices for data gathering, analysis and interpretation are clarified here along with the ethical concerns during this study. This is done to provide for a transparent study which can be seen as reliable and repeatable.

Afterwards the results are discussed, these results are based on primary and secondary data and feature the answers to the research questions above. Primary data is explained through narrative storytelling, this helps in providing a mental picture for the reader to assist in understanding the results. The reader is taken along on a trip throughout Drenthe where several farmers tell about their experiences and how larger scale applications can be implemented. These stories are described after the results based on literature and case studies. By doing so, any similarities and/or differences between the literature/case studies and the empirical part of this research are clearly visible and illustrated.

Finally, a conclusion and discussion section is present. Here the most important findings are briefly summarized, while in the discussion part, the strengths and weaknesses are discussed. Eventually, suggestions for future research are made.

The last section contains the references and appendices, here, all references are mentioned according to the Harvard style. While in the appendices, the answers obtained during the interviews can be found, along with the coding reports.

Theoretical framework

Here the most important concepts are defined.

Cover cropping: Crops grown after the main crop has been harvested on arable land in fall. Which mostly serves to prevent soil erosion by using a vegetative cover while preserving soil and environmental quality (Latos, 2009). This is a very straight-forward definition of cover cropping, most other literature used does show examples, however no explicit definition is mentioned. Therefore this definition is used.

Post-growth farming: This term is completely new, at the moment of writing. No sources are available on this specific term. Therefore a new definition is created for this study based on the work on post-growth economics and planning by Claeys, 2017., Daly, 2009., Harangazo et al., 2017., Herman, 1997., Lamker & Schulze Dieckhoff, 2020., Koch, 2020., Jackson, 2009., Jackson, 2018 and Todaro & Smith, 2014. Post-growth farming is a future approach which acknowledges the environmental and natural limits to growth in farming and instead focuses on a long term sustainable type of farming. Where profitability and increasing scales are no longer a sole primary concern, see figure 1.

These sources are used because they indicate several descriptions of post-growth, furthermore they indicate requirements for post-growth economics and planning approaches.

The two concepts above are the most important throughout this study, post-growth farming focusses on long-term sustainability for the environment. In order to do so, soil quality has to be preserved. As the soil lies at the heart of all agricultural activities, cover cropping can be useful here (Lal, 2008; Lal, 2013; latos, 2009; Soltangheisi et al., 2019; Schjønning et al., 2004). However, currently, cover cropping is only executed on smaller individual land plots. Many farmers do not yet use cover cropping in Drenthe and in order to achieve municipal scale benefits, spatial planners should be involved. This can be seen in the amount of sources on soil quality and post-growth, however the link between these two concepts does not exist yet and farming is not yet addressed in post-growth literature.

This study will not focus entirely on soil quality, however it will use some concepts from soil science and related studies, such as sustainable land management, in order to examine benefits and how cover cropping can be applied on a municipal spatial scale.

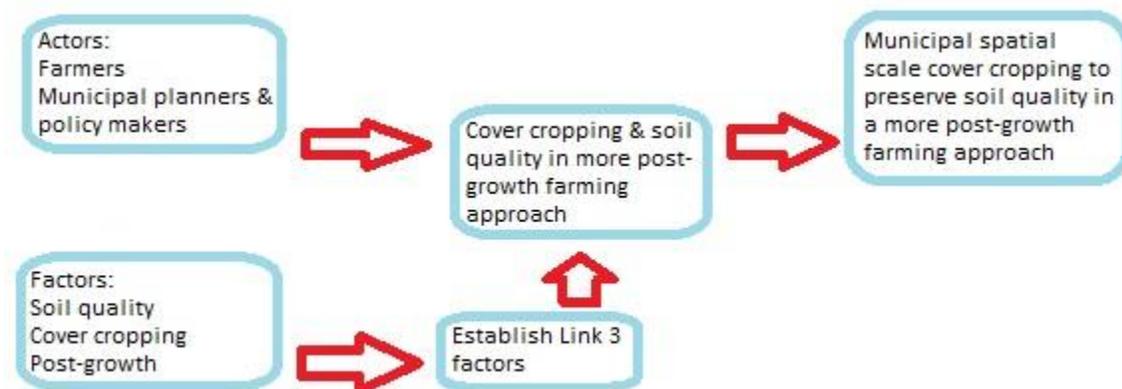


Figure 1: Conceptual model

As this study is qualitative, the following is an expectation rather than hypothesis. Expectations are that cover cropping reduces the amount of fertilizers N, K and P in the soil and the soil's

need for these fertilizers, simultaneously it adds natural organic fertilizer to the soil which preserves quality. Advantages and disadvantages are seen on individual parcels of land from individual farmers, mostly improved quality and soil life as advantages and costs as disadvantages. However in order to achieve municipal wide benefits, spatial planning is needed. A combined approach, consisting of tailor-made solutions and close collaboration between private and public actors are required to achieve municipal scale benefits of cover cropping. Furthermore as costs are expected as a major disadvantage, some subsidies from the municipality or other actors could prove very beneficial. The link between cover cropping and post-growth is mostly the focus on long-term sustainability. And not just the focus on short-term profits and productivity.

Methodology

Primary data:

Sub Questions 1, 2 and 3 are partially answered using primary data, subquestion 4 is mostly based on primary data. As literature on this is scarce at the time of writing. The data comes from 5 interviews with farmers in different sub sectors of agriculture in Drenthe, who already use some kind of cover cropping or have used it in the past. The photos serve as illustrations to show examples of how cover cropping is currently done. In selecting locations for the photographs the location is not specified, furthermore, the photos are made in such a way that the specific location can not be determined by the photo alone.

The interviews aim at the experiences and opinions of farmers themselves, the questions for the interviews are indicated below and are formulated in such a way that they can not be used to identify the respondent. Also, the questions here as well as in the study are in English, however the interviews themselves are in Dutch. They remain original in the appendices, so anyone can read the responses, however during this study the questions are in English.

The results are written in a narrative story, where the reader is taken along on a trip with the farmers in Drenthe to share experiences. The coding reports from atlas.ti can also be found in the appendices. Thus, an international audience can also read and understand the questions and answers. At the time of writing, farmers are warming up to prepare their land, therefore the interviews are 30 minutes maximum. For this study, qualitative interviews are used due to their capacity to delve into the subject and get a good understanding from the farmers themselves. Unlike many soil science studies which are quantitative and do not take the farmers' experiences into account. Furthermore, due to COVID-19 measures still in place at the moment of writing the interviews are conducted via the telephone, or, when explicitly asked for, in person, in april. Participants are recruited this way as well, by first contacting those already known and then using a respondents network to reach out to other farmers. The data will be coded accordingly, using the programme atlas.ti. The choice for atlas.ti for the interviews is due to previous experience in several other studies, positive experiences after these studies and the user friendliness while allowing easy analysis and systematization of qualitative data. The interviews are stored in a secured file with password on a private computer. As indicated before, interviews are anonymous. The interviews do not contain any information which could be used to identify the location or identity of the respondent, furthermore interview questions are mostly open-end questions. This way, the opinion and experiences of respondents can be incorporated instead of having just yes or no as answers.

Interview questions:

- 1: *On what percentage of your land do you use some kind of cover cropping?*
- 2: *What differences have you noticed in soil quality with plots where you don't use cover cropping?*
- 3: *Which advantages and disadvantages have you seen?*
- 4: *Would you like to apply cover cropping on more plots of land, if yes what are your main reasons for doing so?*
- 5: *How would you like the municipality to play a role in large scale application of cover cropping?*

Secondary data

Case studies and relevant literature are used to answer the four sub questions as well, these sources are located through worldcat provided by the Groningen university. This is limited to academic sources, filtered according to their relevance and usefulness. Relevant literature is related to topics on post-growth (planning and economics) land management and soil quality, by applying a systematic literature review any relevant information in this literature is used to answer the research questions.

A content analysis is applied on the relevant case studies, information from these case studies is used to answer the research questions based on studies conducted elsewhere. The focus is oriented towards the advantages and disadvantages of cover cropping, effects on soil quality and, if the case, the role of the municipality.

The study of secondary data is done before and after the collection of primary data. By doing so, a theoretical understanding is created about the topic. This will make the collection of primary data easier, as it is known what to ask and what to look for. Simultaneously it is easier to understand the responses from respondents. These respondents have experience with cover cropping, in order to fully understand and analyse their responses a strong theoretical understanding must be built on forehand. After primary data collection, the same studies are again examined to find possible similarities and differences. Therefore, primary data collection depends on accurate secondary data analysis.

See figure 2 for a brief overview of data analysis.

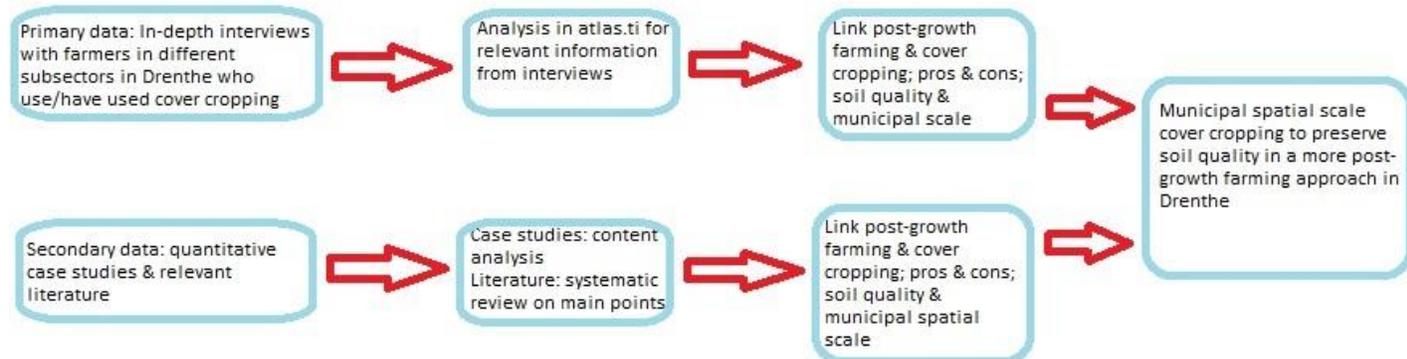


Figure 2: data analysis scheme

Results

The four photos below serve as examples of how cover cropping is currently present in Drenthe.



Figure 3: After grain harvest, rammenas leaf was sown as cover crop. Keeping the land green and adding organic matter to the soil.



Figure 4: Shortly after mowing the cover crop on a field with sugar beets, a thick layer of green organic matter is ready to be used as green fertilizer.



Figure 5: After the harvest of corn, grass was allowed to regrow. Taking up excess nitrogen, after plowing, this re-enters the soil as organic matter.



Figure 6: Also after the harvest of corn, the harvest on this plot failed however as well as the sown cover crop.

“How Big is big enough?” as stated by Harongozo et al., 2017 describes the issue perfectly. The effects on soil quality due to long-term agricultural production are known, decreasing natural nutrients and quality are observed (Beretta-Blanco et al., 2019; Lal, 2013).

Post-growth farming, as defined in the theoretical framework, involves long-term sustainable farming; cover cropping plays a role here due to reducing the need for artificial fertilizers (Cates & Jackson, 2019). In post-growth, the focus should not be on continuing growth, which causes further quality decrease (Beretta-Blanco et al., 2019). In post-growth planning the work from Lamker & Schulze Dieckhoff, 2020 illustrates good examples of how cover cropping and post-growth farming can be linked together. Post-growth planning can cause transformations through small-scale interventions, it is experimental and learns from failures. Cover cropping is therefore a good intervention. It is applied on smaller scales, most notably individual land plots from individual farmers. Involved actors can experiment with cover cropping to see which approach or crop works best. They can learn from failures and successes, and apply the best possible solution, this can be translated into a location-specific and tailor-based solution and also suggests the importance of the state in a post-growth approach (Koch, 2020). A post-growth approach also requires good communication between actors, as indicated above, since individual assessment monitoring programmes alone are insufficient (Sparrow et al., 2008).

The farmers in Drenthe noticed the environmental issues in Drenthe, especially the loss of soil quality. They have noticed that cover cropping has potential to preserve soil quality, however results differ amongst different subsectors. “Even within a single company!” Says one farmer, while another one adds “i try to experiment as much as possible, to see what works”.

By using cover cropping, buying new machines for this cover cropping, by still applying it despite the disadvantages and by investing both time and money in cover cropping, the farmers have shown that agriculture in Drenthe is taking on a post-growth approach. And cover cropping has a vital role to play in this post-growth farming approach by not only preserving the soil quality, but also by allowing farmers to experiment with methods which are best suited to them.

Cover cropping preserves soil quality in several ways, Reicoski & Forcella, 1998 indicate that cover cropping is vital. As it serves as an organic carbon source, see figures 3, 4, 5 and 6 as

examples. They also describe a post-growth approach in this, where a sustainable environment, economic wellbeing and high quality of life are all addressed. This connects post-growth to cover cropping; as seen with 6 elements needed for post-growth planning described by Lamker & Schulze Dieckhoff, 2020. More on this is discussed later in this section. Cover cropping also increases the growing season length in annual agriculture; which increases organic carbon uptake from the soil (Cates & Jackson, 2019). However the same study also indicates strong differences, for example between *Secale Cereale L.*, *Poa pratensis L.* and *Zea mays L.* These three species have different effects on organic carbon uptake by the soil, a similar observation was already made by Mingwei et al., 2017.

Another important aspect of cover cropping is the capability to reduce the demand for inorganic fertilizers such as phosphorus (Soltangheisi et al., 2020). Finally, cover cropping adds natural fertilizer to compensate for nutrient uptake by the production crops. Sometimes up to 100-150 kilograms of nitrogen, phosphorus and potassium per hectare (Sogbedji et al., 2006). By applying cover cropping, these three most important nutrients are added to the soil again which reduces the demand for inorganic fertilizers (Lal, 2008; Sogbedji et al., 2006).

Farmers in Drenthe have seen different results in soil quality after the application of cover cropping, however these differences are contradicting. The arable farmers indicate improved water holding capability, less soil erosion in the winter, better rooting from the production crop and less need for artificial fertilizers. These farmers are very satisfied with their cover cropping efforts, "having no soil erosion in winter makes the first tasks on the land during spring a lot easier" said one farmer. While another indicated "water holding capabilities of the soil are now much better during the summer, this saves time and effort".

Another farmer confirmed this, also indicating that precipitation was better absorbed on plots where cover cropping was applied. "Besides the positive effects on soil quality, we have also seen several fauna species using the cover crops as a shelter."

Dairy, beef and cattle raising farmers however have negative experiences. "I was unpleasantly surprised to see corn about half the height it should be, along with weeds growing in between" Another farmer says something similar, but also adds "it is a compulsory obstruction". A biological farmer no longer had to apply cover cropping, saying "I have covered the land with productive crops throughout the year, for example first corn for my cattle, followed by winter rye".

But why these differences? One farmer says "the arable farmers are allowed to use more fertilizer. Current policies are based on results originating from elsewhere, without considering the colder climate here."

The arable farmers confirm this by indicating a small amount of fertilizer is needed to provide the advantages of cover cropping.

Cover cropping has both advantages and disadvantages, as already mentioned, cover cropping has the potential to reduce the need for artificial fertilizers, improve water holding capacity, reduce nutrient losses, adding organic matter and better rooting for the main production crop (Mingwei et al., 2017; Soltangheisi et al., 2020; Sogbedji et al., 2006; Latos, 2009; Schjønning et al., 2004). This is due to cover cropping providing cover, and due to roots holding the groundwater nearer to the surface. Good examples of this are found in figures 3 and 4.

Disadvantages are mostly costs, excess water use during draughts and every single cover crop has different effects, this is also indicated by Cates & Jackson, 2019 and Reicosky & Forcella, 1998. Since other studies, such as Mingwei et al., 2017, are quantitative soil science studies, costs are not taken into account as disadvantages. These costs emerge due to extra time and money required for sowing, as well as increased water uptake during droughts. Finally, every crop has different demands. Which also results in different effects of a cover crop on soil quality.

Despite good potential, cover cropping has major disadvantages as well. The dairy and beef farmers in Drenthe often do not have positive experiences with cover cropping, with corn for cattle feed it can be seen that cover cropping only seems to work with additional nitrogen rich fertilizer. If this is not applied, the corn harvest next year is actually worse with cover cropping. These farmers often see an increase in weeds, yellowish grass, decreasing productivity and extra costs to buy this cattle feed elsewhere. These farmers are often subject to a large number of rules on all governmental levels, strict deadlines related to corn growing and amount of fertilizers which can be used. "Sandy soils in Drenthe are naturally nutrient poor, the climate here is colder when compared to further South and the municipality has already limited the maximum amount of fertilizers we can use".

The arable farmers shed a different light on the disadvantages, "for us, it's mostly costs". One farmer had decided to really apply cover cropping on all plots, they even decided to buy a front valve mower and cultivator designed specifically for cover cropping.

"Initial costs are indeed high" according to these arable farmers, "furthermore, the cover cropping has to be destroyed before entering the soil again. This causes an increased cost and labour intensity in spring".

"Remember what I explained about water holding capacity? And how this improved due to cover cropping? This is also an issue, I have to wait longer to access the land due to it being wetter with cover cropping. And it dries much slower."

An interesting note here is how nematodes in the soil respond in two different ways on cover cropping "Nematodes seem to multiply much faster with certain types of cover cropping, we therefore are going to try a different kind of cover crop which prevents this".

"Based on my experiences that will work" says another, "some cover crops i use already prevent nematodes multiplying". See figure 3 as an example, as well as figure 6.

Application of cover on a municipal spatial scale is new in academic literature; most studies on cover cropping and soil quality address a specific production crop or they look at the effects on soil quality only. Also, most studies do not explicitly mention spatial planning. Fortunately some of these studies do provide information to how municipal scale application could look like, for example Cates & Jackson, 2019 and Mingwei et al., 2017 indicate several aspects of cover cropping which are vital in a municipal scale application. However they do also indicate the importance of land management. Some of the other studies do indicate how a post-growth approach can be applied, for example by a democratic and just approach, where experiments and learning from these experiments and mistakes are vital (Lamker & Schulze Dieckhoff, 2020). The ever increasing attitude of bigger and more production as described by Brussaard, 1992 is no longer considered efficient (Jackson, 2009; Jackson, 2018; Todaro & Smith, 2014). A more realistic approach has to be taken which also focuses on long-term sustainability (Claeys,

2017; Daly, 2009; Schmidt, 2019; Todaro & Smith, 2014). Not just in spatial planning, but also in economics and perhaps most important psychologically (Ferreira & von Schönfeld, 2020; Harangozo et al., 2017). Although an issue emerges from this post-growth literature, it addresses the idea of less growth. However agriculture is responsible for feeding a growing population, it is therefore important not to have a sole post-growth farming approach. Notice the need for communication between involved actors, another vital aspect is to realise that soil monitoring and assessment programmes alone are not sufficient to apply cover cropping on a larger municipal spatial scale (Sparrow et al., 2008).

Since cover cropping is a good example of a bottom-up initiative, it is important to include all involved actors, together with the municipal spatial planner. However, as can be seen below, the focus should be on arable farmers. Thus also indicating a target group-oriented approach in municipal spatial planning when applying cover cropping.

The municipal spatial planner has the capacity to determine which and where measures should be taken, since farmers do have to upload data on their plots, the required data is already available. Cates & Jackson, 2019 and Soltangheisi et al., 2020 already indicate different effects regarding soil, fertilizers and types of cover crop. This also suggests the importance of a location-specific and tailor-made solution which should be applied by the municipal spatial planner. This could unfortunately be labour and capital intensive, as the spatial planner has to be aware of the soil conditions and issues on individual land plots. It could be useful to focus on those farmers who apply cover cropping the most, the arable farmers.

Since cover cropping allows for CO₂ uptake during the winter months and decreases the need for inorganic fertilizers, it contributes to a more sustainable approach in agriculture.

This is very much in line with the decentralisation process as described by Zuidema & de Roo, 2014. This decentralized approach from the Dutch government has allowed local municipalities to also implement their own rules and regulations in environmental planning, which also applies to cover cropping as this can be considered a complex case which requires both technical top-down and communicative bottom-up approaches (Zuidema & de Roo, 2014).

However a critical point must be made, as indicated by Zuidema & de Roo, 2014, little is known about the results of decentralizing. Many tasks and responsibilities were given to the municipalities, however issues which cross municipal boundaries, such as soil quality preservation in agriculture, are difficult to address in a decentralized manner. This is due to different, contradicting and conflicting policies and stakes (Zuidema & de Roo, 2014). Also the following question can be asked: Do the municipalities have the capacity to truly apply a bottom-up, target group oriented, tailor made and location specific approach for all the farmers in their jurisdiction? Since much is still unknown, this question does not yet have a clear answer (Zuidema & de Roo, 2014).

“For dairy farmers the municipality has much stricter fertilizer rules in place, we are simply not allowed to use as much as arable farmers, why? no idea” Says one farmer, also indicating this is probably the reason why cover cropping seems to work much better for arable farmers.

“By making it an obligation you do not really involve us in the process, it becomes a forced obstruction which only creates more work” says another. Indicating the municipality already has a role in applying cover cropping on a larger municipal spatial scale, however it is the wrong role.

“Financial compensation performs miracles” says an arable farmer, “costs are mostly the issue. Financial compensation managed by the municipality ensures encouragement.”

All farmers indicate differences in their land, different soil compositions, different qualities and hydrological aspects and differences in presence of natural nutrients. This indicates the importance of a tailor made and location specific solution, as one farmer indicates “The municipality simply looked elsewhere and copied that policy, they did not even look at the possible differences in soil and climate”.

Another farmer adds to this, “currently, the municipality forces cover cropping on to us. However they do not encourage or allow us to do things differently, or to come up with our own suggestions. This is very limiting to the way I would like to run my business and also leads to misbehaviour”.

There should be clearer rules in place, the current rules are confusing and often contradicting.

“We all have to submit our combined statement, or gecombineerde opgave in Dutch. These records can be accessed by all government levels, so they have the required data from us. Why are they not using this to create a tailor made solution for us?” An arable farmer adds to this, “If you do things right, the costs will repay themselves. However when things do go wrong with cover cropping, financial security would be very welcome.”

Another farmer adds a completely different point to the story, “The municipality has limited roles in this, they can explain and teach people what is going on with and on our lands. The national government should play a role as well, mostly in allowing us to use byproducts and animal fertilizers from our own production chain. For example, Betacal.”

Conclusion

Continuing to increase the scale of farming may be profitable in the short term, but is not sustainable in the long term. A sustainable and realistic approach where increasing scales are no longer the primary concern, and long term sustainability go hand in hand, is needed, cover cropping can play a vital role in this. Post-growth planning and economics are experimental and learn from failures. By applying cover cropping, farmers, municipal spatial planners and policy makers can experiment and learn from failures and successes alike. Based on this, small individual initiatives from individual farmers serve as experiments from which can be learned. Cover cropping is also an application which combines the short term productivity with long term sustainability in a very realistic manner, it allows the soil quality to recover after a period of use for intensive production and contributes to a sustainable approach as it makes the soil healthy and usable for a longer period of time.

However, it is important to include post-growth aspects like cover cropping and not just focus completely on post-growth or degrowth farming. This is due to an increasing population to be fed, and many post-growth studies do not keep this into account.

Cover cropping can improve soil quality in several ways, it adds an organic source of the most important nutrients nitrogen, phosphorus and potassium. This results in a reduced need for inorganic or artificial fertilizers. Soil quality can also improve through an increase in soil biodiversity, such as nematodes, however this strongly depends on the type of cover cropping as some species can benefit soil biodiversity, while others negatively affect this. Furthermore, cover cropping leads to improved rooting of the main production crop. Soil quality also improves through better water holding capabilities and easier infiltration of precipitation, due to less soil erosion.

Advantages and disadvantages of cover cropping are as expected, however many differences are also observed. Advantages are long-term, with improved soil quality due to adding organic matter and nutrients, less need for inorganic or artificial fertilizers and improved water holding capacities. Along with improved rooting of the main production crop. However many disadvantages are also observed, cover cropping always needs additional fertilizer in order to be successful. This was already suggested by some studies but not further clarified, however all interviews in the appendices indicate this importance as well. Different issue, as expected, is costs. When applying cover cropping, extra costs have to be made in the form of both finances and labour. Another issue is when cover cropping fails, if this happens, cover cropping is rendered completely useless. Dairy, beef and cattle raising farmers only experience negative aspects on their cornfields, with the exception of better rooting. Not being allowed to use as much fertilizer as the arable farmers mostly causes cover cropping to fail for them. Corn production, for example, is reduced by half. Which forces these farmers to buy corn elsewhere. Biological farming is somewhat of an exception here, cover cropping is not used there, as these farmers have productive crops throughout the year. Unfortunately, biological farms alone are insufficient to keep up supply with demand.

Application of cover cropping on a municipal spatial scale is needed in order to maximize the advantages and benefits observed, however in order to do so several things are needed.

Following this study is that issues, such as mentioned above, can not be solved by one actor alone, some literature already suggested this and the respondents from the interviews also indicated this. These issues can only be addressed if all involved actors share a part in possible solutions, not just the farmers themselves. But also the citizens and their initiatives, non-agricultural businesses and businesses surrounding the agricultural industry, NGO's, governmental actors and also quite important, independent research institutions such as research and applied science universities.

Firstly, a focus should be on arable farmers, as they use cover cropping the most. This emerged from the interviews in the appendices, it is also more realistically achievable in terms of human and capital resources. This also suggests a target-group oriented approach. Secondly, fertilizer rules should be less strict. At the moment, fertilizer rules for dairy, beef and cattle raising farmers are stricter and dates on which corn should be harvested and cover crop sown do not work in the colder climate in Drenthe, Therefore cover cropping does not work for them while they would like to apply it on a larger scale.

Thirdly, as partially expected, a tailor-made solution along with a location-specific approach has to be applied by the municipal spatial planners and policy makers. Each and every plot of land is different, requires different nutrients and has different problems.

This should be taken into account when creating policies and spatial plans for cover cropping on a municipal spatial scale.

Fourth, the points above are possible due to the decentralization reforms in the Netherlands. However due to the large scale of agriculture, some top-down involvement is needed.

Last and not least, a financial compensation for cover cropping. Cover cropping requires extra labour and financial resources, this comes with a risk, if cover cropping fails these resources have been wasted. The municipality should create and manage a central "money jar" with money being put in by the farmers, civil initiatives and others involved. This money can then be used to financially support farmers if they wish to apply cover cropping on a larger scale, to make investments in mechanisation or to compensate for failure in applying cover cropping.

Discussion & further research

An important starting point must be made here, the author is an insider. Having grown up in a biological agricultural company, this allowed to have basic knowledge on the topic early on. While also being familiar with those already applying cover cropping.

Being an insider, who is concerned with long-term sustainability, sufficient production and liveability in agriculture allowed for a neutral and objective view during this study. Where the focus was not to convince just one, perhaps ideological, part. But to address both short-term liveability and profits, while also doing so for long-term sustainability. Discovering completely new and unexpected aspects about cover cropping and examining and including those in this study is a good example.

Coming across these unexpected new aspects led to a much better understanding, as well as more suggestions on future research. Perhaps even more important, it allowed to develop a strong and critical approach to this study.

The biggest strength of this study is that it addresses a link which has not been established previously, work is already done on post-growth. Mostly in planning and economics, the same applies to cover cropping and its effects on soil quality. However linking all these together and involving spatial planning as well was not done before, the need to do so was there however. This can be seen in the societal and scientific relevance described in the introduction section. Another major strength is the qualitative nature of this study, all soil science and land management literature used in this study is quantitative.

However this study is qualitative, with experiences and opinions from farmers, which, sometimes, are completely different from these quantitative studies.

Furthermore a suggestion is made on how to apply cover cropping on a municipal spatial scale, this suggestion is based on the examined literature and case studies, as well as on empirical research involving in-depth interviews with farmers. This can not be found in soil science studies used as the theoretical basis for this study.

The major weakness of this study is the absence of soil quality measurements. All information regarding this is gathered through interviews, relevant literature and case studies. This is done for various reasons: firstly, literature about soil quality is already plentiful and easily accessible. As well as data on soil quality. Secondly, this study aims at spatial planning, not soil science. Its main purpose is to clarify how it could be applied on a larger municipal spatial scale, as this is a concern in society and there is no literature available on this.

Another key point must be made here, the conclusions and results are realistically achievable due to decentralization. However the large scale of agriculture and individual farms in the Netherlands, as well as the complex character, does imply the need for some top-down technical approach.

Although the measurements on soil quality were not done for this specific study, they could have been very helpful in further clarifying the potential positive and negative effects. This is therefore also suggested for future research, furthermore a lot of literature suggested positive effects of cover cropping on biodiversity. Not just species, but also functional biodiversity both in and on the soil. Similar results surfaced after the primary data collection through interviews, however it was not addressed in this specific study. It would be very interesting to see how cover cropping could benefit biodiversity in and/or on the soil for further research, since this is also a concern

going on in society. A third suggestion can be made on examining the relation between cover cropping and hydrology, for example how cover cropping could impact the groundwater table. Some examined studies and literature briefly touched upon this, as well as the respondents who already indicated soil quality improvements due to better water holding capabilities and easier precipitation infiltration. However it is not addressed here in detail. A fourth suggestion can be made as well, a similar study to this one, however near natural areas and parks. As described earlier in the conclusion, the spatial scale at which farmers operate is very large. Often they are not just dealing with the municipality in which they live, but also other municipalities and even the province. This results in farmland being right next to sensitive natural areas, future research could focus on how cover cropping affects this and if application near these areas could reduce nitrogen deposition there.

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Appendices

Interviews

Interview 1:

1: Op welk percentage (ongeveer) van het totale land wordt gewas bedekking/groenbemester gebruikt?

Nu 0%, daarvoor variërend. Enkel van maïs naar grasland.

2: Zijn er verschillen te zien op deze percelen ten opzichte van percelen waar het niet wordt gebruikt?

Geel, onkruid, slechte opbrengst, met maïs is de oogst zelfs minder.

3: Welke voor- en nadelen zijn er?

-: Werkt niet met de huidige bemestingsregels, opbrengst is slecht, lagere bemesting hoeveelheden in Drenthe ten opzichte van bijvoorbeeld Brabant. Daardoor een lagere opbrengst in zowel gras als maïs.

+: geen

4: Zou u dit op meer percelen willen toepassen? Wat zijn de voornaamste beweegredenen voor deze keuze?

Nee, heeft geen toegevoegde waarde, voor ons als melkveehouders heeft het geen toegevoegde waarde. Wel voor akkerbouwers, komt door lagere stikstofwaarden in Grasland & hogere bemesting op akkerbouwland.

5: Op wat voor manier zou de gemeente een rol kunnen spelen in grootschalige toepassing van gewas bedekking/groenbemesting?

Soepelere bemestingsregels voor melkveehouders, overzichtelijker regels, niet verplicht maken, soepelere regels voor maisoogst, regels specifiek voor koudere omgeving & armere gronden in Drenthe. De gegevens hiervoor moeten middels gecombineerde opgave worden verstuurd dus dat is makkelijk te realiseren.

Interview 2:

1: Op welk percentage (ongeveer) van het totale land wordt gewas bedekking/groenbemester gebruikt?

50%

2: Zijn er verschillen te zien op deze percelen ten opzichte van percelen waar het niet wordt gebruikt?

Nee geen verschil, wel extra obstakel en kosten.

3: Welke voor- en nadelen zijn er?

-: Extra kosten, 2 extra niet noodzakelijke bewerkingen, betere resultaten zonder groenbemesting

+: geen

4: Zou u dit op meer percelen willen toepassen? Wat zijn de voornaamste beweegredenen voor deze keuze?

Nee, volledig op tegen. Bij maisteelt moet de grond schoon zijn, zonder andere gewassen, onkruid of groenbemesters

5: Op wat voor manier zou de gemeente een rol kunnen spelen in grootschalige toepassing van gewas bedekking/groenbemesting?

Bemesting Regelingen versoepelen, meer vrijheid voor de boeren om eigen bedrijfsvoering te voeren zoals zij zelf het beste achten

Interview 3:

1: Op welk percentage (ongeveer) van het totale land wordt gewas bedekking/groenbemester gebruikt?

0%, momenteel ben ik biologisch en heb ik het gehele jaar bedekking op het land staan, groenbemesting is dan niet meer noodzakelijk.

2: Zijn er verschillen te zien op deze percelen ten opzichte van percelen waar het niet wordt gebruikt?

Onbekend, het was verplicht om toe te passen op maisland en ik paste op elk perceel maïs toe. Daardoor heb ik geen verschillen gezien.

3: Welke voor- en nadelen zijn er?

+: Als je het goed doet krijg je de kosten wel weer terug.

-: kosten.

4: Zou u dit op meer percelen willen toepassen? Wat zijn de voornaamste beweegredenen voor deze keuze?

Ik ben biologisch dus niet nodig, gebruik nu vruchtwisseling en heb het land het gehele jaar bedekt.

5: Op wat voor manier zou de gemeente een rol kunnen spelen in grootschalige toepassing van gewas bedekking/groenbemesting?

Financiële pot, met goed boerenverstand moet het zonder ook lukken, uitdaging is om de akkerbouwers te verleiden om dit te gebruiken.

Interview 4:

1: Op welk percentage (ongeveer) van het totale land wordt gewas bedekking/groenbemester gebruikt?

70%

2: Zijn er verschillen te zien op deze percelen ten opzichte van percelen waar het niet wordt gebruikt?

Houdt nutriënten beter vast, minder erosie en schade na de winter.

3: Welke voor- en nadelen zijn er?

+: Houdt nutriënten en vocht goed vast, voorkomt erosie.

-: als het te groot moet ik het doodspuiten, dat is niet de mooiste oplossing. Alleen als het klein is kan het goed gebruikt worden, aaltjesvermeerdering in de bodem is minder.

4: Zou u dit op meer percelen willen toepassen? Wat zijn de voornaamste beweegredenen voor deze keuze?

Ja, ik wil graag dat land groen is in de winter. Houdt vocht goed vast, beworteling van de gewassen is beter.

5: Op wat voor manier zou de gemeente een rol kunnen spelen in grootschalige toepassing van gewas bedekking/groenbemesting?

Wij doen het sowieso, financiële prikkeling helpt zeker maar is voor ons niet noodzakelijk.

Interview 5:

1: Op welk percentage (ongeveer) van het totale land wordt gewas bedekking/groenbemester gebruikt?

Wij passen op 30 procent van ons areaal groenbemesters toe. Met name een mengsel van bladrammenas en een beetje gele mosterd en vlas.

2: Zijn er verschillen te zien op deze percelen ten opzichte van percelen waar het niet wordt gebruikt?

Deze percelen blijven tot de vorst invalt mooi groen en vormen een schuilplaats voor fauna. Ook zorgt de goede beworteling voor infiltratie van regenwater.

3: Welke voor- en nadelen zijn er?

Het gewas wat na de groenbemester komt heeft een klein voordeel door de vastgelegde nutriënten en de betere structuur. Ook neemt de organische stof in de bodem licht toe.

Nadeel is de hoge kostenpost voor zaaizaad en bemesting. Zonder een lichte bemesting mislukt de teelt. Ook zijn nattere percelen in het voorjaar minder snel te betreden bij aanwezigheid van een groenbemester. Het droogt minder snel. Ook het correct vernietigen van de groenbemester zorgt voor kosten en indien het pas in het voorjaar gebeurt een nog hogere arbeidspiek.

Nog een nadeel is dat sommige soorten groenbemesters bepaalde (voor de gewassen schadelijke) aaltjes in de bodem vermeerderen.

4: Zou u dit op meer percelen willen toepassen? Wat zijn de voornaamste beweegredenen voor deze keuze?

Doel voor ons is om groenbemesters structureel toe te blijven passen. Misschien nog wat variatie in soorten. Dit teeltjaar gaan we voor het eerst Tagetes telen als groenbemester en biologische aaltjesbestrijder. Voor de groenbemesters is mechanisatie aangeschaft in de vorm van een frontklepelmaaier en een juiste cultivator. De positieve effecten zijn vooral op de lange termijn. Op de korte termijn zijn er met name veel kosten.

5: Op wat voor manier zou de gemeente een rol kunnen spelen in grootschalige toepassing van gewas bedekking/groenbemesting?

De rol van de gemeente is denk ik beperkt op dit vlak. Misschien het voorlichten van de burger over wat er gebeurt op de akkers. Met name de landelijke overheid moet akkerbouwers de ruimte geven om dierlijke meststoffen en restproducten uit onze eigen keten, zoals Betacal, toe te passen. Dit zorgt voor toename van groenbemester teelt en daarmee toename organische stof, soortenrijkdom en koolstofbinding en reduceert kunstmestgebruik. Het huidige beleid, en ook de toekomstvisies werken daarin, hoe gek ook, averechts.

Code reportsProject: interview1

Report created by 1 on 8-4-2021

Code Report

All (6) codes

- -: Werkt niet met de huidige bemestingsr

1 Quotations:

1:3 -: Werkt niet met de huidige bemestingsregels, opbrengst is slecht, la..... (1:371 [1:582]) - D 1: interview1

-: Werkt niet met de huidige bemestingsregels, opbrengst is slecht, lagere bemesting hoeveelheden in Drenthe ten opzichte van bijvoorbeeld Brabant. Daardoor een lagere opbrengst in zowel gras als maïs.

+: geen

0 Codes

- 0%,

1 Quotations:

1:1 0%, (1:104 [1:107]) - D 1: interview1

0%,

0 Codes

- Geel, onkruid, slechte opbrengst, met ma

1 Quotations:

1:2 Geel, onkruid, slechte opbrengst, met maïs is de oogst zelfs minder. (1:266 [1:335]) - D 1: interview1

Geel, onkruid, slechte opbrengst, met maïs is de oogst zelfs minder.

0 Codes

- Nee,

0 Quotations

0 Codes

- Soepelere bemestingsregels voor melkveeh

1 Quotations:

1:6 Soepelere bemestingsregels voor melkveehouders, overzichtelijker regel..... (1:1022 [1:1218]) - D 1: interview1

Soepelere bemestingsregels voor melkveehouders, overzichtelijker regels, niet verplicht maken, soepelere regels voor maisoogst, regels specifiek voor koudere omgeving & armere gronden in Drenthe.

0 Codes

- voor ons als melkveehouders heeft het ge

0 Quotations

0 Codes

Project: Interview2

Report created by 1 on 7-4-2021

Code Report

All (6) codes

- -: Extra kosten, 2 extra niet noodzakeli

1 Quotations:

1:3 -: Extra kosten, 2 extra niet noodzakelijke bewerkingen, betere result..... (290:394) - D 1: Interview2

-: Extra kosten, 2 extra niet noodzakelijke bewerkingen, betere resultaten zonder groenbemesting

+: geen

- 50%

1 Quotations:

1:1 50% (99:101) - D 1: Interview2

50%

- Bemestingsregelingen versoepelen, meer v

1 Quotations:

1:6 Bemestingsregelingen versoepelen, meer vrijheid voor de boeren om eigen.....
(736:864) - D 1: Interview2

Bemestingsregelingen versoepelen, meer vrijheid voor de boeren om eigen
bedrijfsvoering te voeren zoals zij zelf het beste achten

- Bij maisteelt moet de grond schoon zijn

0 Quotations

- Nee

1 Quotations:

1:5 Bij maisteelt moet de grond schoon zijn (521:559) - D 1: Interview2

Bij maisteelt moet de grond schoon zijn

- Nee geen verschil, wel extra obstakel en

1 Quotations:

1:2 Nee geen verschil, wel extra obstakel en kosten. (207:254) - D 1: Interview2

Nee geen verschil, wel extra obstakel en kosten.

Project: Interview3

Report created by 1 on 8-4-2021

Code Report

All (11) codes

- +: Als je het goed doet krijg je de kost

1 Quotations:

1:6 +: Als je het goed doet krijg je de kosten wel weer terug. -: kosten. (506:574) - D 1: Interview 3

+ : Als je het goed doet krijg je de kosten wel weer terug.

- : kosten.

o 0%

0 Quotations

o akkerbouwers te verleiden om dit te gebr

0 Quotations

o biologisch dus niet nodig

0 Quotations

o elk perceel maïs toe. Daardoor heb ik ge

1 Quotations:

1:5 elk perceel maïs toe. Daardoor heb ik geen verschillen gezien. (408:469) - D 1: Interview 3

elk perceel maïs toe. Daardoor heb ik geen verschillen gezien.

o Financiële pot

0 Quotations

o gehele jaar bedekt

0 Quotations

o groenbemesting is dan niet meer noodzake

1 Quotations:

1:3 groenbemesting is dan niet meer noodzakelijk (186:229) - D 1: Interview 3

groenbemesting is dan niet meer noodzakelijk

o momenteel ben ik biologisch

1 Quotations:

1:2 momenteel ben ik biologisch (103:129) - D 1: Interview 3

momenteel ben ik biologisch

- nu vruchtwisseling

1 Quotations:

1:8 nu vruchtwisseling (720:737) - D 1: Interview 3

nu vruchtwisseling

- Onbekend

0 Quotations

Project: Interview4 bscprj

Report created by 1 on 8-4-2021

Code Report

All (9) codes

- +: Houdt nutriënten en vocht goed vast,

1 Quotations:

1:3 +: Houdt nutriënten en vocht goed vast, voorkomt erosie. -: als het te..... (308:541) - D 1: Interview 4

+: Houdt nutriënten en vocht goed vast, voorkomt erosie.

-: als het te groot moet ik het doodspuiten, dat is niet de mooiste oplossing. Alleen als het klein is kan het goed gebruikt worden, aaltjesvermeerdering in de bodem is minder.

1 Codes:

- +: Houdt nutriënten en vocht goed vast,

0 Codes

- 70%

1 Quotations:

1:1 70% (99:102) - D 1: Interview 4

70%

1 Codes:

- 70%

0 Codes

- beworteling

1 Quotations:

1:7 beworteling (716:726) - D 1: Interview 4

beworteling

1 Codes:

- beworteling

0 Codes

- financiële prikkeling helpt zeker

1 Quotations:

1:9 financiële prikkeling helpt zeker (900:933) - D 1: Interview 4

financiële prikkeling helpt zeker

1 Codes:

- financiële prikkeling helpt zeker

0 Codes

- groen is in de winter

1 Quotations:

1:5 groen is in de winter (670:690) - D 1: Interview 4

groen is in de winter

1 Codes:

- groen is in de winter

0 Codes

- Houdt nutriënten beter vast, minder eros

1 Quotations:

1:2 Houdt nutriënten beter vast, minder erosie en schade na de winter. (207:273) - D 1: Interview 4

Houdt nutriënten beter vast, minder erosie en schade na de winter.

1 Codes:

- Houdt nutriënten beter vast, minder eros

0 Codes

- Ja

0 Quotations

- vocht

1 Quotations:

1:6 vocht (699:703) - D 1: Interview 4

vocht

1 Codes:

- vocht

0 Codes

- Wij doen het sowieso

1 Quotations:

1:8 Wij doen het sowieso (879:898) - D 1: Interview 4

Wij doen het sowieso

1 Codes:

- Wij doen het sowieso

0 Codes

Project: interview5 bscprj

Report created by 1 on 14-4-2021

Code Report

All (21) codes

○ 30 procent

1 Quotations:

1:1 30 procent (126:135) - D 1: Interview5

30 procent

1 Codes:

○ 30 procent

0 Codes

○ aaltjes in de bodem vermeederen

1 Quotations:

1:13 aaltjes in de bodem vermeederen (1176:1208) - D 1: Interview5

aaltjes in de bodem vermeederen

1 Codes:

○ aaltjes in de bodem vermeederen

0 Codes

○ beperkt op dit vlak

1 Quotations:

1:18 beperkt op dit vlak (1901:1920) - D 1: Interview5

beperkt op dit vlak

1 Codes:

○ beperkt op dit vlak

0 Codes

- goede beworteling

1 Quotations:

1:4 goede beworteling (455:471) - D 1: Interview5

goede beworteling

1 Codes:

- goede beworteling

0 Codes

- Het huidige beleid, en ook de toekomstvi

1 Quotations:

1:21 Het huidige beleid, en ook de toekomstvisies werken daarin, hoe gek oo.....
(2303:2386) - D 1: Interview5

Het huidige beleid, en ook de toekomstvisies werken daarin, hoe gek ook, averechts.

1 Codes:

- Het huidige beleid, en ook de toekomstvi

0 Codes

- infiltratie van regenwater

1 Quotations:

1:5 infiltratie van regenwater (477:503) - D 1: Interview5

infiltratie van regenwater

1 Codes:

- infiltratie van regenwater

0 Codes

- landelijke overheid moet akkerbouwers de

1 Quotations:

1:20 landelijke overheid moet akkerbouwers de ruimte geven om dierlijke mes.....
(2009:2154) - D 1: Interview5

landelijke overheid moet akkerbouwers de ruimte geven om dierlijke meststoffen en restproducten uit onze eigen keten, zoals Betacal, toe te passen

1 Codes:

- landelijke overheid moet akkerbouwers de

0 Codes

- mechanisatie aangeschaft in de vorm van

1 Quotations:

1:17 mechanisatie aangeschaft in de vorm van een frontklepelmaaier en een j.....
(1551:1637) - D 1: Interview5

mechanisatie aangeschaft in de vorm van een frontklepelmaaier en een juiste cultivator.

1 Codes:

- mechanisatie aangeschaft in de vorm van

0 Codes

- Nadeel is de hoge kostenpost voor zaaiza

1 Quotations:

1:8 Nadeel is de hoge kostenpost voor zaaizaad en bemesting (713:767) - D 1: Interview5

Nadeel is de hoge kostenpost voor zaaizaad en bemesting

1 Codes:

- Nadeel is de hoge kostenpost voor zaaiza

0 Codes

- nattere percelen in het voorjaar minder

1 Quotations:

1:10 nattere percelen in het voorjaar minder snel te betreden bij aanwezig..... (825:943) -
D 1: Interview5

nattere percelen in het voorjaar minder snel te betreden bij aanwezigheid van een groenbemester. Het droogt minder snel

1 Codes:

- nattere percelen in het voorjaar minder

0 Codes

- organische stof in de bodem licht toe.

1 Quotations:

1:7 organische stof in de bodem licht toe. (673:710) - D 1: Interview5

organische stof in de bodem licht toe.

1 Codes:

- organische stof in de bodem licht toe.

0 Codes

- schuilplaats voor fauna

1 Quotations:

1:3 schuilplaats voor fauna (416:439) - D 1: Interview5

schuilplaats voor fauna

1 Codes:

- schuilplaats voor fauna

0 Codes

- sommige soorten groenbemesters

1 Quotations:

1:12 sommige soorten groenbemesters (1106:1135) - D 1: Interview5

sommige soorten groenbemesters

1 Codes:

- sommige soorten groenbemesters

0 Codes

- structureel toe te blijven passen

1 Quotations:

1:14 structureel toe te blijven passen (1347:1380) - D 1: Interview5

structureel toe te blijven passen

1 Codes:

- structureel toe te blijven passen

0 Codes

- tot de vorst invalt mooi groen

1 Quotations:

1:2 tot de vorst invalt mooi groen (371:401) - D 1: Interview5

tot de vorst invalt mooi groen

1 Codes:

- tot de vorst invalt mooi groen

0 Codes

- variatie in soorten

1 Quotations:

1:15 variatie in soorten (1400:1419) - D 1: Interview5

variatie in soorten

1 Codes:

- variatie in soorten

0 Codes

- vastgelegde nutriënten en de betere stru

1 Quotations:

1:6 vastgelegde nutriënten en de betere structuur (613:657) - D 1: Interview5

vastgelegde nutriënten en de betere structuur

1 Codes:

- vastgelegde nutriënten en de betere stru

0 Codes

- vernietigen van de groenbemester zorgt v

1 Quotations:

1:11 vernietigen van de groenbemester zorgt voor kosten en indien het pas i.....
(962:1081) - D 1: Interview5

vernietigen van de groenbemester zorgt voor kosten en indien het pas in het voorjaar
gebeurt een nog hogere arbeidspiek.

1 Codes:

- vernietigen van de groenbemester zorgt v

0 Codes

- voor het eerst Tagetes telen als groenbe

1 Quotations:

1:16 voor het eerst Tagetes telen als groenbemester en biologische aaltjesb.....
(1443:1522) - D 1: Interview5

voor het eerst Tagetes telen als groenbemester en biologische aaltjesbestrijder

1 Codes:

- voor het eerst Tagetes telen als groenbe

0 Codes

- voorlichten van de burger over wat er ge

1 Quotations:

1:19 voorlichten van de burger over wat er gebeurt op de akkers (1936:1994) - D 1:
Interview5

voorlichten van de burger over wat er gebeurt op de akkers

1 Codes:

- voorlichten van de burger over wat er ge

0 Codes

- Zonder een lichte bemesting mislukt de t

1 Quotations:

1:9 Zonder een lichte bemesting mislukt de teelt (769:813) - D 1: Interview5

Zonder een lichte bemesting mislukt de teelt

1 Codes:

- Zonder een lichte bemesting mislukt de t

0 Codes