

SUSTAINABLE GRAIN PRODUCTION WITH CONTINUOUS IMPROVEMENTS AND LEAN PRODUCTION

J. Olsson, and A. Rydberg

JTI – Swedish Institute of Agricultural and Environmental Engineering
Uppsala, Sweden

B. Sundström

SIK - the Swedish Institute for Food and Biotechnology
Gothenburg, Sweden

H. Åström

HS Halland - Rural Economy and Agricultural Societies of Halland
Falkenberg, Sweden

ABSTRACT

When improvements in agricultural production processes are being sought, the focus is generally on biological and agronomic aspects. However, an equal focus on farm-level management and organization is needed. Lean production (Lean) comprises a set of management practices for implementing improvements and has proven successful in other industries. This study investigated Lean in an agricultural application, grain production, where labor and most processes proceed in an annual cycle.

A method was developed to facilitate the introduction of Lean into Swedish grain production and to gain an increased understanding of how farm-level work performance relates to environmental impact in a life cycle perspective. The study was conducted on three large grain farms practicing precision agriculture, which were given opportunities to start working towards improved productivity and resource efficiency through three coaching sessions and their own independent work. By the end of the project, all three farms were working with daily visual control and an initial visual aid system for continuous improvements. Work on preventive maintenance had been facilitated by orderliness and visual planning.

The farms are just beginning a new way of working and more time is needed for them to save time. The future rewards of the work will hopefully meet the expectations of farmers and researchers – reduced environmental impact, increased productivity, higher profitability, and ultimately greater competitiveness.

Keywords: Grain production, Lean production, Lean, Farm management, Continuous improvements

INTRODUCTION

Few farmers spend time critically examining their production processes and any improvements made often focus on the biological and agronomic aspects of production. However, the profitability of farm

enterprises is dependent on both production (what I do) and work organization (how I do it). The agricultural advisory services in Sweden are very advanced as regards matters relating to biological production (crop production planning, soil mapping, etc.), but there is a need for corresponding activities in management and organization.

Many activities on arable farms are extended in time over a whole year, i.e. the time between sowing and harvest. A particular set of work operations often occurs only once a year, greatly limiting the possibilities to monitor the process and accomplish improvements. During the most labor-intensive periods in crop production, it is difficult to find the time to work with long-term improvements. Many farms have seasonal workers who need to be quickly put to work, which takes time for planning. However, it can be difficult to make plans for farm work far into the future. Another important factor that affects when a certain work operation can be done is the weather. However, there are still things that need to be prioritized, and for that some kind of planning is needed.

This study formed part of a Swedish research cluster consisting of three projects on introducing lean production (Lean) into agriculture. It focused on grain production, while the other two studies dealt with milk and pork production.

Lean is a set of management practices for improvements that has been proven to work in a variety of industries. It has its origins in philosophies and approaches developed at the car manufacturer Toyota. The Western world's interpretation of the Toyota way of working is affected by Liker's fourteen principles (Liker, 2004). Examples of some focus points in Lean are customer satisfaction and making improvements by minimizing waste, devising robust and sustainable systems, and viewing employees as an important resource. One of the reasons why Lean has become a successful strategy is that it is based on having an organization that is continually challenging itself to become better by decreasing the proportion of waste.

MATERIALS AND METHODS

In this study we developed a method to facilitate the introduction of Lean into Swedish grain production and to gain an increased understanding for how work performance on the farm relates to the environmental impact in a life cycle perspective. The method was developed based on experiences and knowledge from both grain production and introducing Lean into other agricultural enterprises (dairy and pork production) and the food industry (Melin et al., 2013; Rydberg et al., 2011).

The study was conducted on three grain-producing farms practicing precision agriculture. Farm size varied from 600 to 1500 hectares, which in Sweden represents a large farm, and all three farms had more than two employees. The farms were located in three different geographical areas of Sweden. The crops grown in the study period (2011) were cereals, pasture, canola, potatoes, sugar beet, peas, corn, and carrots.

The Lean implementation method comprised two parts: 1. A study trip and workshop, in which all three farms participated.

2. Farm visits with Lean coaching (three separate occasions per farm).

Study trip and workshop

The purpose of the combined study visit and workshop was to provide an initial introduction to Lean, focusing both on practical Lean work and on what can be achieved, and to map the most important work processes during one year of crop production on farm level and the communication routines used in organization.

Farm visits

During the first farm visit, the owner/s and all staff working with crop production were introduced to Lean. This included e.g. Lean tools, continuous improvement, working towards determined goals or visions,

PDCA (Plan-Do-Check-Act), continuous learning in the organization, visualization, and 5S (sorting, straightening, shining, standardizing, and sustaining). A needs analysis of work and communication on the farm was conducted to get a better understanding of the need for change. The staff and owner/s were asked questions about problem management, standardized working practices, visual control, communication, involvement of employees, etc.

The improvement work was initiated with discussions on waste and measures to eliminate waste. An action plan with all improvement measures identified was compiled. The farms were given tasks to accomplish between the farm visits, one of which was to implement the suggested improvements.

On the second farm visit, work to date was reviewed and further development of the initial work from the first visit was planned. The employees and the owner/s were also introduced to the need for orderliness (5S), visualization, and documentation of routine maintenance.

During the third and final farm visit, plans were made for continuing Lean work after the end of the study. In parallel with Lean work, checklists were developed to reduce the farm's carbon footprint. As a basis for developing these checklists, the environmental footprint of crop production on the different farms was calculated using farm-specific data. The results from the calculations were presented and discussed on the third farm visit.

RESULTS

Identification of waste in grain production

Lack of communication was one of the sources of waste identified in Swedish grain production. This can lead to duplication of work, long waiting times, overlooked or inadequate maintenance work on machines, etc. This waste becomes even more obvious on farms with seasonal workers when instructions and checklists for how the work should be done are lacking.

Lack of leadership is relatively common in agriculture, in particular on farms which have increased from no to several employees within a short time. Problems can arise when too much information and decision making has to take place via a manager.

Lack of orderliness, for example in spare parts storage and the farm workshop, can generate waste in the form of time and unnecessary movements.

Continuous improvement

Each farm developed a system for continuous improvement which involved a procedure for how that farm would make use of the improvement suggestions and how it could use visualization to simplify communication. Whiteboards were tested for planning and visualization of work. The owner/s and employees reached agreement about how to collect suggestions for further improvements from the employees and transform them into measures via a plan of action.

Communication

The owners and the employees wanted to achieve more distinct, visual communication. By visualization, the farm had a tool to create more orderliness concerning communication in both daily work and daily control. The whiteboards were used for rough planning on a daily level, listing tasks that to be done that day and who would do each of these tasks. On the whiteboard there was a separate column for a list of tasks that had to be done during the coming week or in the immediate future. The participating farms reported planning to hold daily breakfast meetings in front of the whiteboards, which would act as a living document during the week and be updated as the week proceeds.

Orderliness – 5S

On all three farms, the workshop was already in good order when the study was initiated, especially regarding tools, which were often marked with name and place. However, the storage room for spare parts was in need of better structuring. The farm staff had started to organize the storage room according to 5S by cleaning, categorizing the objects according to how often they are used (sorting), and deciding on a convenient structure for organizing the different parts (straightening). Having a structured storage room is important especially for new employees and seasonal workers.

Preventive maintenance measures are an important part of crop production, to ensure that the machines are in order when needed and to minimize the number of break-downs. There has to be an agreed system for keeping track of maintenance measures. The participating farms were given a training task to show how preventive maintenance measures ought to be visualized and documented. Visualization and having a standardized way of working in preventive maintenance are the foundation for continuous improvement.

The Method

The method developed in this project can be used as inspiration for introducing Lean into a farm enterprise. Contributing farms received an initial system and tools for constant improvement by involving employees in the improvement process. Carrying out a needs analysis of the activities on grain production farms through questions and discussions, both individually and in groups, with owners, managers, and employees, proved to work excellently.

Improvement work can also be seen as an opportunity for owners/managers to manage structured improvement against targets. By visualizing, the participating farms had clearer communication in daily work and in daily governance. The visualization also provided the farms with the tools to create better order.

Applying Lean in grain production on farm level has great potential in that it involves a structured way of leading the work on the farm, with the focus on continuous improvement.

Customer focus in grain production

Grain production in Sweden is controlled by the payment structure. Factors affecting the price received for grain include protein content, falling number, and hygiene quality. There is some communication between the grain buyer and the producer, but communication is lacking concerning the possibilities for the farmer to develop the products on farm level and supply a product that suits the user better. The question is what the user really wants, as there is a lack of communication between farmer and user on this issue. Variable quality can cause waste in food production and it might be possible to control this by a variable payment system.

Checklists to reduce the farm's carbon footprint

It was possible to include the checklists to reduce the farm's carbon footprint as part of the ordinary process of improvement. Much of the environmental impact from grain production takes place in the field. The Lean process mainly affects what takes place around the field work, but where there are points of contact, the checklist focuses on those. The main parameters regarding environmental impact on the checklist are:

- Nitrogen utilization in mineral fertilizers
- Nitrogen utilization in manure
- Energy use on the farm
- Nutrient balance
- Soil compaction

DISCUSSION

The method developed in this project is not a universal solution; each farm business is unique and therefore Lean has to be adapted to each farm. However, the method can act as inspiration for advisors and farmers who are interested in initiating the Lean process. Introducing Lean into a business means changing the way of thinking and changing existing ways of working and structures in the company. Changing management takes time. The farms that participated in this study were given the opportunity to start their Lean work, and if they continue the work they initiated and challenge themselves to become Lean, they will be able to achieve reduced environmental impact, increased productivity, higher profitability, and ultimately greater competitiveness. There is a great deal of improvement work left for the farmers to continue with after the project. The number of farm visits was too few and there is a need for more coaching than was included in the project.

On grain farms, where the results of the work are seen once a year (at harvest) as a result of a long chain of processes, there is a great need for control points that continuously describe the business. This way of thinking is new to many farmers and it can be difficult to find suitable control points. A possible control point could be interruptions or disturbances for machines in the field.

Grain farms are no different from other businesses when it comes to communication and the difficulties that can arise. The challenge on grain farms is to ensure that all employees get the information they need, even if they are not present when the information is given, and that everybody knows the current situation according to the targets of the business. The leadership on farm level is very important. It is needed by the employees, responsibility has to be delegated, and guidelines and working procedures have to be clear.

In order to retain employees all year around on a grain-producing farm, it is necessary to involve these employees in work that does not concern grain production directly, such as other maintenance, entrepreneurial work, etc. This change between different types of work requires a planning tool. A visual communication and planning aid, for an example a task list on a whiteboard, can help prioritize between different work tasks.

Large grain farms have a great focus on preventive maintenance measures, which are an important factor in the smooth running of the business, and they have come a long way in this area. However, since Lean focuses on continuous improvement, there is still a great possibility to decrease waste on the farm. The understanding that Lean means a constant ambition to become better had not been recognized by everybody on our study farms within the short coaching time.

When change is discussed in an agricultural business, the focus is generally on different types of investments. These changes are important, but small, easy changes in the way of working can also be of major benefit to the business. Lean is best introduced during a less hectic part of the year, when it is easier to try new ways of working and when there is time for reflection and during more relaxed conditions to change mindsets and behaviors.

CONCLUSIONS

- Lean is not limited to a certain business or production process. This study showed that Lean is fully applicable to agriculture.
- The farms studied had all implemented daily visual control and an initial visual aid system for continuous improvements.
- Work with the preventive maintenance on-farm was facilitated by orderliness and visual planning.
- The farms studied are just starting a new way of working and more time is needed for the results to be fully visible. Continuation of Lean work will hopefully fulfill the expectations of farmers and researchers – reduced environmental impact, increased productivity, higher profitability, and ultimately greater competitiveness.

- Customer focus is an important part of Lean. In the production chain for grain there is traditionally a wide gap between producer and user, which makes it difficult for the producer (farmer) to improve profitability by product development.
- There are many synergies between reducing the environmental impact on farms and Lean work.

ACKNOWLEDGEMENTS

We would like to thank the farms and their employees who participated in the project. Funding for this project was provided by the Foundation of Agricultural Research (SLF), Stockholm, Sweden

REFERENCES

Liker, J., 2004. The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer. McGraw-Hill ISBN 0071392319.

Melin, M., Rydberg, A., Sundström, B., Östergren, K. & Berglund, M., 2013. Lean för konkurrenskraftig och klimateffektiv mjölkproduktion. Rapport 414, Lantbruk & industri. JTI – Institutet för Jordbruks- och Miljöteknik, Uppsala.

Rydberg, A., Melin, M., Sundström, B., Östergren, K. & Berglund, M., 2011. Konkurrenskraftigare grisföretagare med Lean. Metodik för hur Lean kan introduceras på slaktgrisgårdar. Rapport 399, Lantbruk & industri. JTI – Institutet för Jordbruks- och Miljöteknik, Uppsala.