Lean manufacturing

Achieving efficient use of labour in protected edible crops

Contents

Foreword

At present labour utilisation is one of the biggest production costs in the protected edible crop sector. Data from UK tomato growers suggests that the annual labour bill for fruit picking alone is over £10 million pa. So even if small improvements could be made to labour use efficiency, it would deliver significant cost savings.

The technique of Lean manufacturing enabled savings running into £10,000's per year to be identified on a commercial tomato nursery as part of HDC project PC 257. In the vast majority of cases these savings required little or no capital investment. In all cases the return on investment was under two years.

"The Lean project helped to tap into the numerous ideas from staff on how to improve the business and delivered immediate savings for us. If we persist with this approach, I'm convinced that much greater improvements and savings will follow," commented Alan Parker, former Director of Wight Salads.

In many different businesses Lean has been proven time and again to deliver significant improvements, typically:

- Lead times reduced by up to 50%
- Stock levels reduced by as much as 75%
- Staff productivity improvements of up to 50%

This grower guide is designed to give you the information and tools to begin implementing a Lean system to reduce your labour costs; improve the overall efficiency of labour operations; develop a more flexible and motivated workforce that can cope better with sudden peaks in sales and, achieve improvements in product quality & timeliness of operations.

The guide is intended for use by growers of protected salad crops and is based on the findings of HDC project PC 257: Lean manufacturing – applying the principles to harvesting tomatoes. It has been written by the project leader, Tim Pratt of FEC Services, with input from Neil Fedden of Fedden USP who also worked on the project.

We very much hope this resource proves a useful tool to your business.

Jenny Lang

Senior Communications Manager

What is ‘Lean’

Lean manufacturing is a work organisational concept that was borne from the car industry starting with Toyota in Japan in the 50’s and 60’s - a time when it was seen that Japan offered manufacturing efficiency beyond that considered to be possible in the West.

At the time the efficiency of the Japanese production systems was thought to be due to their psyche of working. But when Japanese manufacturing came to Europe with Toyota, Nissan and Honda in the car manufacturing complexes of the 80’s and 90’s, it was found that the UK factories were able to meet the output of the original Japanese plants – but with European workers.

So the efficiency and quality characteristics of the output were not an ‘ethnic’ characteristic of the workers, it had to be the way that the production system was organised. The method by which efficiencies were achieved were embodied in what was to become known as “Lean”.

So the study of Lean manufacturing came to be, and it soon became clear that Lean had a part to play not only in the car industry but in many other business types as well.

Lean manufacturing and horticulture

Horticulture has many similar characteristics to the car manufacturing industry in that it involves repetitive routine exercises producing a quality homogeneous product. As such, the principles of Lean work well with horticultural businesses.

This report provides an insight into Lean and draws on the experience gained at Wight Salads Group Ltd as a part of HDC project PC 257.

Where implemented, Lean manufacturing was shown to generate savings running into tens of £1,000’s per year. Great returns were achieved from little or no capital investment. In all cases return on investment has been under two years.

In this report front-line Lean tools are explained alongside practical examples from PC 257 and elsewhere. (Previous HDC tomato labour projects including PC 217 and PC 217a were also referenced to develop improved working practices).

It is hoped that growers will find areas of immediate use and relevance to their business, especially the various practical examples given. It is clear that Lean has the potential to deliver fundamental change and business improvement. However, realising the full benefits requires long-term commitment and resources at all levels.

A Lean history

Lean, also known as the Toyota Production System, originates from the automotive industry. Developed by Toyota in the 1950’s it is widely acknowledged as a major factor in their success. However, Lean was only recognised in the western world in the 80’s and 90’s and its application to non-engineering businesses started in the late 90’s. The successful introduction of Lean to the nursery stock/ornamentals sector prompted the HDC to fund project PC 257 in 2006 to investigate its application to the protected edible crop sector.

Back in the 1950's Toyota faced a number of challenges which show interesting parallels with those faced by the UK tomato sector today. These were:

- Increased demand for product variety.
- Increasing customer expectation in the form of quality and speed of delivery.
- Continued pressure on the cost of production.
- Increased competition.

Toyota recognised that to compete with the American manufacturers they had to offer greater variety at the same (if not lower) cost, better quality and faster speed of delivery. At the same time Toyota had very little working capital so they were driven by the need to:

- Convert raw materials into final product as quickly as possible.
- Maximise the ratio of output to raw material input by reducing waste.
- Minimise capital tied up by reducing stock levels.

How Lean works

The concepts used in Lean can be grouped under four categories:

1. Value.
2. Pull and flow.
3. Waste reduction.
4. Continuous improvement.

A major focus of Lean is the efficient use of all resources, especially labour. This is an important area in edible crop production where labour represents as much as 40% of the cost of production.

The core principles of Lean

Value

What does your customer actually pay for?

What does your customer really want?

This is what Lean defines as true 'value'. Anything that delivers it is a 'value adding process'.

Surprisingly processes which add true value can represent as little as 5% of the total costs incurred by a business. In other words, in some cases 95% of activities add no value in terms of how your customer would perceive the product they buy.

The Lean process involves questioning everything that does not add value and asks "Can this can be removed from the process?"

Using these ideas, processes can be split into three categories:

1. Non value add.
2. Unavoidable non value add.
3. Value add.

Table 1 – Example processes in tomato production

Non value add	Unavoidable non value add	Value add
Time taken to walk from the canteen to the greenhouse	Leaf removal	Picking directly into a punnet
Climbing on/off a work platform	*Placement of new growing media slabs each year*	Wrapping
Transporting fruit from the greenhouse to the pack house		Labelling
Disposal of damaged fruit		*Picking from the plant*

Categorising processes can be difficult. Generally, a safe approach is to regard any process as non value add unless it is obviously value add. The process can be simplified by dealing with the obvious non value add items first, as these are the prime candidates for modification. Section 6 on Waste will help to identify some of the more obvious non value add processes.

In the table above, the items shown in italics are those whose value status might be open to question and could in fact be categorised in another group.

For example, placing of growing media slabs has been categorised as unavoidable non value add, but in fact ultimately they could be replaced by nutrient film technique therefore dispensing with the need for the process. Alternatively, appropriately shaped hanging gutters could be filled with a granulated product from a motorised hopper. As such, be wary of labelling things as unavoidable non value add. It may be we regard them in this way just because they are so engrained into the way we have always done things.

Another question we might ask is "Is picking really value add?" - there is no doubt that it is unavoidable. On analysis it does have an impact on quality and if done well and consistently it does add customer value.

Pull and Flow

Pull and Flow help to achieve the seemingly incompatible goals of the need to keep low stock levels, but respond to short delivery times and maintain maximum utilisation of processing capacity. The classical way to enable 'off the shelf' delivery is to hold high levels of stock - but of course this ties up a lot of cash.

Generally, it is not possible to hold high levels of stock with edible crop production because of the short shelf life of the product. In this respect therefore, the short marketable period of time for horticultural crop helps to avoid the tendency to rely on high stock levels to manage demand.

However, there must always be some stock in the flow process between production and customer even in horticulture; and of course, it is not possible to 'turn off' a plant when sales are low. But some control can be exercised certainly in that area of processing and packing where it may be possible to stop operations (cease incurring cost) for produce that does not have a confirmed order.

In Lean theory, Pull occurs when an order is received instructing a process to be carried out.

In the case of edibles crops this may occur at many points – in the dispatch area for instance or at the end of the packing line.

Ideally, every stage in the production process should have one 'unit' of part-processed product in stock, When complete, dispatch takes the pallet of completed product from the end of the packing line and this 'vacuum' should be the signal to the packing line to produce another one. Therefore, the packing line only produces when there is a 'space to fill' and it stops as soon as there is a full pallet that has not been taken away. This causes a chain reaction which 'pulls' products through the process and makes it flow.

Of course, in practice this has to be compromised by the ability of the production system to match the variations in demand. Making to order is the simplest way of minimising stock but speed of delivery can suffer. Clearly, having a high level of excess production / processing capacity to handle large orders at the last minute is one way round the problem but this leads to overstaffing and long idle times.

It is also common practice to batch process and 'push' an order through a manufacturing process. This is the equivalent of only starting to pick when the final order quantity is received; then picking the whole requirement before it is transported to the pack house. If stock levels are kept to a minimum, it is likely that the pack house will have nothing to do until new supplies arrive from the greenhouse and have little time left to meet the delivery schedule.

So what are Pull and Flow?

The chain reaction goes further; the lack of a pallet of raw product at the start of the packing line tells the fork-lift driver to go and fetch one from the greenhouse. The lack of a pallet full of tomatoes in the greenhouse tells the picking team to pick some more. In Lean terminology the signal to produce more caused by the space left when a product is moved to the next stage of production is called a kanban.

The photograph on the right shows a workstation at the end of the day. The markings on the floor are for full boxes of waste fruit – the signal is 'take it away and give me an empty one'. Just visible are areas marked on the top of the bench – in this case the signal is 'I need more punnets' whenever there are none in the marked area.

The effect is:

- There is only one 'unit' of stock at each stage in the process.
- When the order arrives everybody in the whole process works to deliver. The order is not satisfied by the pack house drawing from stock.
- The product flows smoothly through the process with no 'stop-start' as with batch production.

Maximum benefits from pull and the achievement of smooth flow comes from the optimum sizing of a unit of production. Too big and it is no different to large batch production in terms of stock levels. Too small and you have each picker running to the pack house with a single vine in his/her hands.

Take the following situation for example. What would be best?

- A fork-lift driver moving 10 pallets at a time from production to packing.
- A fork-lift driver moving 5 pallets at a time but twice as often.

From the fork-lift driver's point of view, he would probably regard it as most efficient to move 10 pallets at a time. This means he could get that job done and move on to another area without having to return so often.

But from the point of view of the packing line there maybe some significant down sides.

For example:

- Having to wait for 10 pallets in the production area to be ready for shipping to the packing area before packing can start.
- Finding short term storage for 10 pallets in the picking area.
- Finding short term storage for the 10 pallets in the packing area, then arranging for them to be moved up to the packing line one by one.
- Timing the end of the shift to coincide with last of the pallet line and coordinating this with the whole picking and production process.

So, in fact what seems to be an efficient arrangement for the fork-lift driver might end up being a costly and difficult arrangement for the rest of the production system.

Many businesses would fail to recognise that such problems exist within their systems. But in reality when things are looked at closely they may be much more common and much more disruptive than first thought. More importantly the associated costs can be high.

Waste reduction

The identification and reduction of waste is probably the most obvious and easy to understand concept in Lean. It is often the first area that businesses focus on when implementing Lean. Waste reduction leads to quick, cheap to implement and obvious wins.

Even simple low cost improvements which deliver marginal savings can be implemented as they represent real savings. A wholesale adoption of these savings, be they only small, will promote a positive attitude to Lean which will become vital when more significant changes are required.

The first trawl for waste usually highlights obvious, even common-sense areas for improvement. Things that have annoyed staff for years or just didn't seem important. When identified, people may comment that these improvements are nothing to do with Lean and they are just common sense solutions put into practice, but in fact the process of identifying and dealing with them is key to the Lean process. The tools that Lean uses take us back to basics.

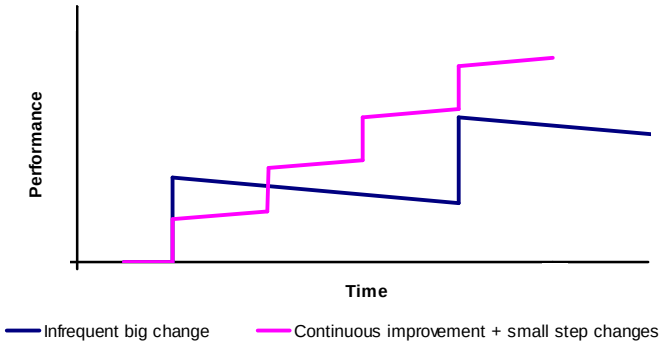
The reduction of waste is such a major component of Lean that eight specific categories of waste have been identified and a section focussing specifically on waste is included in this report.

Continuous improvement

A stereotypical western approach to business development is to make big step changes and work investments until 'the competition' catches up or even overtakes. Big step changes usually require large amounts of capital and tend to be more risky than organic change. This is especially true when there isn't a culture of change in the business. More often than not the benefits of step change reduce over time as old ways of working are restored.

Lean focuses on regular, small changes. In this way the business and employees become used to the culture of change and therefore more receptive to it. The cost of implementing small changes is relatively low and the implications of failure are less critical. When bigger step changes come along, the change culture helps these to be accepted and therefore they are more likely to succeed.

Creating a culture receptive to change can be a long, slow process and requires a long-term commitment from management to ensure success.



The 7 wastes +1

Lean splits waste into eight main categories.

1.	Over-production	5. Waiting and delays
2.	Movement of product	6. Movement of people
3.	Over-stocking	7. Defects
4.	Over-processing	8. Talent

The '+1' is Talent, it was not originally recognised as waste in Japan because regular consultation with staff was part of their culture.

Over-production

Over-production is inherent in the way in which fruit is grown. The quantity and size of fruit produced by a plant, being a biological process is largely beyond the control of the grower. So in the face of highly variable demand for the product some waste is almost inevitable.

A couple of examples of how this can be managed follow:

- Where product is picked straight into a pack and then disposed of because of over-production, significant cost is incurred in the wasted packing. If it is known that product is to be disposed off, then it makes sense to avoid picking in to the pack and instead pick for direct disposal.
- Picking directly into a punnet is a common practice which can reduce the amount of double handling and improve efficiency compared to picking into a larger box. However, where the final product specification might change quickly or where there maybe many different delivery specifications, picking into a larger box can help to match the market by allowing the flexibility to change packing easily in the pack house. But most nurseries either choose to pick entirely into the final pack or entirely into large boxes. But why? The most efficient solution may be to pick guaranteed orders or a proportion of predicted orders directly into punnets and to pick the rest into boxes. This may seem complicated compared to picking everything into punnets every day, but it may prove to be much more cost effective.

Movement of product

In this context 'product' means anything from fruit, to bags of fertiliser, to pallets of punnets. In fact, any physical element of production which may need to be moved.

Take the example of buying a whole years supply of punnets in one batch. They will often be stored in an empty building at the far end of the site and transported in smaller batches to storage close to the packing line. Finally they may be transported as individual pallets to the packing line itself.

An alternative might be to consider the receiving of regular smaller deliveries to the site that could be unloaded straight into the pack house. Thus the concept of having smaller deliveries to match demand is referred to as 'Just In Time' delivery.

With Just In Time the reduced costs from lower stocks and reduced traffic have to be balanced with a greater risk of stoppage associated with non delivery of materials. With reliable suppliers the latter issue may not be a problem at all and this would allow stock levels to be reduced and costs cut.

Over-stocking

Over-stocking has clear links to the last issue, (movement of stock) but it has other implications too. Over-stocking leads to:

- Additional capital requirement – interest payments on capital and the tying up of working capital which could be utilised somewhere else in the business.
- The need for long-term storage requirements.
- Obsolescence – due to changes in customer specification or lower than expected sales.

Over-stocking may bring marginal benefits in terms of bulk purchase savings, but these are often overstated and rarely enough to offset the additional costs of over-stocking.

In some non-horticultural businesses the actual cost of bulk buying has been shown to be double the initial purchase cost.

Over-processing

In simple terms, this is providing the customer with more than they asked for. Sometimes this is done as an insurance policy 'just in case' standards slip to avoid rejects. Part of the Lean approach is to ensure that standards are maintained all the time and therefore over-processing is not required.

'Give-away' or over-supply falls into this category. For some growers a figure of 5% over-supply is considered to be acceptable even though this could still be costing over £20,000/Ha p.a. If by investment in better production, the need for over-supply could be reduced, a three year payback on investment criteria would allow £12,000/Ha to be invested for every 1% improvement.

Interestingly, although packaging is largely specified by the retailer, it could be argued that punnet, printed film wrap and promotional label are all over-processing in terms of the actual requirement of the consumer.

Waiting and delays

Losses incurred though waiting and delays are one of the more obvious and common inefficiencies. Consider how much time is wasted when people and equipment aren't where they should be. For example:

- Flat battery on work platform or somebody has borrowed it and not brought it back.
- Run out of boxes in the greenhouse; the whole picking team stops.
- Run out of fruit in the pack house; the whole packing line stops.
- Something / somebody in your way when changing rows.

Movement of people

Moving workers around for whatever reason is time consuming and wasteful. Consider how much time workers spend walking from one place to another each day:

- Is it really necessary?
- Can it be avoided?

How much of the working day could be spent doing something useful or in Lean terminology 'adding value' rather than:

- Trying to find a supervisor.
- Walking to the end of the greenhouse because spare hangers were forgotten.
- Going to the workshop for a spanner that is required every week or even every day.

Defects

Product defects either reduce or eliminate value or increase costs. These come in many forms:

- A truss that does not meet the minimum weight specification due to bad truss pruning.
- Fruit damaged during transport to the pack house.
- A truss with green fruit that should not have been picked.
- A leaking irrigation pipe.

Defects can also include those things that incur additional work / cost because there were not done correctly the first time. Quality of crop work definitely falls into this category.

Talent

The most important participants and advocates in Lean are the workers themselves. They know the work better than anyone else and most ideas for improvement will come from them. People instinctively want to make their work as easy as possible so many of the most effective and simple ideas will come from people who actually do the job. The stereotypical suggestion box may have a place but only if ideas are acted upon. Suggestions soon become rare if they lead to nothing. A better route is by the active participation of staff in improvement projects. This draws out the ideas and encourages commitment to making them work.

The Lean toolbox

This section of the report describes the frontline Lean tools that were used in the HDC project at Wight Salads. The project used just a selection of the many techniques available in Lean and represents a good starting point for any business new to the underlying ideas.

Process mapping and string diagrams

Process mapping and string diagrams are used to help identify, document and visualise what really happens in processes. They often reveal considerable differences to what people first perceive is / should be happening in a process. Process maps and string diagrams are best completed by the people who do the job. Tracking a task as it is carried out usually helps to produce the clearest representation of the process.

String diagrams

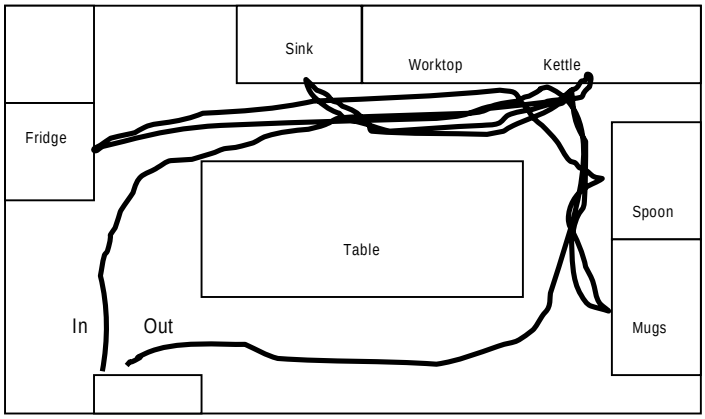
These are used to help visualise the movement of people and products. The following simple example shows the making of a cup of tea.

Original process

The string shows the route taken during the process.

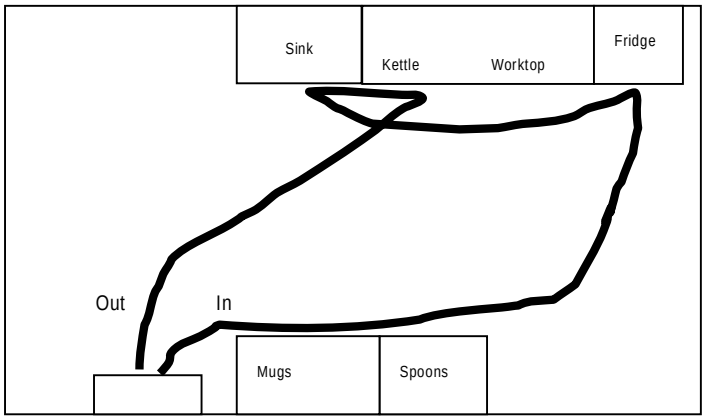
Note in this case:

- The obstruction caused by the table.
- The distance between the kettle, fridge, sink, spoon, mugs etc.



Modified process

- It wasn't practical to move the sink because of the plumbing.
- The table wasn't used for anything else so it was removed.
- Everything else was re-positioned to promote flow and reduce 'back tracking'.



Ideally, the sink could have been moved, but realistically the cost and effort involved in doing this might not be considered as worth the benefit it would deliver. The modified process however, is clearly a vast improvement on what went before.

Demonstrating success using simple actions like the ones shown above builds confidence in the process and may encourage more far reaching modifications in the future – i.e. the sink might be moved.

String diagrams can be applied to everything from the route a fork-lift takes around a site to the movement of boxes on a picking trolley.

Process mapping

Process mapping lists every individual action that is required to complete a particular process. This should be done for each small increment of the process with defined start and end points; otherwise it can become a daunting task. The time taken, tools / equipment required, distance travelled and problems encountered that delay the process should all be listed. The value status of each one should be categorised (see Section 5.1 on Value). A useful technique used by EEF consultants is to use coloured Post-It™ notes for each value type. This means that non value add processes are more easily identified. The photograph below shows a 'low level' process map for picking (plant – pack house intake). The orange notes indicate problem issues identified that delayed the process. Note how many there are and how easily they are identified by their colour alone.

Problem solving

After mapping the process its current state has been defined; warts and all. It is likely that some non value add processes or wastes are very obvious and simple to solve. However, the solution to some problems will not be quite so obvious.

A common mistake is to deal with problems superficially without tackling the underlying cause. Superficial solutions might provide a quick fix but will not stop the problem from re-occurring.

An example of this is shown in the photograph opposite where a red box has been positioned to catch fruit which accidentally falls off the conveyor. But stopping the fruit falling off in the first place might be a better solution?

The 5 Why's analysis

The 5 Why's analysis helps to get to the root cause of a problem. It's based around the idea that if you keep asking 'why?' long enough you will eventually reach the core of the problem – and 5 Why's is usually enough!

Of course sometimes it's not necessary to be that persistent. The photograph above is relatively straightforward.

Q. Why do the punnets of fruit fall off?

A. There are no guide rails.

So the solution is to fit some, not just to catch what falls off.

However, the answer is not always so obvious. In another example: picking stops due to a lack of boxes. A simple solution could be to buy more boxes and maintain higher stock levels in the greenhouse. Applying the 5 Why's:

- Why did we run out of boxes? – the fork-lift was late.
- Why was the fork-lift late? – it ran out of fuel.
- Why did it run out of fuel? – the driver didn't realise it was nearly empty.
- Why did the driver not realise? – the fuel gauge was broken.
- Solution – mend the fuel gauge.

5W + 1H (What, Why, Where, When, Who, + How)

Another analysis-through-question idea is 5W + 1H. This is used to analyse the purpose of a process and why it is undertaken in the current way, place, sequence etc.

The table below provides more detail on how it works.

	To find out	Example questions
What	It's purpose	What is it for? What would happen if we stopped doing it? What else could we do?
Why	The need for it	Do we have to do it? Does it have to be done that way?
Where	The best location for it	Why is it done there? Could it be done somewhere else? Can we do it all in one place?
When	The sequence of events	Why is it done in that sequence? Does it have to be done at this time? Can it be done at another time?
Who	The skills required	Why is it done by this person? Can somebody else do it?
How	The way it is done	How do you do it? Why do you do it like that? Can it be done another way?

Setup reduction

With an increasingly wide range of product specifications, especially in the tomato sector, and the need to react to last minute changes to order quantities, growers have to be able to react quickly to meet customer demands. If cost was no object the simple solution would be to have a high capacity packing facility for each product line. However, this is rarely practical because of cost and space limitations.

In practice, single lines are often switched between products at regular intervals. At Wight Salads, albeit rarely, a single line could change products up to 20 times per day. With16 people on the line, even with a switch over time of 5 minutes per change, 1.3 hours of staff time would be wasted for every changeover. That would account for 27 man-hours lost on the worst day. It should not be assumed that this only happens infrequently or that it only takes seconds to change products. In reality it can be disturbingly frequent and time consuming.

Shortening the time to switch from product to product can save in many ways. These include:

- Reduction in staff idle time.
- Increase in machine output – reducing the need for investment in additional capacity.
- Faster response – reducing the need for stock.
- Increased flexibility – greater customer satisfaction.

Reducing setup / change-over time

A good example of the need to reduce change-over time is at Formula 1 racing car pit stop. This may seem far removed from a glasshouse production system but the principles employed are essentially the same. Key elements are:

- Do as much preparation as possible before turning the machine off - in Lean terminology convert internal processes to external processes.
- Streamline internals and externals – make operations as efficient as possible.
- Utilise all staff - everybody can contribute to the change.
- Set procedures and train staff so that everybody knows what to do and when.
- Simplify - use simple dedicated tools to make it easier and foolproof.

In the Wight Salads example above, based on time alone they could afford to dedicate one hour of preparation time to each change-over and still make savings based on wasted time alone.

Areas identified were:

- Passing on of responsibility; in some cases only a supervisor might be allowed to change settings because of the critical effect on the quality of the end product. However, with the correct training and systems in place line workers could change settings. All the supervisor really needs to do is quality check the first product off the line.
- Set procedures with checklists; this ensures that everything is done and checked.

- Put names against jobs to ensure that everybody knows what they are doing.
- Develop simple tools and jigs to ensure *right first time, every time*. This avoids the need for fine-tuning and repeated quality checks. For example, using a punnet to set guide rails can be difficult and inaccurate because they flex so much. A better solution is to have a solid wooden or plastic block of the same dimensions.
- Machine specific tools rather than personal ones ensure that they are always where they are needed and are appropriate for the job.
- Can that nut be replaced by quick release system?
- Colour code nuts and spanners to enable fast identification / selection.

A simple example at Wight Salads was a label machine where changing the labels was difficult and therefore slow. A second spindle allowed the new labels to be prepared 'externally' and placed on the machine within seconds rather than minutes. A truly Lean solution would have been to continue to ask why and identify what caused the label change to be difficult in the first place. In many cases the purchasing department will buy a cheaper product without knowing about the additional costs it incurs in the process.

This project has focussed mostly on the application of setup reduction techniques in the pack house. However, the principles are applicable to processes that are regularly changed from one configuration to another. Possibly even the end of season turnaround.

5S

5S is a structured approach to organising a workspace (especially a shared workspace) and keeping it organised. It is very much about 'a place for everything and everything in its place'. How much time is wasted just trying to find tools and equipment, even a pen on your desk?

Which would you prefer?

A clear space with nothing to get in your way …….. or working in-between all of this?

Sort

Take out the clutter so that you are only left with the things you need on a regular basis. Question the need for everything being where it is. If there is only a pen on your desk you will be able to find it immediately.

Retaining the desk analogy, if something is used:

- several times/day it should be on your desk.
- Once/day – in the drawer.
- Once/week – in the filing cabinet.
- Once/month – in the filing room.
- Once/year – archived.

Lean uses a technique called red tag attack to help determine the best place for something. If you are unsure how often something is used put a red label on it and only remove it when the equipment is used. After one week check what has / hasn't been used. It is surprising how little you use on a daily basis. This can be applied to any area from a work platform to the whole pack house.

Set

As well as everything having a place it's important that the place is appropriate to who is using the item in question. For instance, in an office the benefits of sort will be lost if the filing room is a long way from your desk and you are the only person who uses the document. Think about the best location for everything, then label / mark where things should be. In the greenhouse this can be as simple as drawing boxes on the floor to indicate the position of equipment e.g. work platform needing repair, or using shadow boards for tools and jigs.

Shine

This is more than just a daily / weekly tidy up, it is also an inspection of equipment and tools to help identify any issues as soon as possible. For example having to repeatedly clean away tomatoes from one particular area of a machine indicates that there is an issue that requires attention. A tool that is rarely on the shadow board could mean that there aren't enough of them.

You won't always get everything right first time; there will be times when a re-think is required.

Standardise

As soon as the shine process has ironed out any problems, write down the procedures and locations of equipment. Take photographs to show the desired state and display them in the work area. Replace temporary markings with permanent ones and where applicable roll out the standard approach across the business.

Sustain

Each stage of 5S is progressively more difficult to complete. The greatest challenge of all is to retain interest and enthusiasm. The old ways can so easily creep back in. Regular reviews and continuous improvement ensure that new problems are solved as they occur and that changes in the customer's requirements are integrated efficiently and not just 'bolted on'.

The first 5S cycle will make things better, but don't use it as an excuse to do nothing for a while. There are occasions when an even better way becomes apparent because 5S has just been completed.

Other Lean tools

The following section includes some other Lean tools that were found to be useful in this project.

Problem resolution charts

A problem resolution chart is similar to a 'maintenance book' or 'suggestion box'. The chart should be in a prominent position close to where the work is carried out. The advantage of a chart is that entries are immediately visible to all concerned. The chart should also be used to record when a problem has been noted and acted upon and it should be checked at least weekly. If problems are not noted and acted upon, users will become disenchanted with the system and the chart will not be used.

Initially, resolution charts will generate a lot of work as the hassles and annoyances of day to day work are addressed. The value of resolving these should not be underestimated even if they are effectively cost neutral. It shows a commitment to improving things. This will help with adaptation to bigger changes that might come along later and will encourage the drawing out of more fundamental problems and solutions.

The figure below shows a sample format for a problem resolution chart. Key components are an area which indicates to staff that a problem has been noted by management, who is going to sort it out and by when. All that remains is for it to be completed on time!

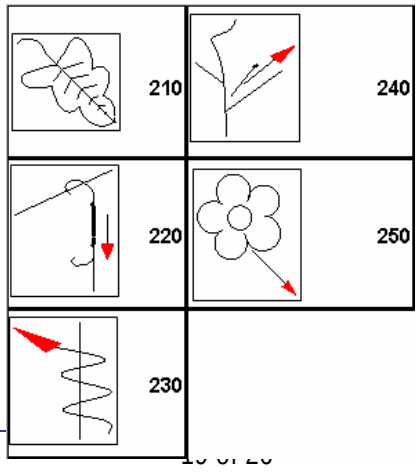
Date logged	Problem	Logged by	Expected completion date	Owner	Actual completion date	Status
1st Aug	Automatic door broken	JS	7th Aug	TP	6th Aug	■
4th Aug	Battery charger 4 not working	CP	10th Aug	NF		◧
10th Aug	Platform 12, electrical problem	JL				▭

◧ Problem noted ◧ Solution found ◧ Solution implemented ■ Completed – process has improved

Visual systems

Information can be more rapidly absorbed from pictures and symbols than text. This is especially important in horticulture where there is widespread use of workers whose first language is not English.

Where appropriate, examples of good practice and common mistakes can be included in symbolic instructions. Care must be taken not to be



too detailed or elaborate; a single image showing the required specification should be adequate and be positioned close to the point of work. More detailed compilations of best practice and common mistakes should be reserved for training or the staff handbook.

The chart opposite uses images to describe specific crop work tasks and their associated job code. This was developed to aid accurate labour recording as part of PC 227a.

So where do you start?

Implementing Lean will lead to change and often change is resisted. Fear of failure, fear of the unknown, fear of a hidden agenda may hamper the introduction of change. Therefore, any changes within a business whether driven by Lean or not need to be introduced sensitively otherwise their full potential will not be realised, or they may even fail.

- Commitment to the process is required at all levels.
- Organisation commitment and goals need to be communicated to staff.
- The commitment needs to be confirmed by resource and action.
- Success breeds success; form an effective team and pick off some easy wins to demonstrate what can be achieved.

One of the objectives of the Wight Salads project was to see how many different areas could be improved through lean. The outcome demonstrated a surprisingly large number of applicable areas. In fact so many areas were identified that it was not possible to bring them all to fruition.

It's important to not regard Lean as a quick fix applicable to the most obvious areas. Using 5S to get things tidied up is a step in the right direction. But if after the exercise things immediately start to slip back again, Lean has not truly been applied.

Rather than taking a piecemeal approach in the adoption of Lean a more productive approach might be to take part in a Lean introduction workshop / training course. This will increase your confidence in the concepts and their benefits before trialling them for real. You will then have a much greater chance of success.

Dip your toe in the water

Rather than tackling all problems immediately, dip your toe in the water. Focussing on the immediately obvious problems delivers quick wins – like the application of 5S alone:

- You might spend less time looking for labels and not run out of stock again!
- Marking out a location for a spare platform will mean that everybody knows where to get one from and similarly where one requiring repair should be placed.

However, be aware that this level of Lean implementation tends to:

- Only resolve problems that you already know about.
- Fix immediate problems but not necessarily tackle their long term causes - so they may reoccur.
- Not completely identify and remove inherent inefficiencies in the process.

- Lead to criticism that Lean is too simplistic to be important and is, in fact, little more than the application of common sense – so who needs it anyway?

Get both feet wet

This takes more commitment and involves using all the Lean tools available like string diagrams, process mapping, waste identification, 5S etc. This will start to reveal more deep seated issues like:

- The identification of hidden waste.
- The underlying cause of a problem allowing a permanent solution to be considered rather than a temporary one.
- The need to develop innovative, but quite often simple process improvements.

A Lean workshop on your own nursery may seem a big step but it can help to apply the Lean techniques to real problems affecting your business. Using a Lean specialist to run the workshop is a good idea as it will:

- Provide Lean training to a wide group of people.
- Demonstrate a commitment to Lean.
- Possibly identify a member of staff who has the potential to develop into your own Lean champion.

You should select the right process to analyse. You may wish to concentrate a more rigorous application of Lean to a particular process. Such a process will:

- Have easily defined / manageable boundaries.
- Present opportunities for quick / easy improvements.

Examples are:

- *Storage of labels and packaging* – to avoid over-stocking, time wasted finding the required item etc.
- *Work platform maintenance / repair* – to avoid time wasted finding a replacement and ensure timely repair and even reduce the number of breakdowns in the first place.

There are usually plenty of processes that staff can immediately identify as having potential problems. Remember that even if one process problem is solved completely this represents a better result than if lots of processes are considered but no actual conclusion / solution is reached.

Select a team

The team should include a representative from each key stage in the process as they will all be able to relate an opinion in respect of their own function and experience and how they might be affected by conclusions reached. Their inclusion will stimulate ideas from all angles,

produce a more robust conclusion and increase their commitment to make it work.

A Lean workshop

The workshop should include:

- Introduction to Lean principles and tools.
- How to apply tools to specific processes.
- Solutions development.
- Solutions implementation.
- Monitoring results.
- Promoting successes.

Working towards a solution

Very few proposed solutions work first time and it takes persistence to come up with the right answer to any problem. Therefore, it's common to go through several cycles of development, implementation and monitoring before things reach a satisfactory conclusion. Developing a Lean approach is not a one-off process, it is a continuous cycle. Left unattended initial improvements can revert back into old ways. Implementing Lean is like rolling a boulder, it takes a lot effort to start but much less to keep it going.

Example improvements

Here are a few examples of how Lean has helped to improve the efficiency of systems.

Crop work quality assessments

The process mapping of a picker's work highlighted wasted time and product because of having to pick fruit off the floor. A 5 Why's analysis found that the fruit had been knocked off the plant at the time that de-leafing was being carried out by a crop worker i.e. poor quality of work. This should have been highlighted by a crop work quality assessment. But this had not been rigorously applied and the results were not readily available.

It was revealed that:

- Good crop workers complained that 'other workers' were getting away with poor work because they didn't know for sure that it had been noted.
- Managers didn't know if / when checks had been done by supervisors and if poor work quality had been noted.
- Supervisors didn't have the time to carry out weekly checks on everybody.

Improvement

The 'Traffic Light System'

This was displayed in each greenhouse block so that everybody could see the status at any given time.

Week	10	11	12	13	14	15	16	17	18	19	20
Rob											
Jon											
Jenny											
Tony											

Acceptable quality
Improvement required
Major quality problems

Major quality problem - bonus immediately withdrawn. The penalty was simple and clear.

Improvement required. Two successive ambers - bonus withdrawn. This reinforced that persistently 'below par' work would not be tolerated.

Two successive greens - return of bonus. This gave a clear and achievable path to the reinstatement of a bonus therefore encouraging improvement.

Continued greens – less frequent assessments. This demonstrated trust and reduced the supervisor's workload allowing them to focus on poor performing staff.

On-site communication

This was revealed when the work of a picker was process mapped. A single picking team leader wasted at least 15 minutes each day trying to locate a supervisor. Total time wasted (5 days/week, 30 week peak picking season) was 37.5 hours i.e. one picking team leader spent 1 working week every year looking for a supervisor.

Improvement

The solution proposed was to have a fixed radio point in each greenhouse so anyone working within that area would have access to communication. This was expected to reduce the time to find a supervisor to 5 minutes saving 25 hours per affected person per year.

An even better approach would have been to find out why the supervisor needed to be contacted and put systems in place to render this unnecessary.

Work platform specification

This was highlighted by the process mapping of the work of a crop worker. It was common for new crop workers in particular to forget some of their tools or run out of spare bobbins part way along a row. Time wasted 10 minutes per incident.

Improvement

A visual checklist was fixed to each work platform and dedicated 'stocks' provided close to the place of work.

Boxes for picking

This was highlighted by process mapping of the work of a picker. Collapsible boxes used for picking took time to rebuild prior to filling. They were also difficult to secure on pallets requiring strapping and shrink wrap before they could be transported to the pack house. Although it was not analysed it was also considered that associated costs / waste would be occurring in the pack house.

Improvement

Rigid boxes specifically designed to stack on a pallet and interlock to reduce the need for strapping were introduced. Small scale trials showed a 10% improvement in overall picking speed.

Picking trolleys

Padding fitted to picking trolleys to protect workers when pushing them along with their legs was missing. Although the production benefits of repairing the padding were not easy to quantify, the goodwill engendered by undertaking this simple exercise increased morale and confidence.

Improvement

An annual service and monthly checklist was suggested to ensure that simple repairs were carried out promptly. An alternative suggestion was to use a block maintenance log or problem resolution chart.

Labelling machine

A low level waste walk identified that promotional labels were applied by hand. This began as a short-term requirement that did not initially justify investment in automation. However, over time promotions of one type or another occurred more frequently until label application was occupying two people, full-time.

Improvement

Purchase of two automatic labelling machines. Payback in less than 12 months.

A 'runner' on the packing line

A low level waste walk identified that workers on the packing line replenished their own individual stack of punnets from a single point at the end of the line and emptied their own waste bin. Some walked 15 metres each time.

Improvement

A dedicated worker or 'runner' was made responsible for these tasks. Kanbans were also suggested to allow rapid identification of who required punnets and to avoid excess punnets being stacked at work stations. This also helped to streamline the change-over from one product to another.

Acknowledgements

We are extremely grateful to all staff at Wight Salads for their time and dedication to project PC 257 and for helping us to start implementing a Lean system within the business. We hope it is a process that will continue in the future and so help the business to prosper further.