Introduction

The initial goal of this project was to improve the sealing process on the GRN and ZRII lines of production at Innovative Flexpak. Certain problems were encountered while attempting to analyze and generate samples of the cosmetic defects: because the process was out of statistical control, we were unable to establish the cause of these flaws. In order for us to analyze the packet-filling process with the most accurate results, it would be ideal for the process to be put in statistical control. However, we continued with an examination of the process to determine the efficiency of the system.

Through reevaluating the process, we discovered an issue with weight variation among the products in the GRN line. Our group determined that there were very few operational definitions in use. There were also other factors in the process that needed to be taken into account and analyzed, such as issues caused by the foaming of the product or a lack of measurement systems. A switch in focus was made to the HRT and GRN lines of production.

To enhance and make our investigation a worthy project, we took analysis of traditional loss, Taguchi loss, capability, and operational definitions to enable Innovative Flexpak to improve the GRN and HRT production lines. This information will help increase production as well as suggest ways to put the process into control.

Cosmetic Concerns

During the first visit to Innovative Flexpak, our team was informed that cosmetic defects were a concern. This included wrinkles in the seals of the packets, excess material around the sealed top, and bubbles trapped in the seal. The company thought it would be beneficial to them for us to look at the issues directly involving packet seals. There were two lines in particular that had many cosmetic defects: ZRII and GRN. However, only the GRN line was running, so we focused on that process.

While studying the GRN line, we observed specific areas where variation in the feed rate system directly affected the quality of the product. After every changeover, the workers had to estimate the appropriate feed rate of the gel through trial and error. This resulted in wasted packets, gel, and time.

We took samples of the GRN line to find out if the process is in control. For a process to be “in control,” there must not be any outliers. An outlier is something that is out of the normal, or something that has high variation. In this case, the samples taken were analyzed and measured to determine if the sampled data points fit inside an upper and lower control limit. This calculation will determine whether or not the process is “in control”. The upper and lower control limits are limits that are calculated using standard deviations from the collected data. For the GRN process that we sampled, the process was out of control: there were too many outliers. Because the process was out of control, we were unable to perform further analysis.

Challenges with Analysis

Quality in a product is based on the needs and wants of the customer. The level of quality is determined by how well a company can satisfy the standards set by the customer. Variation is the enemy to quality. When variation appears in the products, the process has drifted away from the expected quality that the customer has communicated to the company. The purpose of our analysis was to statistically determine how well the product lines at Innovative Flexpak are meeting the level of quality expected by their customers for those products, and how variation could be reduced on those lines to improve the quality of the products.

In our analysis of the process, we wanted to perform a Design of Experiments (DOE) to determine the cause of the cosmetic defects. A DOE is a system of tests performed on a process where different factors of the process are tested to determine which factors affect the product the most. With this information, changes can be made with informed decisions to improve the system. However, without proper measurement systems placed in certain areas of the process, there was no way for us to test the necessary factors.

DOEs are generally performed on processes where variable data can be gathered. In a situation where only attribute data can be gathered, DOEs are difficult to perform. For clarification purposes, variable data is collected in quantities that are measured on an infinite and continuous scale. Attribute data is data that is collected in whole numbers. This means that there is only a pass/fail system.

It is currently not possible to determine the pressure of the sealing clamps. If this measurement system was in place, variable data could be collected and a DOE could be performed. The performance of a DOE is also determined by whether the process is in statistical control or not. Unfortunately, the GRN and HRT lines are not.

A control chart was generated to display the amount of variation in the product due to variation. When the data was analyzed, we determined that the main cause of defects was leakage due to broken seals in the packets. As we further examined the data with a control chart, we saw that the system was out of control, and we needed to get the system in control before further analysis was to be completed.

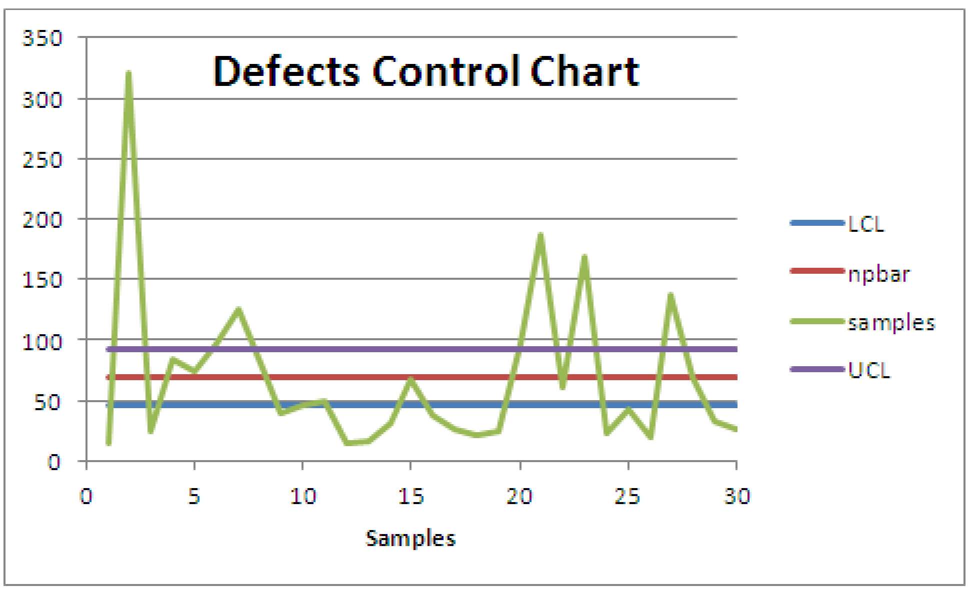


Table 1: Control Chart for Defects

Another issue caused by lack of measurement systems is the amount of scrapped material and time lost when a changeover is performed. We discovered that when a changeover takes place, operators spend close to a full day adjusting the machine as it runs to get it to acceptable quality levels. This has to be done because, again, there is a lack of measurement systems in place. The optimal sealing clamp pressure is unknown because there is no way to measure the pressure. Also, there is no way to measure the injection pressure of the product; the operator has to tamper the tightness in the knob in order to find the right injection flow rate. There is no record kept concerning the optimal sealing clamp temperature, leading to subjective operator opinions of an ideal temperature. All of these factors are adjusted continuously by the operator at each changeover until the process meets quality standards. Despite those efforts, the process is still out of statistical control.

We also discovered that there is a general lack of operational definitions in the process of inspecting the product for cosmetic problems and leakage issues. An operational definition is a standard that is very explicit in meaning. It eliminates vagueness and grey areas in which an operator may be confused. Currently, there is no standard, picture, or diagram that tells the operators and inspectors what constitutes a cosmetic defect.

Figure 1: ZRII Cosmetic Specifications

The picture above is the closest representation of an operational definition at the company. It displays the acceptable wrinkles for ZRII packets. The general vagueness in process directions allows for inspectors' subjectivity in determining whether a packet should be scrapped or not. The current method of determining a proper packet seal also varies between inspectors. Currently, to test whether a packet is properly sealed, the inspector hits it with the heel or palm of their hand. There is no set standard for testing the seal of a packet, as it is left up to the inspector to decide where they should hit the packet, how hard to hit, with what part of the hand, etc. It is understandable that wrinkles and other cosmetic defects are hard to define, but in other areas of the process it is necessary to establish operational definitions.

In terms of the sealing pressure of the packets, there is currently no way to determine the pressure of the final sealing clamps. Due to this, it is necessary at the start of each shift to experiment with the pressure until the ideal is found, resulting in product that has poor sealing quality and must be scrapped.

From our own analysis of the data and operator insight, we labeled the following possibilities for the cause of the problem:

- Clamping pressure variation
- Temperature of packet sealing
- Injection speed for filling packets
- Speed of product movement down the line

Variable Data

Another area of the process where a lack of measurement tools is causing variation in the product is in the feeding/filling system and in the hopper. Due to the varying feeding rates between the main vat and the hopper, the product gets sent to the hopper where there is a pause in the filling of the packets. When the product is sent back to the main vat, it drops a distance of up to five feet from the top of the vat to the bottom, where air is mixed into the mixture. When the product is pumped back to the hopper, it is mainly foam, which collects in the hopper.

This foamy product is lighter and creates variation in the weight of the individual packets when they are filled. The foam can be ladled out of the hopper and disposed of; however, there is no way to tell when the hopper is full of foam, because there is no measurement system in place to notify the operator of the foam. As a result, there are boxes of packets that are lighter than the company's and customers' standard.

Figure 2: "Waterfall Effect"

One possible solution is to install a density probe in the hopper. This probe could be calibrated to notify the operator when the product in the hopper begins to reach a density that will affect the weight of the individual product packets.

However, the best solution to the issue of foamy product in the feeding system would be to change the system at the main vat where the product is fed back into the hopper. From our analysis, the main reason for the creation of foamy product is the "waterfall effect" experienced when the product is pumped back to the main vat. As it drops from the tube at the top of the main vat, it churns air into the product, creating the foam. The foam in the feeding system could be reduced if a system was put in place at the main vat that prevented this waterfall effect, either by lowering the placement of the return tube, or creating a system that would run the product down the inside wall of the vat to prevent air being churned into the product.

After the issue of weight fluctuation was discovered, data was collected for the GRN and HRT lines. Certain team members went to the company and weighed 1 packet out of a box containing 30 packets. This process was repeated randomly for 100 samples. The data was recorded and used in traditional loss, Taguchi loss, and capability analyses.

Traditional Loss

Traditional loss is the amount of loss that the product will have based on initial pricing. Funds wasted in manufacturing are typically calculated based on the material and time spent on a discarded, faulty product. A faulty product is a product that does not fall within customer specification limits. For example, the individual product cost is $0.20 and $0.27 per packet produced on the GRN and HRT lines, respectively. Any packet with a gel product weight outside of the specified limits, (less than 21g and over 21.6g) is considered faulty. The chart below represents loss from a traditional look: any packet that is scrapped will cost the company $0.20.

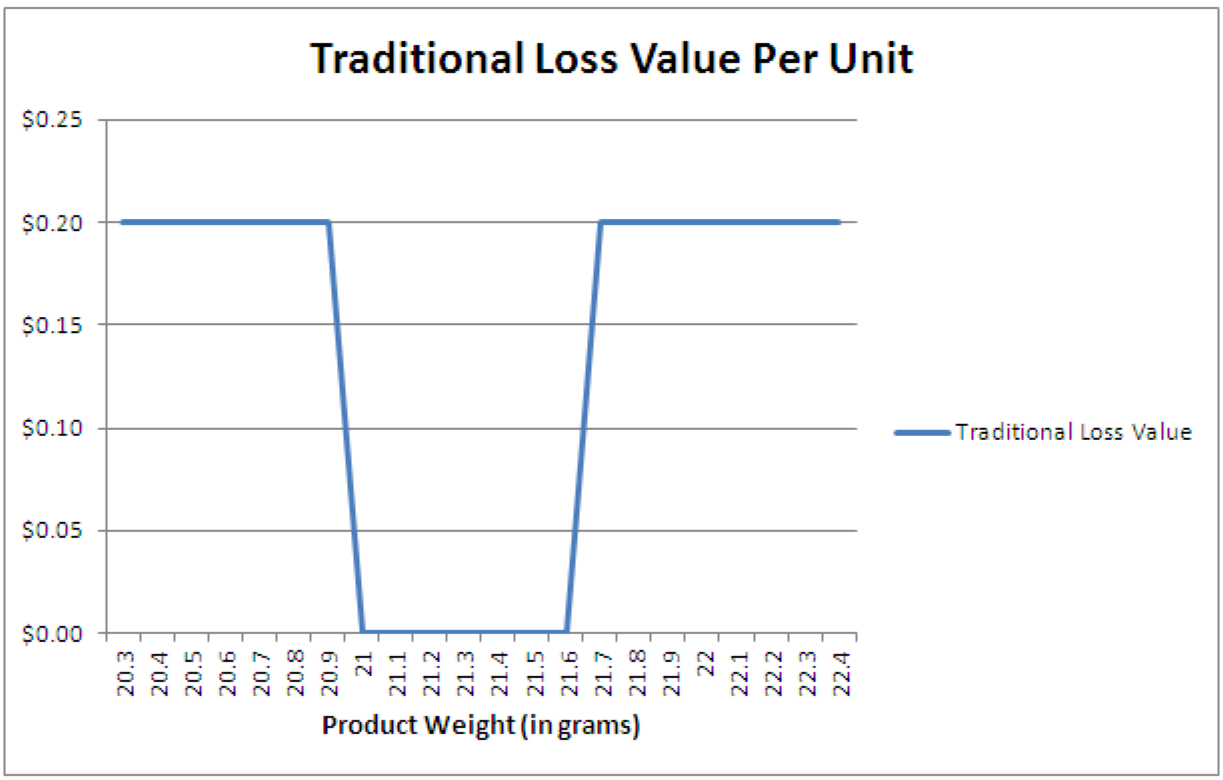


Table 2: GRN Line Traditional Loss

GRN Line

The company lost $8099.00 over the period of twelve days with 55399 units of scrap on the GRN line. This only takes into account the actual material loss. On average the amount of scrap per day is 4,618 packets. 1,380 of these scrap units are empty packets costing $0.02 per package. The rest of the 3,238 packets cost $0.20 per package. This amounts to **$675.20** lost per day due to scrapped packets.

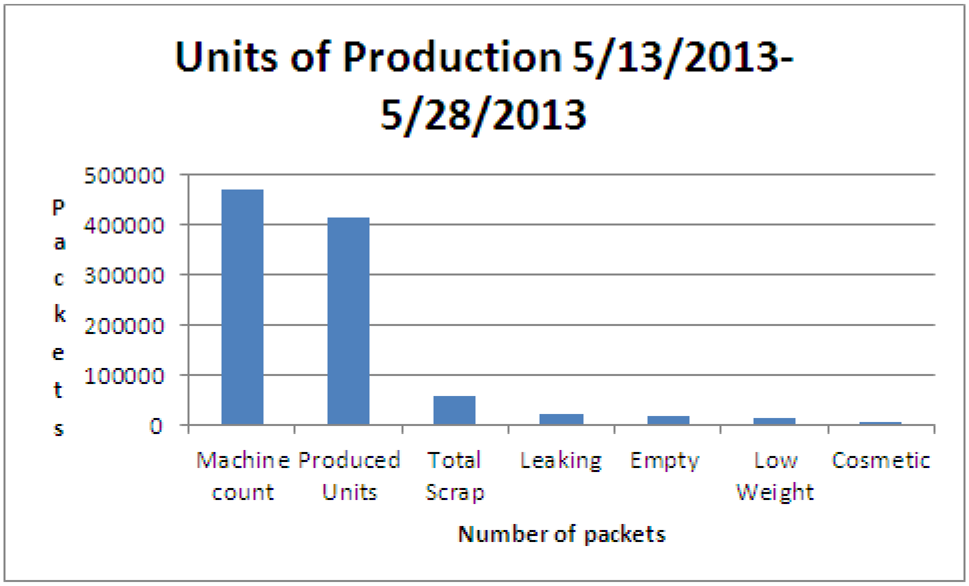


Table 3: Line 10 GRN Data

Machine count	470639
Acceptable units	415050
Scrap units	55399
Leaking packets	21776
Empty packets	16560
Low weight packets	11014
Cosmetic defects	4018

The greatest loss was due to leaking packets. The next greatest losses were incurred first by empty packets, and then by low weight packets; the least loss was incurred by cosmetic defects. The main issue that should be looked at is the amount of leaking packets that are in production, and the last issue that should be looked into is cosmetic defects.

HRT Line

When looking at the traditional loss for the HRT line there were 23,054 scrap parts resulting in $2430.58 for the period of three days. This only takes into account the actual material loss: other losses still need to be taken into account to see the long-term effects.

On average the amount of scrap per day is 7684 packets. 5058 of these scrap units are empty packets costing $0.02 per package. The rest of the 2626 packets cost $0.27 per package. This amounts to **$810.18** lost per day on scrapped HRT packets. The defects in the process for HRT are as follows:

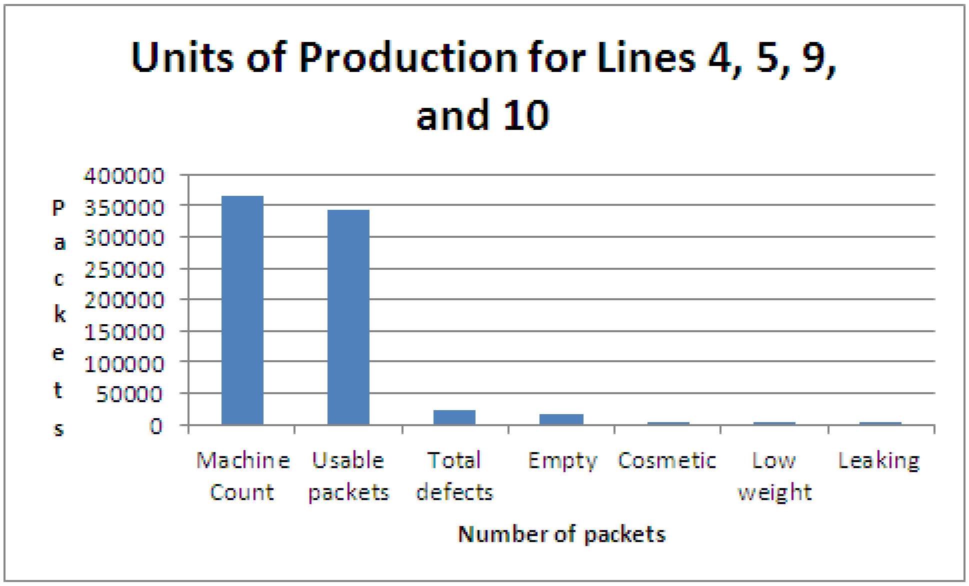


Table 4: Total Production of the HRT lines 4, 5, 9, and 10 from 12/14-12/16/12 and 3/22-3/25/13

Machine count	367327
Acceptable units	344370
Scrap units	23054
Leaking packets	1403
Empty packets	15176
Low weight packets	2356
Cosmetic defects	4001

The following charts are the individual days that show the production of that day and the line number.

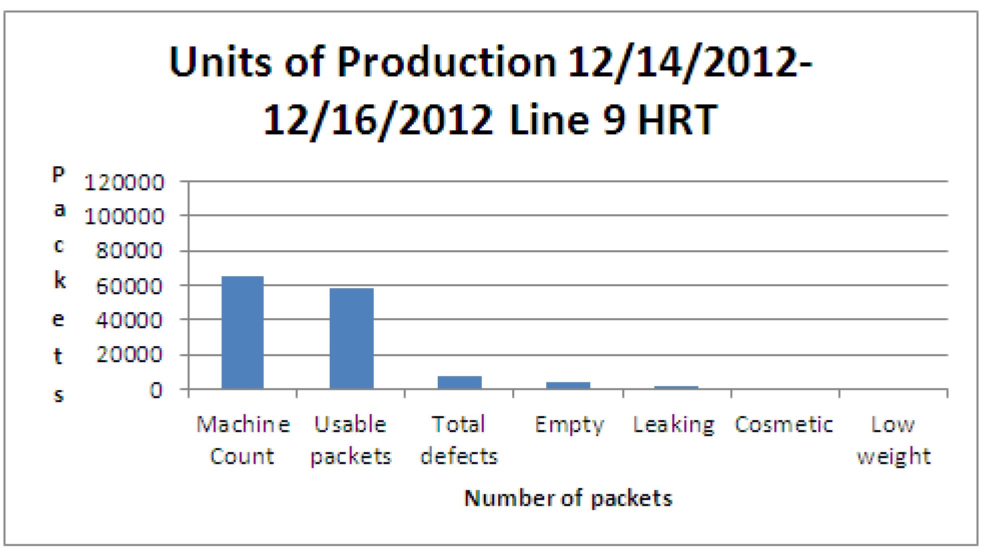


Table 5: Line 9 HRT Data

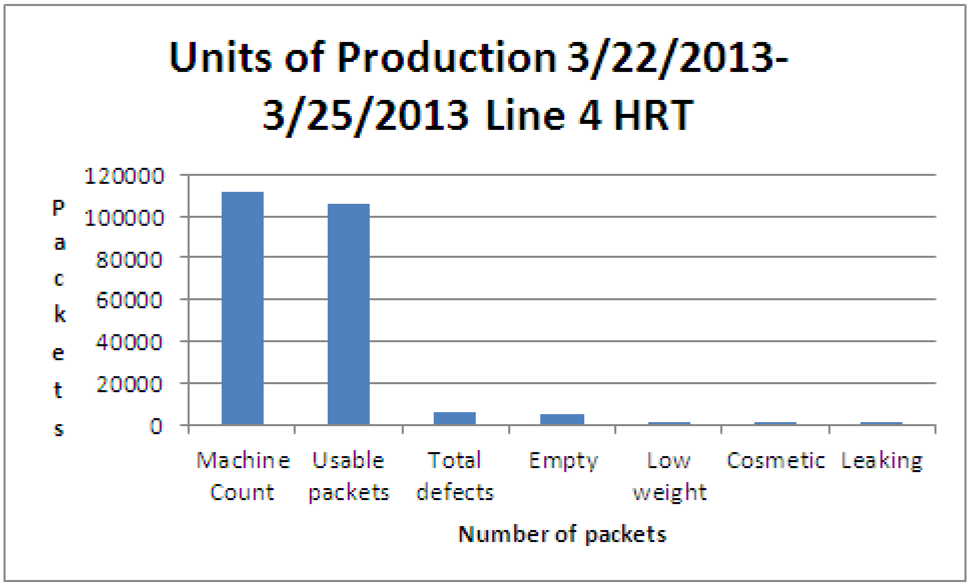


Table 6: Line 4 HRT Data

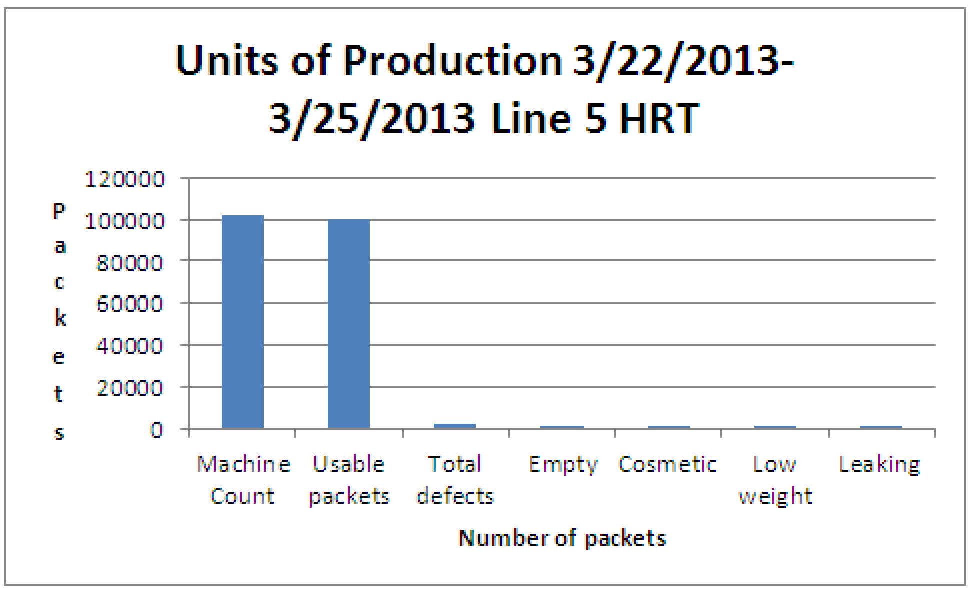


Table 7: Line 5 HRT Data

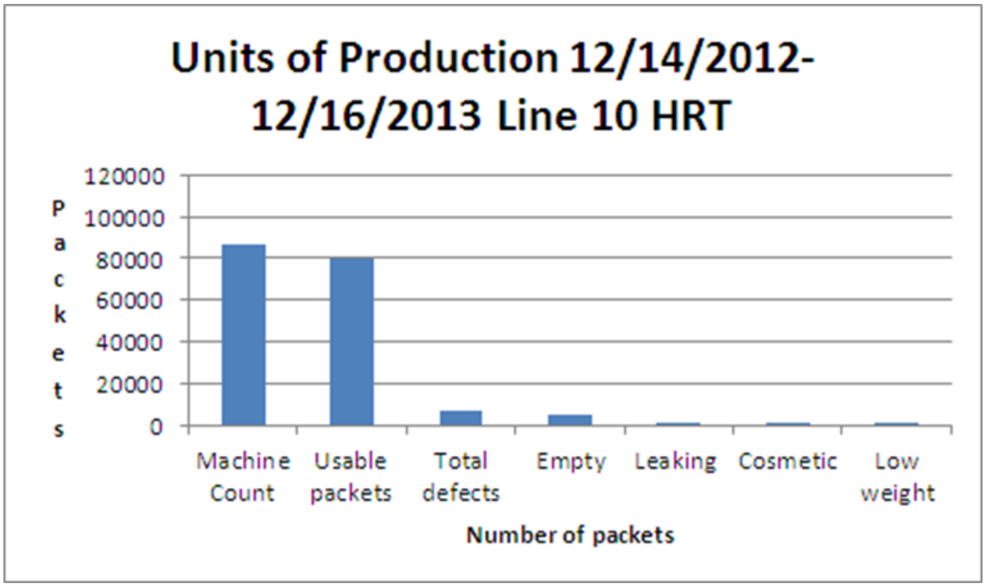


Table 8: Line 10 HRT Data

Taguchi Loss

Unfortunately, material cost and lost time are not the only things wasted when a part is outside specs and must be scrapped. Many other factors must be considered, such as affected processes later on in the system, customer satisfaction, product returns, product leaks post shipping, poor customer experience etc. For example, if a packet is filled too much, there may be losses downstream with cosmetic defects, leaks, and breaks.

Quality does not experience a massive drop when a product is made just outside of specification limits. Rather, the quality of a product experiences gradual drops as more variation is introduced. Loss in product value increases as variation increases. This is why the Taguchi Loss function provides a more reasonable estimate for monetary loss due to variation.

Taguchi Loss Function operates under the assumption that the more variation a product experiences, the more money is lost. Likewise, the closer the individual values are to the target, the more money is saved.

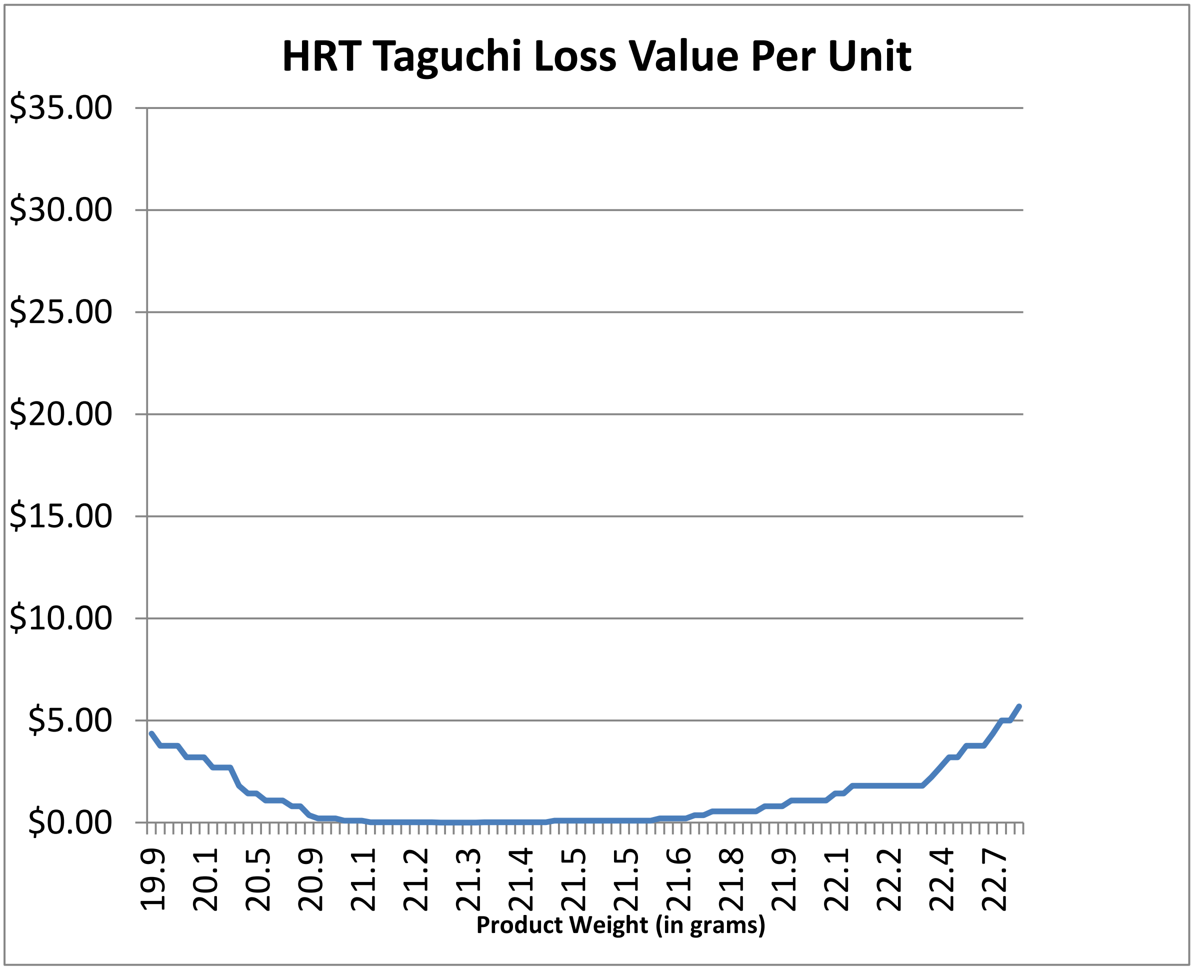


Table 9: Taguchi Loss for HRT

HRT Line Loss Function Statistics	
% Outside Specification limits (below 21g or above 21.6g)	57%
Total Traditional Loss over sample of 100 units:	$11.40
Average Standard Deviation between subgroups:	0.49g
Average Taguchi Loss per packet:	$1.21
Total Taguchi Loss over sample of 100 units:	$120.95

Assuming 35,000 units are produced per day, this means,

Total Traditional Loss over 1 production day:	$3,990
Total Taguchi Loss over 1 production day:	**$42,350**
Total Loss over 1 production day:	**$46,340**

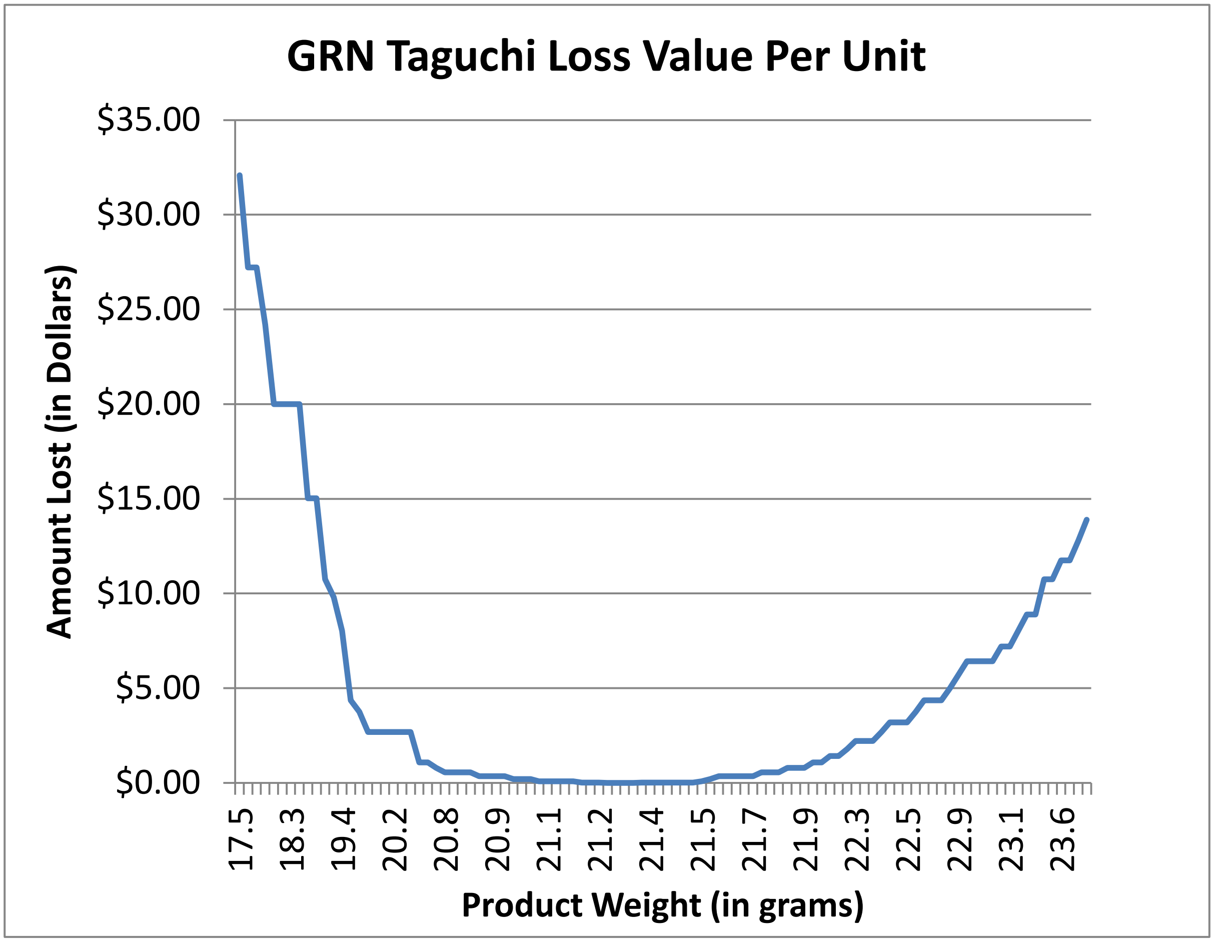


Table 10: Taguchi Loss for GRN

<u>GRN Line Loss Function Statistics</u>

% Outside Specification limits (below 21g or above 21.6g)	76%
Total Traditional Loss over sample of 100 units:	$15.20
Average Standard Deviation between subgroups:	1.18g
Average Taguchi Loss per packet:	$4.83
Total Taguchi Loss over sample of 100 units:	$483.34

Assuming 35,000 units of GRN are produced per day, this means,

Total Traditional Loss over 1 production day:	$5,320
Total Taguchi Loss over 1 production day:	**$169,170**

Total Loss over 1 production day: **$174,490**

Capability

Capability is a ratio of tolerance variation to process variation. It compares the process limits to the customer's requirements. In a process, there are two significant analyses of variation: control chart and capability. Normally, a process must be in control in order to be examined from a capability standpoint. From our calculations, it appears that this particular process is not in control. Therefore, an analysis of capability will be done on the data from Innovative Flexpak as an example.

First, a couple of assumptions must be made:

- The distribution is approximately normal.
- The process is statistically stable.
- The spec limits actually represent the customer's needs.
- There is minimal measurement variation.
- The target value is centered between the spec limits.

These are the basic formulas measuring capability:

$$C_p = \frac{Spec\ Width}{Process\ Width}$$

or

$$C_p = \frac{USL - LSL}{6\sigma}$$

First, we need to solve for the standard deviation, where $\bar{R}$ refers to the average of the ranges in the sample, and d_2 is the value used for a sample size of 5 when establishing a centerline:

$$\sigma = \frac{\bar{R}}{d_2}$$

$$\sigma = \frac{2.865}{2.326}$$

$$\sigma = 1.232$$

When the values are placed in the equation, the following is reached:

$$C_p = \frac{21.6g - 21.0g}{6 * 1.232}$$

$$C_p = .081$$

A C_p value of .081 means that for every .081 grams of tolerance limit variation there is 1 gram of variation in the process. This is not an optimal value. In order to have a capable process, the value should be greater than or equal to 1. That establishes a balance between specification limit variation and process variation.

C_{pk} is slightly different in meaning. It looks at the distance between the mean and the specification limits over the span of 3 standard deviations. If the C_{pk} values are approximately equal, then the data is centered and balanced. However, if the values differ, then the data is skewed towards the smaller value's specification limit.

$$C_{pk1} = \frac{USL - \bar{X}}{3\sigma} \qquad C_{pk2} = \frac{\bar{X} - LSL}{3\sigma}$$

$$C_{pk1} = \frac{21.6g - 21.323g}{3 * 1.232} \qquad C_{pk2} = \frac{21.323g - 21.0g}{3 * 1.232}$$

$$C_{pk1} = .075 \qquad C_{pk2} = .087$$

In this instance, the C_{pk1} value is lower, which means that the average weight is closer to the upper specification limit. It is important to realize that the process is not in control, so this data is technically invalidated. However, this is a good representation on how to analyze capability for when the process does reach statistical control.

The graph below represents an approximate histogram for the samples collected on the GRN line. It should be noted that the specification limits only encapsulate 24 of the 100 samples taken.

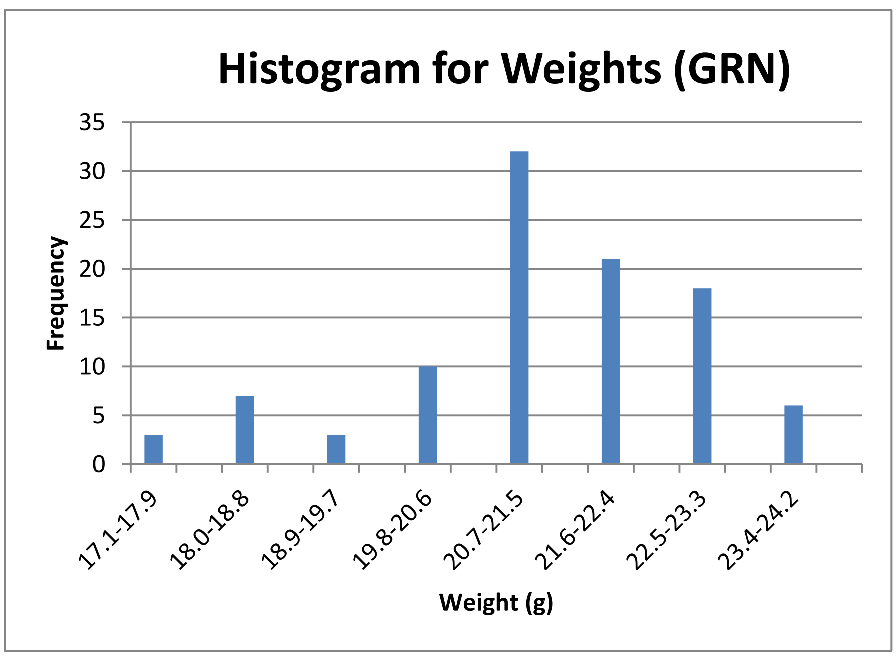


Table 11: Histogram for Weights

Solutions

Short-term

We noticed two places in the GRN/HRT line that contribute to the foaming issue. The first is in the vat where the product is pumped back into when there is a pause in the filling of the packets. The second is at the hopper above the line that feeds product into the packets. Both of these produce the aforementioned "waterfall effect," which causes a significant amount of foaming for the GRN product and causes slightly less foaming for the HRT product. The GRN product is more viscous, therefore it produces more foam. Figure 1 shows the feeding of HRT product into the main tank, which causes a thin layer of foam and bubbles on the surface. This effect is multiplied by large factor with the GRN line due to the difference in viscosity.

A simple and inexpensive solution to minimizing foam caused by the "waterfall effect" would be to attach a tube to the feed in both the vat and the hopper that directs the flow to the inside wall of the vat and extends almost to the bottom eliminating any splashing of the liquids that might cause air to enter the product. These tubes can either be metal and simply welded to the existing feeds or they can be a made out of a PVC-like material that can withstand the high temperature of the product. Either way this is only a quick fix solution that could reduce, but not completely eliminate, the presence of foam in the product.

Figure 3: Solution to "Waterfall Effect"

Long-Term

A more reliable and permanent solution to the foaming problem would be to use a degasifier system to completely remove the air from the product. These systems are commonly used for water and oil purification and can easily be installed on the pipe that feeds into the hopper. Membrana makes a variety of degasifier products that would fit the existing apparatus leading to the hopper. One of their products is called the SuperPhobic Membrane Contactor, which uses reverse osmosis to remove all gas from various liquids. Details on this product can be found in the appendix. The price of one of these degasifiers is only about $2000, which is significantly less than the amount of loss due to variation that we discussed previously in this paper. Installing one of these degasifiers would eliminate the foam and therefore save the company all of the money lost due to uncontrolled weight variation.

We established that operational definitions should be implemented in various stages of the production line. One of these is at the sealing clamps, where currently there is only a set screw that is subjectively adjusted until the mechanism "works right". A simple solution to this subjectivity would be to use a load washer cell between the set screw nut and the clamp to get a quantifiable value for the pressure of the clamps. Once the pressure is quantifiable, an operational definition can be established for the optimal clamp pressure and used as the default setting for every package that goes down the line. Establishing this operational definition will undoubtedly save a lot time and loss at changeover and throughout the entire process.

Another subjective measurement that could be corrected by establishing an operational definition is the way the packages are tested for leaking defects. Currently, the worker tests for leaking by hitting the package with the palm of their hand and seeing whether or not the gel leaks out of the package. There are several issues with this method. One, the gel is still at a scalding temperature and poses a safety hazard for the worker. Two, each worker undoubtedly uses a different amount of force when hitting the packets which allows variation to enter into the inspection process. And finally, this is one step that can be easily and cheaply automated, thus completely eliminating variation in the inspection process. A simple Z-axis actuator controlled with a PLC program would be sufficient to inspect each package using the current strike method but without the variation.

Resolutions

Firstly, operational definitions for quality for the different types of packets must be identified and implemented. Through operational definitions, issues such as what is acceptable and what is not as far as wrinkles on the packet or packet pressure is clearly understood by all operators, inspectors, etc. There is currently no way to measure how much pressure is being used to seal the packets during the clamping process. There needs to be a way that this pressure can be monitored and controlled, such as through loading washers. Methods for measuring product density must also be implemented. With a new density monitoring system in place, the amount of foam in the hopper can be monitored and through this the amount of foamy product that is injected into the packets can be controlled and reduced. A more comprehensive solution to address the issue of foamy product would be to couple the installation of a density monitoring system with an improved refeed system, so that foam is reduced at the source (i.e. in the main vat, when the product is fed back from the hopper to the vat). A short term solution to this refeed system would be a tube-like attachment in the main vat that runs the product down the side of the vat without churning air into the product. A longer term solution would be a degasifier machine, which would eliminate air in the product as it runs through it to the hopper.

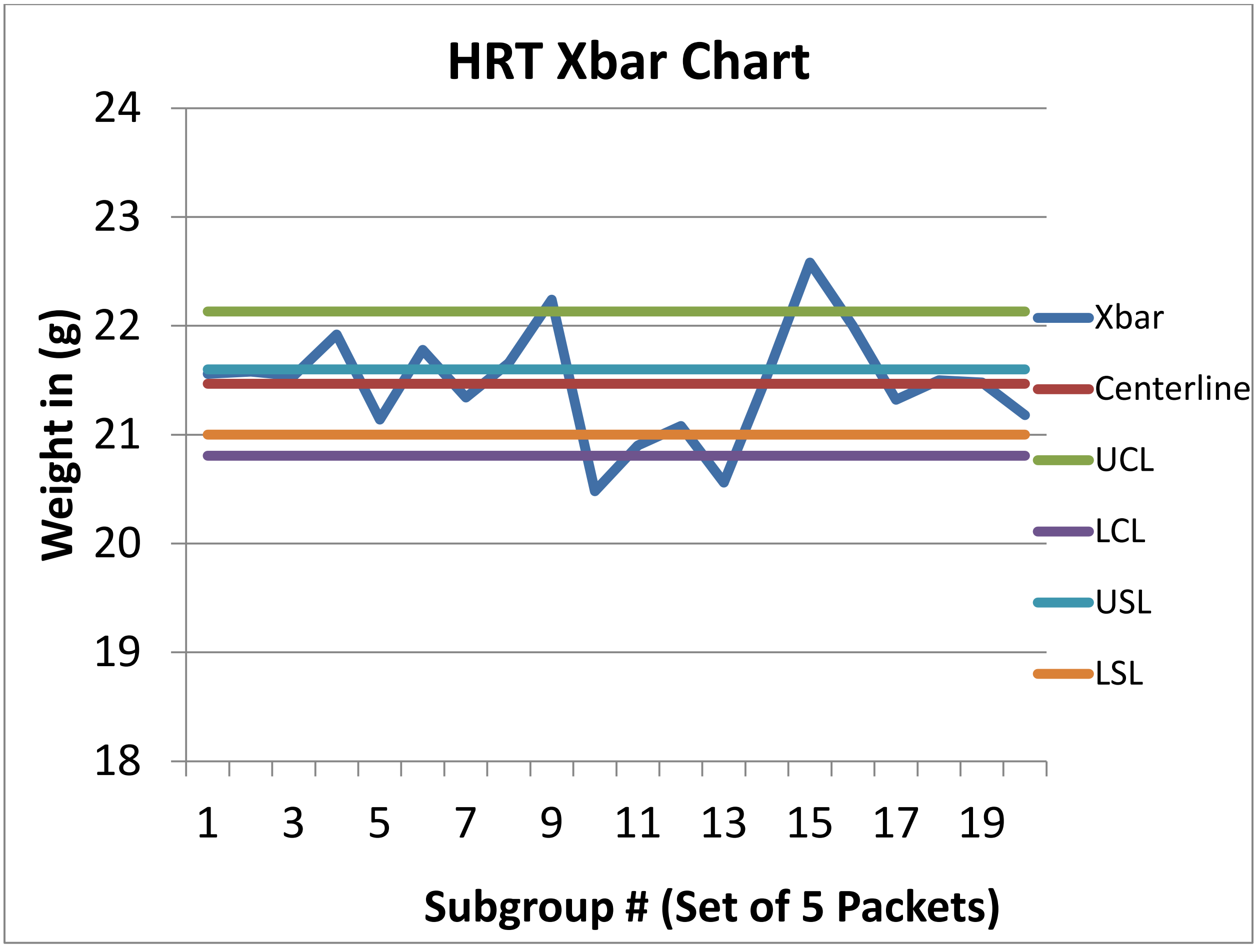
Figure 4: Loading Washer

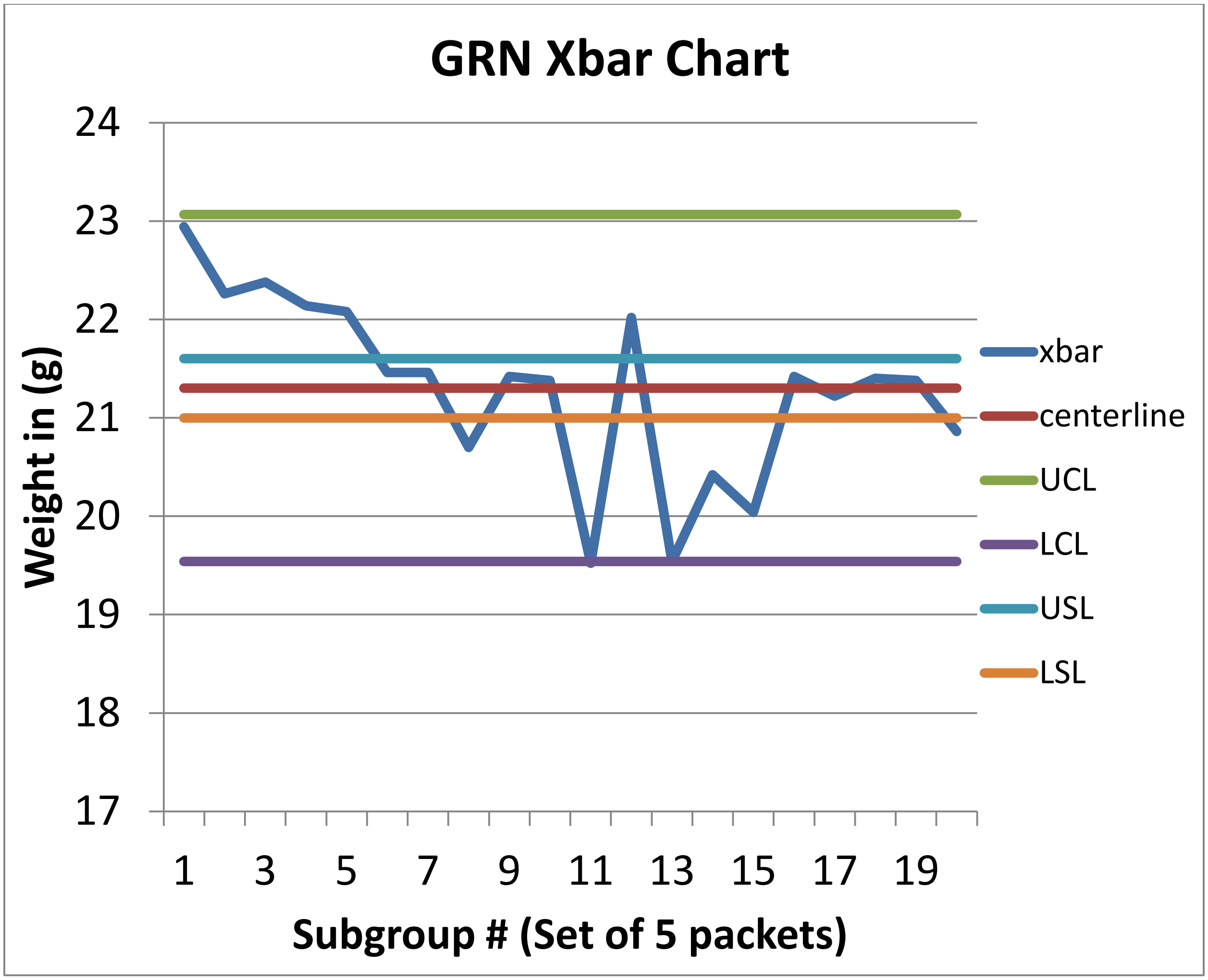
Using the Taguchi loss function, capability, control charts, and operational definition, we can see how much waste there is in the system and how much the system can be enhanced. Some of the main issues causing Innovative Flexpak to incur significant costs include: packets being under-/over- weight, discarded product due to foam in hoppers, cosmetic defects on package seal, and insufficient closure on package seal. Once the process is in control, a DOE would more accurately validate which of these factors affect the variation of the final product.

We are confident that through our analysis and the implementation of our suggestions, Innovative Flexpak will be able to greatly improve their production lines and save a substantial amount on costs.

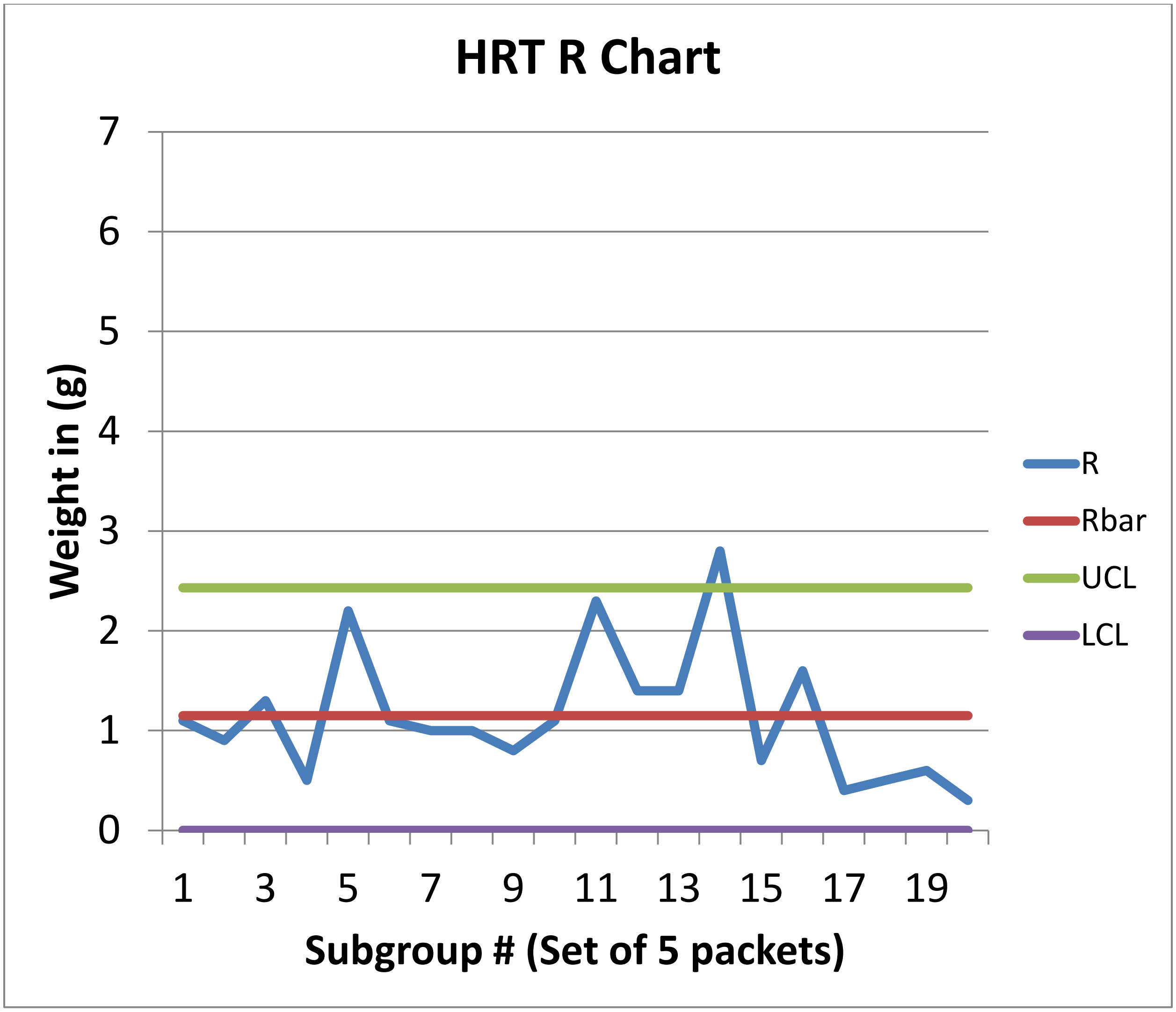
Appendix

Variable Data Control Charts

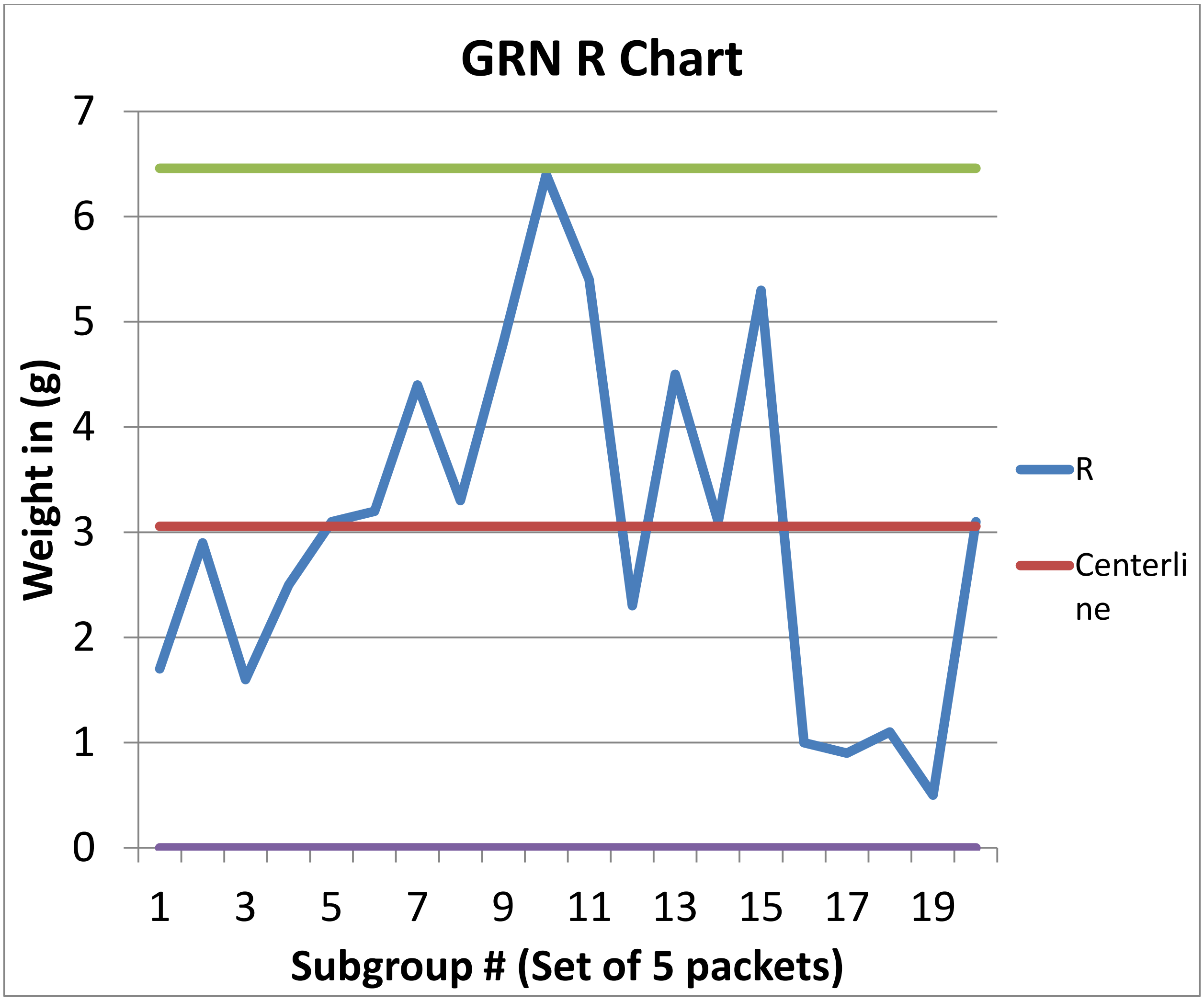



GRN Xbar Chart
24
23
22
21
20
19
18
17
Weight in (g)
1
3
5
7
9
11
13
15
17
19
Subgroup # (Set of 5 packets)
xbar
centerline
UCL
LCL
USL
LSL


GRN


HRT R Chart
7
6
5
4
3
2
1
0
Weight in (g)
1
3
5
7
9
11
13
15
17
19
Subgroup # (Set of 5 packets)
R
Rbar
UCL
LCL

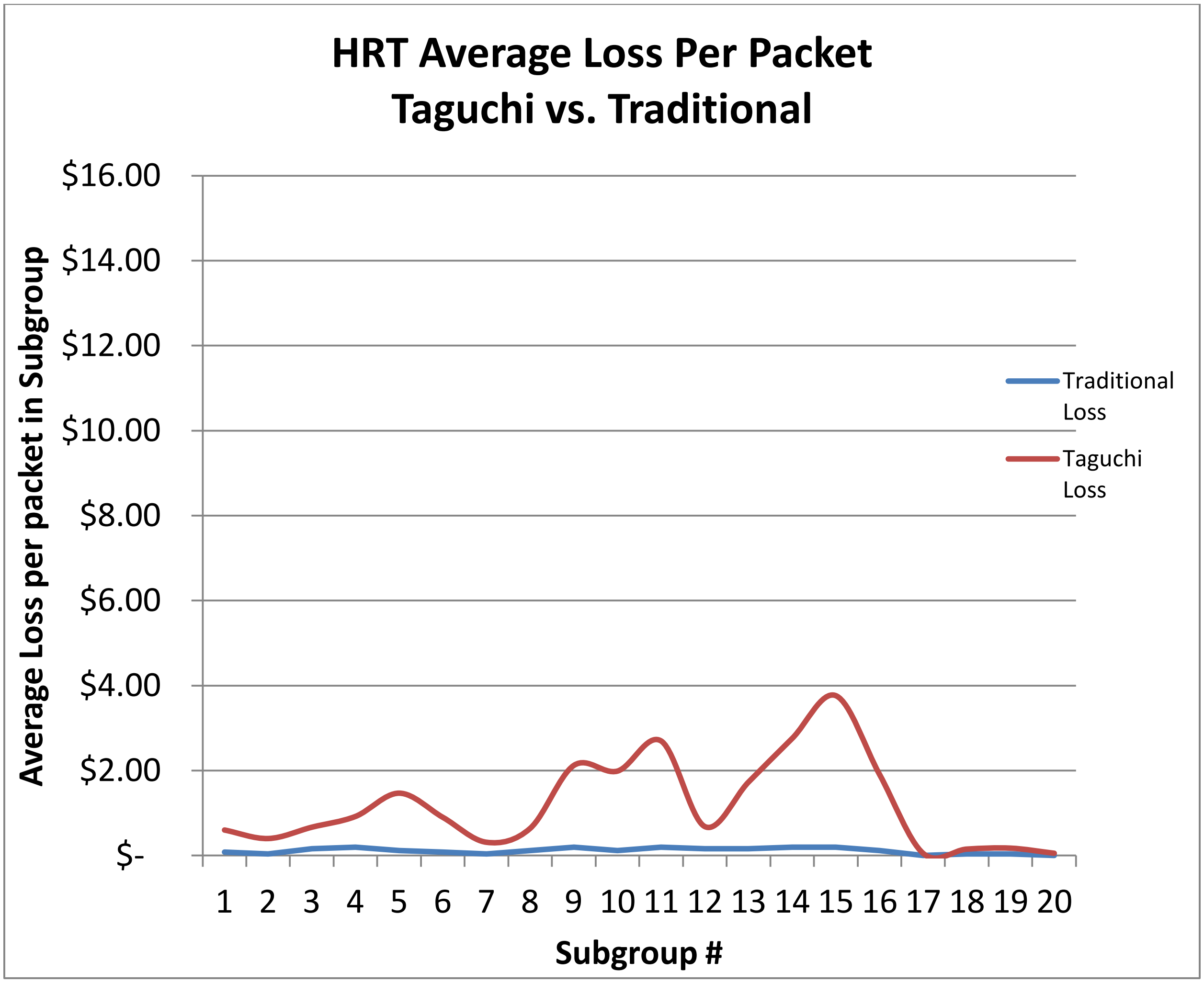

HRT

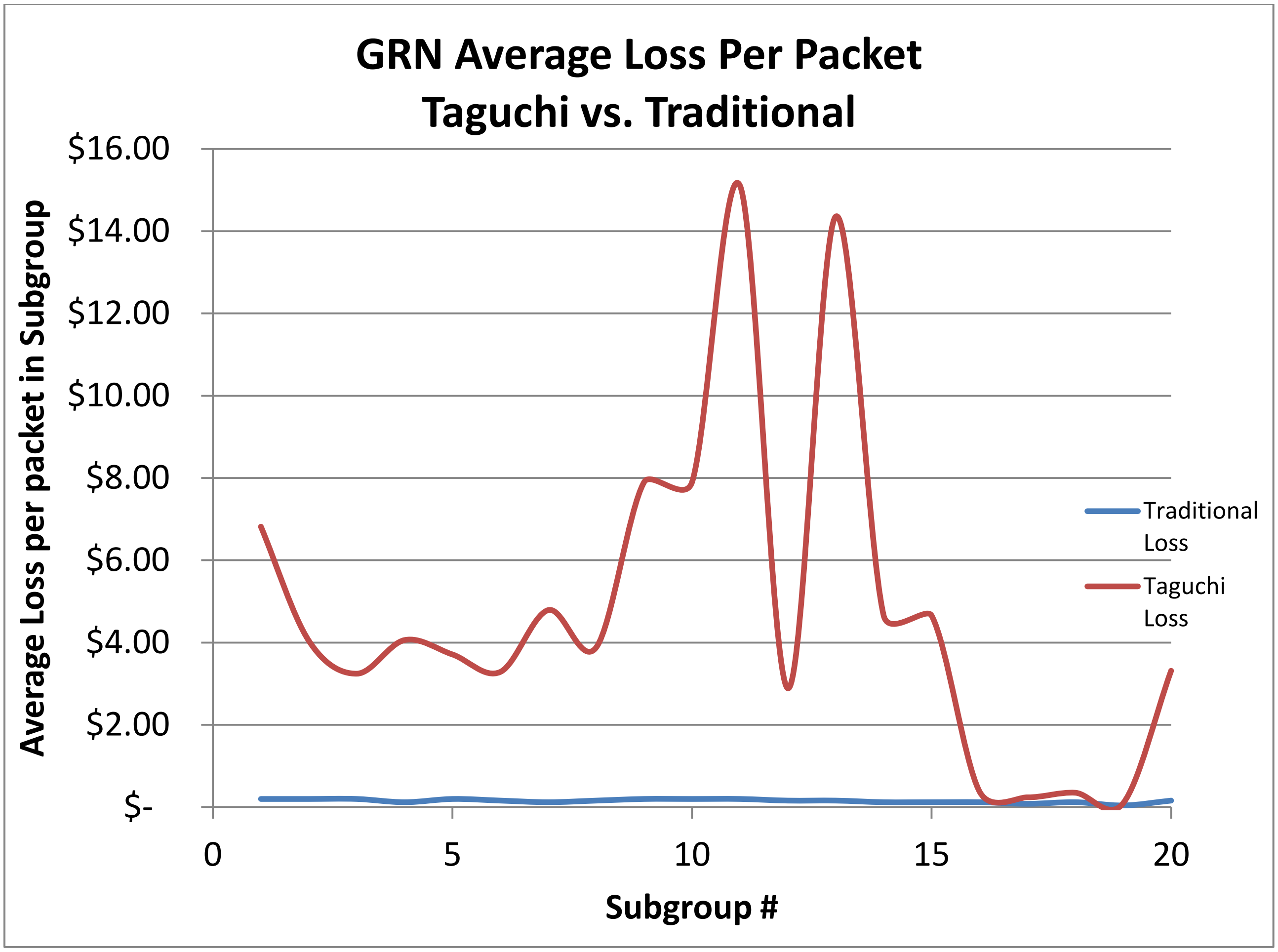


GRN R Chart
7
6
5
4
3
2
1
0
Weight in (g)
1
3
5
7
9
11
13
15
17
19
Subgroup # (Set of 5 packets)
R
Centerline

GRN

Comparisons between
Traditional Loss and Taguchi Loss




GRN Average Loss Per Packet
Taguchi vs. Traditional
Average Loss per packet in Subgroup
$16.00
$14.00
$12.00
$10.00
$8.00
$6.00
$4.00
$2.00
$-
0
5
10
15
20
Subgroup #
Traditional Loss
Taguchi Loss


GRN

Raw Data Points (Weight in Grams) – HRT

Subgroup#	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
1	21.6	22.1	21	21.1	22
2	21.5	21.4	21.5	21.3	22.2
3	20.7	21.7	21.3	22	22
4	22.2	21.9	22	21.7	21.8
5	20.4	20.1	22.3	21.5	21.4
6	21.5	21.5	21.4	22.5	22
7	20.6	21.5	21.5	21.6	21.5
8	21.2	21.2	21.9	22.2	21.8
9	21.8	22.2	22.6	22.4	22.2
10	21	21.1	20.2	20.1	20
11	20.2	22.1	22.2	**19.9**	20.1
12	20.5	20.9	21.9	20.7	21.4
13	**20**	20.6	20.6	21.4	20.2
14	20.5	**20**	22.2	22.8	22.2
15	**22.9**	**22.6**	22.5	**22.7**	22.2
16	21.8	**22.6**	22.8	21.2	21.6
17	21.2	21.4	21.1	21.5	21.4
18	21.3	21.8	21.5	21.5	21.4
19	21.8	21.6	21.2	21.3	21.5
20	21.2	21	21.2	21.2	21.3

Corresponding Taguchi Loss Point Values (In Dollars) – HRT

Subgroup#	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
1	0.2	1.422222	0.2	0.088889	1.088889
2	0.088889	0.022222	0.088889	0	1.8
3	0.8	0.355556	0	1.088889	1.088889
4	1.8	0.8	1.088889	0.355556	0.555556
5	1.8	3.2	2.222222	0.088889	0.022222
6	0.088889	0.088889	0.022222	3.2	1.088889
7	1.088889	0.088889	0.088889	0.2	0.088889
8	0.022222	0.022222	0.8	1.8	0.555556
9	0.555556	1.8	3.755556	2.688889	1.8
10	0.2	0.088889	2.688889	3.2	3.755556
11	2.688889	1.422222	1.8	**4.355556**	3.2
12	1.422222	0.355556	0.8	0.8	0.022222
13	**3.755556**	1.088889	1.088889	0.022222	2.688889
14	1.422222	**3.755556**	1.8	5	1.8
15	**5.688889**	**3.755556**	3.2	**4.355556**	1.8
16	0.555556	**3.755556**	5	0.022222	0.2
17	0.022222	0.022222	0.088889	0.088889	0.022222
18	0	0.555556	0.088889	0.088889	0.022222
19	0.555556	0.2	0.022222	0	0.088889
20	0.022222	0.2	0.022222	0.022222	0

Raw Data Points (Weight in Grams) – GRN

Subgroup#	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
1	21.9	**23.6**	**23.5**	23	22.7
2	22.1	22	20.8	23.7	22.7
3	23.3	21.7	22.2	22.1	22.6
4	23.2	23.6	21.1	21.1	21.7
5	20.2	22.5	23.3	22	22.4
6	21.4	20.6	20.6	20.9	**23.8**
7	22.3	23.5	21.4	21	**19.1**
8	20.2	19.4	19.9	21.3	22.7
9	18.3	23.1	22.5	20.2	23
10	18.3	23.1	22.5	20.2	23
11	22.9	19.2	18	20	**17.5**
12	23	20.7	22.8	22.3	21.3
13	**17.8**	22.3	21.1	**18.7**	**17.8**
14	21.4	21.4	20.2	20.8	18.3
15	21.4	21.4	20.2	20.8	18.3
16	21.9	20.9	21.6	21	21.7
17	20.9	21.8	21	21.1	21.3
18	21.4	20.8	21.7	21.2	21.9
19	21.2	21.2	21.7	21.3	21.5
20	20.9	21.8	21.1	**18.7**	21.8

Corresponding Taguchi Loss Point Values (In Dollars) – GRN

Subgroup#	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
1	0.8	**11.75556**	**10.75556**	6.422222	4.355556
2	1.422222	1.088889	0.555556	12.8	4.355556
3	8.888889	0.355556	1.8	1.422222	3.755556
4	8.022222	11.75556	0.088889	0.088889	0.355556
5	2.688889	3.2	8.888889	1.088889	2.688889
6	0.022222	1.088889	1.088889	0.355556	**13.88889**
7	2.222222	10.75556	0.022222	0.2	**10.75556**
8	2.688889	8.022222	4.355556	0	4.355556
9	**20**	7.2	3.2	2.688889	6.422222
10	**20**	7.2	3.2	2.688889	6.422222
11	5.688889	9.8	24.2	3.755556	**32.08889**
12	6.422222	0.8	5	2.222222	0
13	**27.22222**	2.222222	0.088889	**15.02222**	**27.22222**
14	0.022222	0.022222	2.688889	0.555556	20
15	0.022222	0.022222	2.688889	0.555556	20
16	0.8	0.355556	0.2	0.2	0.355556
17	0.355556	0.555556	0.2	0.088889	0
18	0.022222	0.555556	0.355556	0.022222	0.8
19	0.022222	0.022222	0.355556	0	0.088889
20	0.355556	0.555556	0.088889	**15.02222**	0.555556