

Kristianstad University SE-291 88 Kristianstad +46 44-250 30 00 www.hkr.se

# Heritage Cereals Product development

Sidonie Bridonneau - Romane Chauveteau



Kristianstad University | SE-291 88 Kristianstad | +46 44 250 30 00 | www.hkr.se

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## Abstract

Local or regional crop production is increasingly attractive to consumers due to a growing interest in environmental friendliness and sustainability. Heritage cereals are an example of this as they are suitable for organic farming. Moreover, they can also contribute to a healthy and balanced diet, which is what consumers are aiming for these days. For a more regular consumption of heritage cereals, it would be interesting to build on popular food products such as bread, pasta and biscuits. The aim of this study is to develop innovative recipes based on heritage cereals. To appeal to consumers, it was decided to focus on pasta and biscuits (shortbread and cookies). Following a design with three different cereals (Vete Helkorn, Ölands Vete and Kallunda Varvete Evolutionar), 12 biscuit samples and 10 pasta samples were selected for each type of cereal. For the biscuits, the modified ingredients were butter, flour, sugar and particle size, while for the pasta the modified ingredients were salt, olive oil and also particle size. Sensory and instrumental analyses were carried out on the samples. It can be concluded that the different types of cereals have an impact on sensory aspects as well as on extension. The use of the cereal Kallunda Varvete Evolutionar decreases the intensity of the colour and the number of visible particles in the pasta. Furthermore, for both biscuits and pasta, the ingredients influence many sensory attributes. For pasta, it is mostly the coarse particles that have an impact, while for biscuits, it is mostly the type of flour. Increasing the particle size of the flour increases the hardness and grittiness of the pasta. For biscuits, flour affects colour, thickness and many other attributes. For example, reducing the amount of flour gives a more yellow colour, causes a lower density and thickness and reduces the number of visible particles. However, only pasta is concerned by a significant impact of ingredients on texture.

**Keywords**: heritage cereals, product development, shortbread, cookies, pasta, design, innovation, texture, sensory analysis

## Background

Today, as part of a healthy and local diet, heritage cereals are increasingly attractive to consumers because of their nutritional and sensory properties. Indeed, these cereals make a positive contribution to the environment and to human health thanks to their many advantages. Among the heritage cereals, we can find einkorn, spelt, emmer, millet, Khorasan and many more.<sup>1</sup>

Interested in sustainable and healthy food, consumers are increasingly turning their attention to products made from heritage grains. Bread, pasta and biscuits, being the most popular products, may be the products that could potentially be consumed most if they were made from heritage cereals.<sup>2</sup>

### Definition

There is no universal definition of heritage cereals. This would facilitate the labelling of food products that have them. According to Giambanelli et al. (2013), ancient cereals are defined as "forms which are represented by populations not subjected to any modern breeding or selection, and sometimes retaining characteristics of wild ancestors, such as individual variability, height, brittle rachis, low harvest index and, in some taxa, hulled kernels". For instance, they can be defined as cereals that have not been fundamentally changed over hundreds or thousands of years.<sup>1</sup>

Nowadays, the consumption of modern cereals is important but decreasing in contrast to the consumption of heritage cereals. The differences between heritage and modern cereals are many and varied. First of all, there are differences in nutrition and composition. In addition, the production of these two types of wheat is different. Modern wheat is selectively cultivated and then refined and hybridised. Hybridisation is the act of crossing two different varieties of the same species.<sup>3</sup> Ancient cereals, on the other hand, are natural and have not been modified over the years. Examples of ancient cereals include spelt, einkorn and emmer. Some grains date back thousands of years before modern wheat.<sup>1</sup>

All cereal based products may be based on heritage cereals. We find for example pasta, bread, cookies, pancakes, etc. Bread and pasta are the most consumed, at least once a week according to the study "Consumer Awareness, Attitudes and Preferences towards Heritage cereals".<sup>2</sup> These are then products that should be focused on for a more regular consumption of heritage cereals.

## Assets

Heritage cereals have a number of advantages that are making them increasingly popular as part of a healthy diet.<sup>1</sup>

Firstly, the higher protein, carbohydrate, mineral and vitamin content of heritage cereals compared to modern cereals is an important advantage. Indeed, all these elements have beneficial properties for health. For example, vitamins are essential for the body because they participate in growth and are involved in the muscular, nervous and immune systems... Secondly, heritage cereals can also have a positive impact on certain diseases. For example, they may be less toxic than modern cereals for people with coeliac disease. Celiac disease is an autoimmune disease characterized by a permanent intolerance to different gluten protein fractions contained in different types of cereals such as wheat, barley or rye. Ancient cereals may have lower immunogenic properties than modern cereals and therefore be less toxic to people with celiac diseases. In addition, regular consumption of heritage cereals could reduce the risk of non-communicable diseases such as cardiovascular disease, type 2 diabetes and cancer. Finally, the heritage cereals consumed could protect against oxidative stress which plays an important role in the development of human diseases. However, for all the diseases mentioned, further research needs to be carried out in order to conclude on the beneficial role of heritage cereals on them.<sup>1</sup>

Thirdly, modern cereals have attractive sensory properties that enable them to provide tasty and palatable products. For example, a sensory study showed that sourdough bread made from emmer and spelt received a higher score for its acidic taste than wheat bread.<sup>1</sup>

Finally, heritage cereal crops are suitable for environmentally friendly and climate change resistant organic farming. Indeed, heritage cereals are adapted to organic production and are more resistant than modern cereals to certain extreme climatic conditions. Furthermore, the production of heritage cereals is mainly local or regional, which supports small and medium-sized farmers and millers and also allows for sustainability.<sup>1</sup>

Given the benefits of heritage cereals, there are many reasons to why consumers and farmers are showing increasing interest in them. Indeed, they offer new, tasty, locally produced and healthy products.

### Consumers

Nowadays, the population is consuming more and more heritage cereals based foods because of their many advantages described in the previous section. Indeed, these foods seem to be healthy, beneficial to health and respectful of the environment. It has been shown that products with the claims "ancient", "natural" and "local" are more likely to be chosen by consumers because they tend to be locally and regionally produced.<sup>2</sup>

According to a study of Swedish consumers from two different universities, spelt is the most well-known heritage grain variety, unlike Halland wheat. It is increasingly found in bakeries and pastry creations. Nevertheless, it has been shown that knowledge of cereals differs according to geographical location.<sup>2</sup>

In general, consumers place a high value on the texture and taste of foods containing heritage grains. However, factors such as age and gender influence consumer attitudes and preferences. For example, women are more interested in the origin of cereals and prefer to consume foods containing wholemeal flour than men. In addition, a study also showed that age influences attitudes toward heritage grains. Older people are more likely to spend more on heritage grain foods.<sup>2</sup>

### **Product development**

Market trends are changing very quickly and so are consumer expectations. It is therefore important to innovate as much as possible. Product development involves several methods. In this case, it was decided to create designs for shortbread, cookies and pasta.

First of all, a design<sup>4</sup> is a set of recipe variations to understand how the ingredients influence the product together. To do this, "high" and "low" levels were selected for some of the ingredients chosen in the pretests. The levels should "stretch" the design so that we can still tell that it is a product (e.g. a cookie), but it does not necessarily have to be a good cookie. In addition, these "high" and "low" levels should be symmetrical to the normal value of the recipe.

## Analysis of products

To study our products, several analyses can be carried out: sensory analysis, texture analysis and color measurements. In the following studies on the development of gluten-free pasta and biscuits<sup>5</sup> <sup>6</sup>, sensory analysis, texture analysis and color measurements have been used.

#### Sensory analysis

Sensory analysis<sup>7</sup> is an analysis of products that requires the use of the human senses. This allows us to discover the influence of the different ingredients in the product as well as the different cereals on different attributes describing visual appearance, aroma, taste and texture.

In view of the current health situation related to Covid-19, it was decided to use a consensus method bases on the traditional "flavour profile method"<sup>7</sup>, which involves several steps.

Prior to evaluating the samples, attributes describing visual appearance, aroma, taste and texture were discussed for evaluation on the products. A consensus was reached on the definition of each attribute.

In a second step, each extract was examined one by one by rating each attribute on an intensity scale from 0 to 100, where 0 = no intensity and 100 = the highest possible intensity. Each assessor was asked to consider the positioning of each attribute along the intensity axis. Then, after discussion, a consensus was to be reached to determine a single intensity value for each attribute.

Each assessor signed up for participation after being informed about the products and the terms of participation: voluntary participation, freedom to leave the test without giving a reason and the right to decline to answer specific questions.

#### **Texture analysis**

Texture analysis was used to determine the influence of the different ingredients and grains on the extension, compression and rupture of the doughs and finished products from the design.

During compression, the deformation was measured in mm. It corresponds to the change in size or shape of the dough. <sup>8</sup> The final load of compression and extension was measured on both doughs and pasta. It refers to the force, in Newtons, required to break the dough or the final products.

Following the compression analysis, the adhesive force was obtained. When the dough is in contact with a surface, adhesive forces act on it. They refer to the forces of attraction between the different surfaces to make the dough rise when measuring the compression.<sup>9</sup>

Finally, the rupture load was obtained and used only for biscuits. It corresponds to the force, in Newton, to break shortbread and cookies.

#### **Colour measurements**

The colour analyses provided information on the impact of the cereals and ingredients of the final products on the colour of the product. Following the color measurement, three values are obtained: L\*, a\* and b\* which belong to the chromatic space called CIELAB. The L\* corresponds to the brightness or luminosity, it takes values between 0 (black) and 100 (white). The parameter a\* represents the value on a green  $\rightarrow$  red axis while the parameter b\* represents the value on a blue  $\rightarrow$  yellow axis.<sup>10</sup>

## Aim

To develop innovative recipes from heritage cereals that would appeal to consumers, it was decided to focus on pasta and biscuits. In addition to the visual assessment of the final product, sensory and texture analyses were performed.

#### **Research questions**

- Does the use of different heritage cereals have an impact on the texture, taste and visual appearance of the products developed?
- How do the common ingredients in a recipe influence the texture and sensory aspects of the final products?

## **Materials and Methods**

### **Materials**

#### **Pre-trials**

In a first step, pre-tests were conducted to observe the impact of each ingredient in the different recipes. They will then be used to produce the designs. To do this, the recipes were run many times, changing the quantity of one or more ingredients each time. So, Ingredient levels 1 and 2 were found in order to select those that work. In this case, industrial flour bought in the supermarket was used. Then the visual appearance, taste and texture of each final product were noted on a table. The results of the pre-tests can be found in Appendix 1.

#### Design

In a second step, designs for the pasta and biscuits were made.

A design was made by choosing 10 recipe variants for fresh pasta, 6 for biscuits and 6 for shortbread. To check whether the variations are feasible, they were made using the heritage cereals that we milled into flour from cereal kernel. Indeed, a heritage cereal flour was used to make the designs to confirm the recipes and thus the "low" and "high" levels defined previously. The design tests for the cereal Ölands Vete can be found in Appendix 2 and Appendix 3 for Vete Helkorn.

#### Biscuit design

#### Shortbreads

For the design of the shortbread, 6 recipes were chosen which gave different final products in the pre-tests. Among these 6 recipes, the following were used: the normal recipe, a recipe in which the amount of butter has been increased, a recipe in which the amount of butter has been increased and the amount of sugar has been decreased, a recipe in which the amount of butter and flour has been increased, a recipe in which the amount of flour has been decreased, a recipe in which the amount of flour has been decreased, a recipe in which the amount of flour has been decreased, and finally a recipe in which the size of the flour particles has been increased. These 6 recipes were made with the three types of cereals, which equals 18 final samples.

A decision was made to vary the amount of sugar and butter by 50 grams and to vary the amount of flour by 100 grams from the amount specified in the normal recipe. For example, in the case of the recipe in which the amount of butter was increased from 75 grams to 125 grams, see table 1.

Recipe n°	1	2	3	4	5	6
Sugar	75g	75g	25g	75g	125g	75g
Butter	75g	125g	125g	125g	75g	75g
Flour	165g	165g	165g	265g	65g	165g
Particle size	Middle	Middle	Middle	Middle	Middle	Big
Recipe :	Normal	Butter +	Butter + / sugar -	Butter + / Flour +	Sugar + / Flour -	Big particles

Table 1 : Design of the shortbreads

In the table, the coloured boxes correspond to the quantities that have been modified from the original recipe.

After making this design with flour from the three heritage cereals, it was confirmed that the results were as expected.

#### **Cookies**

To make the design of the biscuits, 6 recipes were kept from the pre-tests. Among these 6 recipes, the following were used: the normal recipe, a recipe in which the amount of flour was decreased, a recipe in which the amount of butter and sugar was increased, a recipe in which the amount of butter and flour was increased, a recipe in which the amount of butter and flour was decreased and finally, a recipe in which the size of the flour particles was increased. These 6 recipes were made with the three types of cereals, which equals 18 final samples.

However, as a result of designing with flour from heritage cereals, some of the resulting recipes did not meet expectations. For example, the dough in which the amount of flour was reduced could not be used. It was therefore decided to replace it with a recipe in which the amount of sugar was increased. Also, when the recipe with less flour and butter was made, the biscuits were very flat and sticky. They didn't look like biscuits. It was therefore decided to change the quantities, which resulted in products that can be considered as biscuits.

As a result of these changes, a new design with 6 recipes was obtained. These 6 recipes include the normal recipe, a recipe in which the amount of sugar has been increased, a recipe in which the amount of butter and sugar has been increased, a recipe in which the amount of butter and flour has been increased, a recipe

in which the amount of butter and flour has been decreased and finally a recipe in which the size of the flour particles has been increased.

In this new design, the amount of butter and sugar varies by 25 grams and the amount of flour by 70 grams, see Table 2.

Recipe n°	1	2	3	4	5	6
Sugar	85g	110g	110g	85g	85g	85g
Butter	85g	85g	110g 110g		60g	85g
Flour	150g	150g	150	250g	50g	150g
Particle size	Little	Little	Little	Little	Little	Big
Recipe :	Normal	Sugar+	Butter + / sugar +	Butter + / flour +	Butter - / flour -	Big particles

Table 2: The final design of the cookies

#### Fresh pasta design

The fresh pasta design includes 10 recipes previously tested in the pre-test and giving correct final products. Among these 10 recipes, the following are used: the normal recipe, then a recipe where the amount of salt has been increased, another where the amount of salt has been increased even more, then a recipe where the amount of olive oil has been increased and a recipe where the amount of olive oil has been increased more.

Then four recipes varying both ingredients at the same time: one recipe where the amount of olive oil and salt were increased with the lowest levels, one recipe where salt and olive oil were increased in large quantities, one recipe where salt was added in small quantities and olive oil in large quantities, and one recipe with salt in large quantities and olive oil in small quantities. Finally, one recipe was made with large flour particles. It was decided to increase the amount of salt by 2g and 4g compared to the amount specified in the normal fresh pasta recipe. As for the olive oil, 2 tablespoons and 4 tablespoons may be added to the recipe compared to the normal recipe. For example, in the recipe with a lot of salt and olive oil, 4g of salt and 4 tablespoons of olive oil have been added to the recipe, see Table 3.

These 10 recipes were made with the three types of cereals, which equals 30 final samples.

The normal recipe calls for 300g of flour. A normal recipe design was tested with 300g of heritage grain flour. However, the dough was very floury and impossible to pass through the pasta machine. So, it was decided to change the amount of flour to 250g. All the recipes in the design were therefore changed to use 250g of heritage flour, see Table 3.

Recipe n°1	1	2	3	4	5	6	7	8	9	10
Flour	250g	250g	250g	250g	250g	250g	250g	250g	250g	250g
Eggs	3	3	3	3	3	3	3	3	3	3
Salt	Og	Og	2g	4g	Og	Og	2g	2g	4g	4g
Olive oil (tablespoon)	0	0	0	0	2	4	2	4	2	4
Particule size	middle	larger	middle	middle	middle	middle	middle	middle	middle	middle
Recipe :	Normal recipe	Normal recipe with high particule	salt +	salt ++	Olive Oil +	Olive Oil ++	salt + / Olive Oil +	salt + /Olive Oil ++	salt ++ / Olive Oil +	salt ++ / Olive Oil ++

#### Table 3: The design of the pasta

After making this design with flour from heritage cereals, it was confirmed that the results were as expected.

## Methods

#### Sensory analysis

In order to carry out the sensory analysis of the products in our design, the consensus method was used because of the current health situation. Under better conditions, i.e. in the absence of the current pandemic, methods with statistical analysis could have been carried out and more participants could have been involved in the sensory analysis. The selected sensory panel consisted of seven assessors, three of whom were part of the analytical panel. The sensory analysis was divided into two days: one day for the pasta and one day for the biscuits.

During the sensory analysis, the pasta was cooked in two stages. Indeed, the day before the analysis, the pasta was made and pre-cooked in boiling salted water (3L of water and 3 grams of salt) for 2 minutes. Then, on the day of the analysis, they were cooked again for 1 minute to test them hot and thus to have a better overview of the taste and smell. The pasta was served in a small individual container with a handful amount.

For the cookies and shortbread, each evaluator had one biscuit to evaluate taste, appearance, aroma and texture.

As described earlier in the background section, the consensus method was used to describe the visual appearance, aroma, taste and texture of the products. Definitions have been agreed for each attribute, see tables 4 & 5.

Appearance	Aroma	Taste	Texture
Colour : from yellow to brown	Butter	Sweet	Fatty : oiliness
Particules : number of particules	Caramel	Butter	Particules / grainy : number of particles (in mouth)
Thickness : from thin to thick		Cereals	Chewy : from very brittle to elastic
Density : from air to dense			Sticky : in hand and teeth

Table 4: Definition of attributes for shortbread and cookies

Apperance	Aroma	Taste	Texture
Colors intensity : Shades of brown	Fresh, grass : Freshness of the pasta: smell of herbs	Salt : From not salty to very salty	Sticky and doughy : gelatinous
Particules : Coarse, fibrous, rough, grians, grainly	Old, stale	Cereals, flour, porridge	Hardness : 0: over cooked and 100 :al dente
	Cereals, strach, dough	Rancidity : britter, astringent	Grainy : Starting to smooth (white pasta) to grainy (rye bread damish)

Table 5: Definition of attributes for fresh pasta

#### **Preference assessment**

At a seminar on heritage cereals, participants had the opportunity to test some samples of cookies and pasta. The test procedure was as follows: participants were asked to taste the three samples offered for the two types of products and then to indicate their favourite sample.

During the coffee break, the numbered samples were placed on a table. Participants were invited to taste them and then place the token corresponding to their favourite sample in a closed box. At the end of the coffee break, the tokens were counted.

#### **Texture analysis**

Texture analyses were carried out on the doughs and the final products obtained after the designs were made. For the pastes, extension and compression were analysed. For the final products, breakage was tested for biscuits while extension was tested for doughs. All measurements were performed using the Ametek Brookfield CTX texture analyser (US).

The values obtained for the different indicators (peak load, deformation peak, final load, adhesive force, rupture load, deformation rupture) were recorded in a table. All measurements were performed three times to obtain better accuracy and to be able to use statistic evaluation, see Appendix 4.

#### **Colour** analysis

The colour was measured at 3 points on the surface of the biscuits and doughs using a colorimeter (Spectrophotometer CM-600d, made in Japan). The following parameters were recorded: L\*, a\*, b\*.

#### **Statistics**

The data of texture analysis and colour measurements were evaluated in Microsoft Excel Version X, version 16.43 and mean values and standard deviations were calculated for each indicator. To identify significant differences between the different cereals and recipes, t-tests were performed on the resulting data. The results of the t-test can be found in Appendix 5. Different letters indicate a significant difference while identical letters imply that there is no significance.

To see if there was a correlation between the texture and sensory analyses, the Pearson correlation was used. It was decided that a value greater than or equal to 0.7 in the Pearson test indicates a correlation. In addition, it was also decided to measure the correlation only between attributes that are related (e.g. between hardness and deformation).

## **Results and discussion**

### Results

#### Sensory analysis

The values obtained in the sensory analysis were grouped into "spider web" figures. The results of the different products were divided by cereal (Vete Helkorn, Ölands Vete and Kallunda Vete Evolutionar) and by major category (appearance, aroma, taste and texture).

#### Shortbreads

#### Appearance





In figures 1, 2 and 3, it can be seen that the reduction in the quantity of flour has a real impact on the various attributes measured: the colour is more yellow than for the other shortbreads, the thickness and density are lower and the number of particles is smaller.

For the cereals Ölands Vete and Kallunda Varvete Evolutionar, the higher particle size leads to an increase in the number of visible particles. Surprisingly, this is not the case for the cereal Vete Helkorn.

Regarding colour and density, the results are very different between the three cereals. It can then be said that the type of cereal can impact the influence of the ingredients on the different attributes.







Figures 4, 5 and 6 show that for the same recipe, increasing the sugar and decreasing the flour leads to an increase in the aroma of butter and caramel.

Surprisingly, increasing the amount of butter in a recipe has no particular impact on the aroma. Similarly, increasing the particle size of the flour does not change the aroma of the product.



Taste



Naturally, adding more sugar to a recipe increases its sweetness, while adding more butter results in a stronger butter taste. This can be seen in the figures 7, 8 and 9. Increasing the flour, on the other hand, decreases the sugar and butter taste and increases the cereal taste.

For the same recipe, increasing the sugar and decreasing the flour results in a much more intense sugar and butter taste than the other recipes and a much less intense grain taste. It is the increase in butter and decrease in sugar combined that results in a stronger cereal taste.



Texture

Figures 10, 11 & 12

Blatantly, in figures 10, 11 and 12, the reduction in flour makes the shortbread fatter, chewier and stickier. Surprisingly, however, increasing the butter in a recipe does not make the biscuits stickier or fatter. Naturally, the increase in particle size makes them more easily discernible by consumers.

#### **Cookies**

#### Appearance



Figures 13, 14 & 15

The reduction of flour in the cookie recipe has a real impact on the different attributes measured: the colour is more yellow than for the other cookies, the thickness and density are lower and the number of particles is smaller. This can be seen in the figures 13, 14 and 15.

The increase in butter and flour combined results in a greater density and thickness of the cookies than other recipes.

Naturally, particle size increases the number of perceived particles.



#### Aroma

Figures 16, 17 & 18

It is observed in figures 16, 17 and 18 that no ingredient has a real impact on the aroma.

In general, the "caramel" aroma is less perceived than the "butter" aroma.

The "caramel" aroma is slightly less intense when using the Kallunda Varvete Evolutionar cereal than when using the other two cereals.

#### Taste



Figures 19, 20 & 21

Surprisingly, the results obtained in figures 19, 20 and 21 are quite similar between each recipe: a very intense taste in butter and sugar. Cookies with more butter or sugar are not perceived as more buttery or sweeter than "normal" cookies.

The combined reduction of butter and flour results in a slightly more intense taste in sugar but less intense in cereals.



#### Texture

Figures 22, 23 & 24

Blatantly, the reduction in flour makes the shortbread tatter, chewier and stickier. Surprisingly, however, increasing the butter in a recipe does not make the biscuits stickier or fatter. This can be seen in the figures 22, 23 and 24.

Naturally, the increase in particle size makes them more easily discernible by consumers.

#### Comparison between shortbread and cookies

Regarding visual appearance, the same results are obtained for cookies and shortbread. The decrease in flour and the increase in butter have a strong impact on the different attributes.

However, there is no real impact of the ingredients on the aroma for cookies and shortbread.

Concerning the taste, we observe a significant impact of the ingredients for the shortbread while none is observed for the cookies.

For shortbread and cookies, the reduction in flour causes a change in texture while butter has no impact.

Finally, the increase in particle size has no real impact on the different attributes except for the perception of the particles.

#### <u>Pasta</u>



#### Appearance



Unsurprisingly, in figures 25, 26 and 27, for all three cereals, the increase in flour particle size leads to an increase in the number of visible particles and thus the intensity of the pasta colour.

Surprisingly, the addition of olive oil does not influence the colour of the pasta compared to the normal recipe.

The type of cereal used seems to influence the appearance of the pasta with high salt content. The same is true for pasta with a lot of salts and olive oil.



Aroma



First of all, figures 28, 29 and 30 show that the combined addition of salts and olive oil has an influence on the fresh grass aroma.

Surprisingly, for all three cereals, the increase of the flour particle size has no influence on the pasta aroma since the values are almost similar to those of the normal recipe.

The type of grain used influences the aroma of "old", "grain" and "starch". The aroma of the pasta does not depend on the added ingredients but rather on the cereals used.

#### Taste





Surprisingly, salt was not perceived in the samples containing a lot of salt for the 3 cereals in figures 31, 32 and 33. This can be explained by the cooking of the pasta. Indeed, they were cooked for 2 minutes the day before the sensory analysis and then 1min30 the same day to evaluate them hot. The NaCl dissolved in the cooking water which explains the absence of a salty taste.

The rancidity and "cereal and flour" taste does not depend on the sample but on the type of cereal used the cereals give a different taste to the pasta.

#### Texture



Figures 34, 35 & 36

Clearly, increasing the particle size of the flour increases the grainy texture of the pasta. This can be seen in the figures 34, 35 and 36.

Surprisingly, the pasta is not stickier when oil is added in large quantities for the cereals Vete Helkorn and Öland Vete. This is because the texture (softening and stickiness) of the pasta varies according to the type of cereal used and does not depend on the added oil or salt.

The samples with larger flour particles are much harder compared to the other recipes.

#### Preference assessment

The results of the preference assessment are shown in Table 7. The number of participants is not the same for pasta and biscuits because the test took place in the afternoon, which did not favour the appeal of pasta.

		Cookies		Pasta						
Recipe	Normal	Butter + / flour +	Butter + / sugar +	High particles	Olive oil ++	Salt ++				
Number of votes	1	8	8	1	4	6				

Table 7: Results of the preference test

For the cookies, there is a perfect equality between the cookies in which the amount of butter and sugar has been increased and the cookies in which the amount of butter and flour has been increased. On the other hand, the "normal" cookies were the least popular.

With regard to pasta, it can be observed that the participants preferred the sample with a higher salt content. Pasta with a larger flour particle size was not appreciated.

This test only allows us to know the preferences of the seminar participants. It does not allow any conclusions to be drawn. This would have required more than 100 participants.

### Texture analysis and colour measurements

As previously mentioned, correlations between the texture and sensory analyses were performed using the Pearson test and presented in figures. All samples are included in each figure.

#### **Shortbreads**

The t-test between the cereals allows us to see if the type of cereal has an impact on the texture. In the case of shortbread, the type of grain has no impact on compression, extension, breakage or colour. No significant differences were observed, see Appendix 5 (b).

The t-test between the recipes allows us to conclude whether the samples differ significantly and whether the ingredient can be said to have had an impact on the texture.



#### Figures 37, 38 & 39

Figure 37 shows the correlation (0,781) between the sensory analysis attribute "grainy" and the texture analysis compression final load for the Vete Helkorn cereal. Butter and flour content or larger flour particle size seem to impact the grainy appearance and compression of the shortbread. Indeed, higher values were observed by a higher content of the ingredients. A high content of sugar seemed to lower the graininess and compression value. However, following the t-test, no significant difference was observed between the recipes, so it is not possible to say that the design parameters have a significant impact on grainy and compression.

Figure 38 shows the correlation (0,936) between the sensory analysis attribute "color" and shortbread lightness for the Vete Helkorn cereal. It can be observed that an increase in the amount of sugar and a decrease in the amount of flour combined can slightly impact the color and brightness as slightly lower values are obtained. However, the t-test does not indicate a significant difference between this recipe and the others and may therefore not have a significant impact on these measurements.

Figure 39 shows the correlation (0,792) between the sensory analysis attribute "particles" and lightness for the cereal Vete Helkorn. It can be observed, as in figure 38, that an increase in the amount of sugar but a decrease in the amount of flour have an impact on the perception of particles and brightness. Indeed, the values obtained for this recipe are lower. However, the t-test does not indicate a significant difference which means that the ingredients do not have a significant impact on these measures.



Figures 40 & 41

Figure 40 shows the correlation (0,991) between the attribute "sticky" from the sensory analysis and the adhesive force for the cereal Kallunda Varvete Evolutionar. According to the diagram, an increase in the amount of sugar combined with a decrease in the amount of flour has a strong impact on the stickiness and adhesive force of the shortbread. The values obtained for the "sugar + / flour -" recipe are clearly higher than for the others. However, the impact of sugar and flour cannot be confirmed as significant on these parameters as the t-test does not show a significant difference between the recipes, although there is a clear trend.

Figure 41 shows the correlation (0,911) between the attribute "colour" and lightness for the Kallunda Varvete Evolutionar grain. In the diagram, lower values are observed for the recipe "sugar + / flour -". A variation in the amount of sugar and flour would therefore affect the colour and brightness of the shortbread. However, following the results of the t-test, it cannot be confirmed that these two ingredients have a significant impact on the measured parameters.

#### **Cookies**

The t-test between the cereals allows us to see if the type of cereal has an impact on the texture. In the case of cookies, the type of cereal only has a significant impact on extension as there is a significant difference between the three cereals, see Appendix 5 (b).

The t-test between recipes allows us to conclude whether or not the different ingredients have a significant impact on texture.





Figure 42 shows the correlation (0,734) between the attribute "sticky" and the adhesive force for the cereal Vete Helkorn". The amount of butter and flour seem to impact both parameters. Indeed, an increase in the quantities of these two ingredients allows to decrease the stickiness and the adhesive force while a decrease in the quantities allows to obtain higher values of the parameters. However, the results of the t-test do not allow to say that the impact of sugar and flour is significant.

Figure 43 shows the correlation (0,832) between the attribute "chewy" and the final load of the compression for the cereal Kallunda Varvete Evolutionar. It can be observed that a combined decrease of butter and flour can have a slight impact on the chewiness and extension as slightly higher values are obtained. On the contrary, an increase in particle size has an impact on the softness and compression by obtaining slightly lower values. However, according to the results of the t-test, it is not possible to conclude on a significant impact of these ingredients on the parameters.

Figure 44 shows the correlation (0,710) between the attribute "grainy" and the final load of the extension for the Kallunda Varvete Evolutionar grain. In this figure, we can see an impact of the coarse particles on the grainy and the extension. Indeed, higher values can be observed. Following the t-test, it is possible to conclude on the significant impact of coarse particles on extension and graininess.



Figures 45, 46 & 47

Figure 45 shows the correlation (0,774) between the attribute "colour" and lightness for the cereal Kallunda Varvete Evolutionar. It can be seen from the figure that no ingredient affects both parameters. The values obtained are very similar. This can be confirmed by the t-test which shows no significant difference between the recipes.

Figure 46 shows the correlation (0,778) between the attribute "particles" and a\* which corresponds to the colours from green to red for the Kallunda grain Varvete Evolutionar. There is a very strong impact of large particles resulting in increased values for particle perception and colour. However, this impact is not considered significant following the t-test.

Figure 47 shows the correlation (0,719) between the attribute "particles" and b\* which corresponds to the colours from blue to yellow for the Kallunda Varvete Evolutionar grain. As in figure 46, a strong impact of large particles is observed on both parameters, resulting in an increase of the values obtained. However, this impact is not significant according to the t-test.

#### Fresh pasta

The t-test between the cereals allows us to see if samples with different type of cereals are significantly different.

As far as fresh pasta is concerned, significant differences can be observed between the different cereals for pasta extension. Thus, the type of cereal used does not have a significant impact on the compression and extension of the dough and on the colour of the fresh pasta, see Appendix 5 (b).

The t-test between recipes allows us to conclude whether or not samples differ and thereby if the different ingredients have a significant impact on texture.





Figure 48 shows the correlation (0.843) between the attribute "hardness" obtained in the sensory analysis and of the "adhesive force" of compression in the texture analysis for the pasta obtained with the Vete Helkorn cereal. The pasta containing large flour particles seems to have higher values of "hardness" and "adhesive force" compared to the other pasta. However, the difference is significative. The size of the flour particles may have an influence on the texture on both the hardness of the pasta and on the adhesive force. However, when comparing with the t-test values, we do not observe a significant difference between "High particles" and the other recipes. Moreover, a very high amount of olive oil also influences the hardness and the adhesive strength since the values obtained are low compared to the values of the other recipes. The t-test indicates that there is no significant difference, which could be explained by almost similar values of "adhesive force".

The same results can be observed for the attribute "Hardness" and the "Final Load" of the compression (0.759) for Vete Helkorn cereal (Figure 49). Thus, the size of the flour particles may have an influence on the hardness of the pasta and the final load of the dough of the pasta. In comparison with the results of the t-test, the differences are significant with the doughs of the normal recipe and those with a very high amount of salts. However, they are not significant with pasta containing a lot of olive oil and pasta with a high amount of olive oil and salts. In addition, a very high amount of olive oil also influences the hardness and the final load since the values obtained are low compared to the values of the other recipes. The results of the t-test indicate that there is no significant difference between the recipes.

Figure 50 shows the values of the attribute "Grainy" obtained in the sensory analysis of the pasta and the "Final Load" of the dough compression for the cereal Öland Vete (correlation: 0.763). Pastas with higher flour particles seem to have generally higher values than other pasta recipes. Looking at the t-test results, the differences are indeed significant with the other recipes.



Figures 51, 52 & 53

The correlation (0.704) between the attribute "Sticky and doughy" of the sensory analysis and the "Final Load" of the pasta extension, with Öland Vete cereals, can be observed in figure 51. For the pasta with a high amount of salt and olive oil, the values are lower compared to the other recipes. Thus, the combined addition of salts and olive oil may have an influence on the sticky and pasty texture of the pasta as well as on the final load of the pasta extension. Looking at the t-test results, the differences are significant with the other recipes except for the normal recipe. The impact is therefore relatively significant.

Figure 52 shows the correlation (0.905) between the attribute "grainy" and the final load of the pasta extension. Higher values for both indicators can be observed for pasta with larger flour particles. Thus, larger flour particles may have an influence on the grainy texture of the pasta and the final load of the pasta extension. The t-test values obtained indicate that the differences are significant with the other recipes except for the normal recipe. Thus, the impact of the large flour particles is significant.

Finally, Figure 53 shows the correlation (0.907) between the attribute "Hardness" from the texture analysis and the dough compression deformation values for Kallunda Varvete Evolutionar cereals. It can be seen that the addition of salt or olive oil has a significant impact on the hardness of the pasta. Conversely, the deformation values during dough compression are similar. The t-test values, based on the deformation, indicate that the differences are not significant.

### Discussion

#### Sensory and texture analysis

Articles "Sensory profiles of cooked grains from wheat species and varieties"<sup>11</sup> and " Evaluation of wheat and emmer varieties for artisanal baking, pasta making, and sensory quality"<sup>12</sup> presenting sensory analyses obtained between food products composed of different cereals show differences for all sensory aspects between the different cereals. Indeed, for example, in the second article cited, significant differences between emmer varieties for roughness, granulometry, firmness and cohesion of pasta were obtained. The results obtained in these articles coincide with the results obtained for pasta, since in the sensory analysis, differences were observable between the 3 types of cereals for each attribute. However, for biscuits, the type of cereal had only a slight impact on the aroma or the visual appearance of the product.

For shortbreads and cookies, it was found that the reduction in flour causes a change in texture while butter has no impact. However, in the "A new sensory tool to analyse the oral trajectory of biscuits with different fat and fibre contents"<sup>13</sup> analysis, increasing and decreasing the amount of butter plays a role in the texture of the biscuits, particularly in terms of their crispness and crunchiness. The flour used in this analysis is industrial flour. It can then be concluded that the use of heritage cereals reduces the impact of fat on the texture of the biscuits.

Finally, the following study "Mealworms as Food Ingredient-Sensory Investigation of a Model System"<sup>14</sup> concluded that large flour particles have a significant impact on the sensory aspects of the products (texture, smell, colour). Indeed, the larger the size of the flour particles, the greater the perceived coarseness and crispness. This is consistent with the results obtained for pasta in the sensory analysis but not for biscuits (shortbreads and cookies). Furthermore, in this study, increasing the amount of salt increased the salty taste and increasing the amount of oil had an impact on the colour of the pasta. These results do not coincide with those obtained for pasta for either salt or olive oil. This can be explained by the pre-cooking of the pasta, carried out the day before the sensory analysis.

#### **General discussion**

This study has some limitations. First of all, during the sensory analysis, choices had to be made in order to facilitate the procedure. For example, it was decided to keep only one value following the consensus. Several values and replicates would have allowed a better precision and statistical analyses could have been applied afterwards. Indeed, in some cases it would have been better to maintain a scale rather than the average value. Furthermore, the sensory analysis of the pasta is questionable because it was pre-cooked the day before and then reheated in boiling water before analysis. This pre-cooking may alter the perception of certain attributes such as saltiness. Finally, few people were able to participate in the sensory analysis because of the current situation with covid-19. The results are therefore less representative.

In a second step, the statistical analyses were only carried out using the Excel tool. This is a simple software, but it would have been interesting to use a specific statistical software like R-studio.

Thirdly, the use of the machine to measure extension, compression and rupture was a breakthrough. Indeed, we had never used a machine of this type for texture analysis. We had to research how to use it and watch tutorials. Thus, the measurements may be questionable and should be taken with caution.

Finally, the wheat milling machine was not very accurate and therefore could produce irregular flour particle sizes. Thus, some analyses may be disturbed by a different particle size.

## Conclusion

In this paper, we ask two questions: Does the use of different heritage cereals have an impact on the texture, taste and visual appearance of the products developed? How do the common ingredients in a recipe influence the texture and sensory aspects of the final products?

Firstly, regarding the shortbread, it can be said that the type of cereal used has an impact on the appearance of the product because the results concerning colour and density are very different between the three cereals used. To take one example, the "butter + flour +" sample has a much more yellow colour with the Ölands Vete cereal than with the other two cereals used. On the contrary, the "butter +" sample has a less yellow colour with this cereal. For all other sensory aspects as well as for texture, no impact of the different types of cereals can be visualised. On the other hand, the ingredients only have an impact on the sensory aspects. Reducing the amount of flour gives a more yellow colour, causes a lower density and thickness and reduces the number of visible particles. It also makes the shortbread stickier, chewier and fatter. Sugar and butter impact the sweetness and butteriness respectively, as well as the cereal taste. Finally, naturally, the increase in the number of particles leads to an increase in the visible particles. So, we can see trends for sensory analysis as we can see trends for texture analysis. However, it is not possible to conclude on a significant impact of the ingredients on the textural aspects.

For cookies, the type of cereal has an impact on the aroma of the biscuits but also on the extension. Indeed, the "caramel" aroma is slightly less intense when using the Kallunda Varvete Evolutionar cereal than when using the other two cereals. Otherwise, no impact of the cereal type on the other sensory and textural aspects can be observed. On the other hand, only certain ingredients have an impact on the sensory aspects. As with shortbread, reducing the amount of flour gives a more yellow colour, causes a lower density and thickness and reduces the number of visible particles. It makes them stickier, chewier and fatter. However, butter and sugar do not have an impact on the buttery or sweet taste. Butter also has no impact on the texture of the cookies measured in the sensory analysis. Finally, increasing the particle size leads to an increase in the number of visible particles. Pearson's correlation and t-test also confirmed the impact of large particles in increasing granularity and extension. Moreover, only this impact is significant, the other ingredients do not have a significant impact on texture, although trends can be observed.

Finally, concerning the pasta, the sensory analysis showed that the type of cereal used has an impact on the aroma, appearance and taste of the pasta. Indeed, different values were obtained between each cereal in the sensory analysis, which validates this finding. For the appearance attribute, the lowest values were obtained with the Kallunda Varvete Evolutionar cereal. The use of this cereal reduced the intensity of the colour and the number of visible particles in the pasta. For the sample with a lot of olive oil, the cereal taste is increased with the cereal Vete Helkorn, compared to the other cereals. Regarding the aroma, the use of Vete Helkorn cereal in the sample with a lot of olive oil also increased the "old" and cereal aroma. The t-test values allow to conclude that the differences between the cereals are mainly visible during the extension of the pasta during the texture analysis.

Furthermore, the ingredients have no impact on the texture and sensory aspects of the pasta except for the large flour particles. Indeed, during the sensory analysis, large flour particles have an impact on the texture (harder and more granular), appearance (larger number of visible particles) and taste (during the seminar). Indeed, during the seminar, the pasta sample with large flour particles corresponds to the least appreciated sample. An increase in particle size increased the taste of cereals and flour with Vete Helkorn and Öland Vete. The Pearson correlation and t-test values show that coarse flour particles have a significant impact on the grainy texture and on the final charge during dough compression and pasta extension. A combined increase in the amount of salt and oil decreased the sticky texture as well as the final load of the pasta extension. In the sensory analysis, this combined increase increased the fresh grass aroma.

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## Appendix

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	Normal recipe	Flour+	Flour -	Sugar+	Sugar-	Butter +	Butter-	Butter + / sugar +	Butter - / sugar-	Butter+/ sugar-	Butter - / Sugar +	Sugar+/Flour+	Sugar - / Flour -	Sugar+/Flour-	Sugar-/ Flour+	Butter + / flour +	Butter-/ flour-	Butter+/fix.	r- Butter-/F	kur + Icing suga	Larger grains of flou
Visual aspect	**	ск	•	•	- 4				- 70	•	(22)			•		ок	•	Ck			
Tante	**	OK (a little dry)	•	•	- (bland and dry)				73)		2	ĺ	Í Í	•			Ok	•			ск
Texture	Crispy	Crispy	Criegy and soft	Crispy	Crispy and soft	Crispy	Crispy	Crispy	Very elastic	Crispy and soft	Very citigay			Cripy and soft		Crispy and soft	Crispy and soft	Crispy		Crispy	Crispy and soft
Comments	Alittle floury, a little more butter? Perfect sugar	Very brittle dough, impossible to spreud with the roller	Very sticky dough, impossible to spread with the roller	Rather brittle dough Impossible to roll out	Very Soury and therefore very breakable dough	Dough possible to roll ou	f. Dough possible to roll ou	Good dough but rather sticky	Very Noury dough Impossible to spread	Good dough, easy t spread Looks a lot like real shortbread, lacks a little sugar	a I Disputting	Dough too floury, Imposible to use	Dough much too sticky due to butter	Dough very sticky due to the lack of four. Too sweet	Cough too floury, Imposible to use	Dough not proaible to spread	Dough too sticky du to lack of flour	e Dough very sta due to butte	cky Dough too f r impossible t	foury, Xouae Very good do:	gh Gooddough
Protos			B	X	 	R			1 A		FU	Nopicture		5		<b>H</b>		R			
Numéro		100	110	140	150	180	190	220	230	240	250	-9	1. S.	350		370	390	390		400	410
	Normal necipe	Flour+	Fiour-	Sugar+	Sugar-	Butter +	Butter-	Butter+/sugar+	Butter-/sagar-	Outlier + / sugar-	Butter - / Sugar +	Sugar+/Flour+	Sugar- / Flour	Sugar+/ Flou	r- Sugar-/Fi	our+ Butter+/	four+ Butte	r-/faur- (	lutter+/flour-	Butter - / Flour +	Larger grains of flour
Visual aspect			1.73	*	- S	•	- S	·	3553	ок	58	2			. 53	0	¢				•
Tanto	+ (because of sugar)	18		0.00	CK (bland)	0.003	-	2		8(	ок	СК			63			*		- (taxtolem)	22
Texture	Crunchy and soft	Saft	Saft	Satt	sati	Satt	Satt	Crunchy and soft	Crunchy and soft	Saft	Salt	Saft			Saft	Grunchy	and soft	Soft		Salt	Soft and granular
Comments	Alittle too sweet Very good dough (not sticky)	Very long cooking time No tabe	Wery flat cookies	Good dough but not possible to roll out	Very floury dough and therefore very breakable (like shortbread)	Sticky parts, therefore difficult to handle	Very long cooking time No taste	Good dough Very aveet cookie	Bland, too floury	Toomuchbutter	Good dough Very sweet cookie	Taxtelens	Dough much too sticky due to butb	Dough much to sticky due to but	oo Niataab teer Diaughitoo f	cool doug good texts cool	n Very Veryst are,good due to l des To	icky dough Do. lack of flour to o weet	agh too sticky due bytter, impossible to use	Dough too floury, difficult to use	Dough a little sticky due to butter Maybe undercooked
Photos		A.S.	Î	È	2		×	3		F		(	No picture	0				3	3		
Numéra		120	150	160	120	200	210	200	220	280	200	500	1.1	901	110	32	0	130		340	150

## Appendix 1 : Pre-tests of shortbreads, cookies and pasta

Recipe	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	19	20	21	22	23
Quantities	Normal recipe	High salt +	High salt ++	Low flour	Low flour	Low flour	Low flour without salt	High flour	High flour	High flour without salt	Low eggs	High eggs	With Olive Oil High +	With Olive Oil High ++	Low Flour - Low Eggs - High olive oil	High Flour - High Eggs -High olive oil	Middel with big particuleof flour : <b>Midel</b>	Middel with big particuleof flour : <b>High Flour</b>	Low Flour - Low Eggs	High Flour - High Eggs	High Flour - High Eggs	High Flour - Low Eggs	Low Flour - High Eggs
Flour	300g	300g	300g	150g	200g	250g	250g	450g	350g	350g	300g	300g	300g	300g	250g	350g	300g	375g	250g	450g	350g	350g or 450g	250g
Eggs	3	3	3	3	3	3	3	3	3	3	2	4	3	3	2	4	3	3	2	4	4	2	4
Salt	09	1g	5g	1g	1g	1g	Og	1g	1g	0g	0g	09	Og	Og	0g	0g	Og	0g	0g	0g	0g	Og	0g
(tablespoo	0	0	0	0	0	0	0	0	0	0	0	0	2 tablespoons	5 tablespoons	2 tablesspoons	5 tablespoons	0	0	0	0	0	0	0
Observatio n of the dough	Very good : flexible and smooth. Dough yellow and sticky	Smooth and flexible. Dough yellow and sticky	Correct but sticky	The dough is sticky, very wet and cannot be used	The dough is very sticky, very wet and cannot be	The dough is sticky and very yellow color	h The dough is sticky and very yellow color	The dough cannot be rolled out. It is too floury with large pieces of flour. It is too thick and does not pass through the	the dough is floury, grainy and cracked. It is not smooth	Floury ans tasteless. Some flour in the bowl	The dough is floury. It is not possible to make a ball	The dough is sticky	The dough is smoothy soft	The dough is elastic ans smooth	The dough is very good ans elastic	The dough is floury	The dough is sticky and hard	The dough is breakable/brittle and compact	Impossible to roll out because the dough is floury and breakable	there is still flour in the bowl: floury and breakable	Sticky but correct	Impossible to make a ball : very floury like crumble	Impossible to make a ball : very sticky
Visual aspect	••	•	••	H	H	-	H	•	•	•	H	H	•	•	**	•		H	H	**	••	H	H
Taste	••	**	**	H	H	+	H	•	**	•	H	H			**	+	•	H	H	++	•	H	H
Texture (Pasta)	Correct	Correct	Correct	H	H	Slime	H	Slime	Correct and less slime	Correct and less slime	#	H	Sticky	Very sticky	Correct	Correct	Granular	H	H	Correct	little sticky	H	H
Observatio ns (Pasta)	Nice taste of eggs and good texture but tasteless (no salt)	Nice taste of eggs and good texture	Correct but salted	H	H	the pasta is a little whiter and sticky.	#	they are very easy to cut in the pasta machine. The dough is not smooth and grainy. There is still some flow in the boul	They look like the pasta of the traditional recipe.	They look like the pasta of the traditional recipe but tasteless	H	H	Olive oil has an impact on the appearance of the pasta. They are sticky and gluey. It has a different taste.				the cooking water is yellow and there is a lot of foam.	H	H		Correct	н	#
Photo		K		Ő		and the second	le l					50						Carlor and Carlor					
Number	201	H	200	H	H		101	110	120	130	H	H	160	170	250	260	180	190	H	210	200	H	H

	Normal recipe	Butter +	Butter + / sugar -	Butter + / Flour +	Sugar + / flour -	Big particles (12)
Visual aspect	++	**	**	8.00	ок	+
Taste	++	+	+	Ok	+	+
Texture	Crispy and soft	Soft	Crispy	Crispy and soft	Crispy and soft	Crispy
Comments	Good dough and good shortbread	Good dough	Good dough Good shortbread but not sweet enough Tasteless	Dough too floury, impossible to spread	Dough very sticky due to the lack of flour	Good dough but difficult to spread
Photos						
Numéro	100	150	110	120	130	140

Appendix 2 : Testing shortbreads and pasta designs with Ōlands Vete cereal

Recipe testing	0	1	2	3	4	5	6	7	8	9	10
Quantities	Normal recipe	Normal recipe	Normal recipe with high particule	Salt +	Salt + +	Olive Oil +	Olive Oil ++	Salt + / Olive Oil +	Salt + / Olive Oil ++	Salt ++ / Olive Oil +	Salt ++ / Olive Oil ++
Flour	300g	250g	250g	250g	250g	250g	250g	250g	250g	250g	250g
Particule of flour	Middle	Middle	Larger	Middle	Middle	Middle	Middle	Middle	Middle	Middle	Middle
Eggs	3	3	3	3	3	3	3	3	3	3	3
Salt	Og	Og	Og	2g	4g	Og	Og	2g	2g	4g	4g
Olive oil (tablespoon)	0	0	0	0	0	2	4	2	4	2	4
Observation of the dough	Too floury due to flour	//	Correct but sticky	//	Correct but little floury	//	Correct but little sticky	Correct	Correct but little sticky	//	Correct but stichy
Visual aspect (Pasta)	//	//		//	++	//	-	++	+	//	++
Taste (Pasta)	//	//	-	//	++	//	-	-		//	+
Texture (Pasta)	//	//	Breakable		Normal	//	Sticky	Correct	sticky	/	little sticky
Observations (Pasta)	//	//	Dough difficult to spread in the pasta machine: brittle and sticky	//	Correct	//	Tasteless	Correct	sticky	//	correct
Photo		//		//		//				//	

	Normal recipe	Sugar +	Butter + / sugar +	Butter + / Flour +	Butter - / Flour -	Butter - / Flour - (suggestion of new quantities)	<b>Big particles</b>
Visual aspect	Ok (not spread out)	++	+	ок	(s <b>2</b> .)	++	+
Taste	++	**	++	+	+	++	+
Texture	Soft	Soft and crispy	Soft and crispy	Soft	Crispy	Soft and crispy	Soft
Comments	Good dough	Good dough and good cookies	Good dough and good cookies but breakable	Good dough. Not much taste	Dough too sticky due to butter Very flat cookies, very sweet	Better dough and better cookies (less sweet)	Dough a little sticky
Photos							
Numéro	200	210	250	260	270	230	280

## Appendix 3 : Testing cookies and pasta designs with Vete Helkorn cereal

Recipe testing	1	2	3	4	5	6	7	8	9	10
Quantities	Normal recipe	Normal recipe with high particule	Salt +	Salt + +	Olive Oil +	Olive Oil ++	Salt + / Olive Oil +	Salt + / Olive Oil ++	Salt ++ / Olive Oil +	Salt ++ / Olive Oil ++
Flour	250g	250g	250g	250g	250g	250g	250g	250g	250g	250g
Particule of flour	Middle	Larger	Middle	Middle	Middle	Middle	Middle	Middle	Middle	Middle
Eggs	3	3	3	3	3	3	3	3	3	3
Salt	Og	0g	2g	4g	0g	0g	2g	2g	4g	4g
Olive oil (tablespoon)	0	0	0	0	2	4	2	4	2	4
Observation of the dough	//	compact	//	good	//	good	Correct	Little sticky	correct	correct
Visual aspect (Pasta)	//	++	//	++	//	++	++	++	++	++
Taste (Pasta)	//	-	//	++	//	+	+	-	+	+
Texture (Pasta)	//	granular	//	correct	//	good	good	little sticky	little sticky	little sticky
Observation s (Pasta)	//	correct	//	correct	//	correct	correct	correct but sticky	correct but sticky	correct
Photo	//		//		//					

6110D7			Nor	mal	Butte	er+	Butter+,	/ sugar -	Butter+,	flour +	Sugar + /	flour -	Big par	rticles
SHORT	BREADS	Cereals	Mean value	Standard deviation										
		Helkorn Vete	10,423	4,444	10,298	2,421	12,558	4,891	18,586	4,063	11,851	4,144	15,834	5,666
	Peak load (N)	Ölands Vete	14,257	4,931	12,458	1,035	16,471	1,394	29,701	15,245	5,685	2,081	10,885	3,850
		Kallunda Varvete Evolutionar	10,360	3,004	6,777	0,550	11,630	2,915	29,136	13,304	5,897	2,321	14,081	1,603
		Helkorn Vete	15,000	0,000	14,967	0,058	15,000	0,000	15,000	0,000	14,967	0,058	15,000	0,000
	Deformation peak (mm)	Ölands Vete	15,000	0,000	14,967	0,058	15,000	0,000	15,000	0,000	14,933	0,058	15,000	0,000
COMPRESSION		Kallunda Varvete Evolutionar	15,000	0,000	14,933	0,058	15,000	0,000	14,967	0,058	14,900	0,000	15,000	0,000
COMPRESSION		Helkorn Vete	8,912	3,125	9,140	2,023	10,595	3,412	15,827	3,303	6,632	1,646	12,940	4,404
	Final load (N)	Ölands Vete	12,211	4,005	10,701	0,976	14,255	0,834	22,590	9,026	4,837	1,572	9,388	3,353
		Kallunda Varvete Evolutionar	9,349	2,299	6,220	0,494	10,424	2,303	22,465	8,264	5,039	1,464	12,152	1,361
		Helkorn Vete	0,655	0,265	2,306	0,170	1,889	0,531	0,091	0,079	2,649	0,249	1,639	0,816
	Adhesive force (N)	Ölands Vete	0,236	0,160	1,758	0,708	3,024	1,525	0,006	0,004	1,538	0,491	1,291	0,208
		Kallunda Varvete Evolutionar	1,908	1,025	1,373	0,523	1,698	0,361	1,388	0,859	7,897	7,574	2,329	0,221
		Helkorn Vete	7,411	0,430	7,491	0,915	7,117	0,150	11,626	0,136	5,829	0,259	10,667	0,164
	Peak load (N)	Ölands Vete	8,694	0,268	8,400	0,734	7,020	0,225	4,868	1,147	5,770	0,155	7,812	0,347
		Kallunda Varvete Evolutionar	6,727	0,064	5,673	0,367	3,248	1,070	6,048	0,189	7,084	0,160	11,238	0,504
		Helkorn Vete	20,333	0,709	22,333	0,351	23,000	0,500	23,600	0,819	23,400	1,652	23,867	0,666
EXTENSION	Deformation peak (mm)	Ölands Vete	21,200	0,436	21,933	0,777	19,733	0,577	18,200	0,985	20,700	1,572	20,933	0,153
		Kallunda Varvete Evolutionar	20,800	0,361	21,933	0,569	18,333	0,153	18,967	0,404	20,800	1,400	24,767	0,981
		Helkorn Vete	7,222	0,413	7,381	0,913	6,969	0,183	11,272	0,064	5,791	0,258	10,519	0,238
	Final load (N)	Ölands Vete	8,407	0,190	8,259	0,729	6,699	0,261	4,565	1,219	5,714	0,163	7,705	0,359
		Kallunda Varvete Evolutionar	6,493	0,036	5,597	0,381	3,142	1,097	5,734	0,153	7,023	0,165	11,012	0,548
		Helkorn Vete	31,445	3,695	10,181	1,345	5,798	1,203	6,811	3,777	4,975	1,383	21,864	3,245
	Rupture load (N)	Ölands Vete	23,683	10,177	7,274	1,795	2,284	0,098	14,296	4,732	10,997	4,752	10,700	2,326
PUDTUDE		Kallunda Varvete Evolutionar	18,844	3,324	13,194	1,365	4,008	0,945	7,326	2,151	12,751	2,798	5,134	1,712
ROPTORE		Helkorn Vete	0,900	0,100	1,567	0,379	1,476	0,569	0,800	0,100	0,500	0,346	0,933	0,321
	Deform rupture (mm)	Ölands Vete	1,767	0,306	1,967	0,551	2,433	0,115	1,000	0,100	1,033	0,551	2,233	0,643
		Kallunda Varvete Evolutionar	1,600	0,265	0,900	0,346	1,467	0,058	1,367	0,451	0,633	0,289	1,333	0,252
		Helkorn Vete	59,207	1,570	59,553	1,348	56,453	1,051	58,890	0,817	52,643	3,476	56,130	0,301
	L*	Ölands Vete	56,760	1,113	58,783	0,196	57,350	1,062	55,737	1,135	55,570	0,351	58,150	1,269
		Kallunda Varvete Evolutionar	61,297	0,293	58,333	0,811	57,663	0,081	58,037	4,025	51,537	5,252	58,297	2,281
		Helkorn Vete	6,570	0,293	8,193	0,587	5,830	0,234	5,597	0,071	6,777	0,140	5,973	0,276
COLOR	a*	Ölands Vete	5,877	0,536	5,570	0,157	5,093	0,165	5,967	0,576	5,413	0,072	5,850	0,173
		Kallunda Varvete Evolutionar	5,943	0,391	6,443	0,101	4,943	0,830	5,423	0,462	6,900	1,175	5,483	0,285
		Helkorn Vete	16,280	0,271	17,973	0,404	14,433	0,287	14,877	0,240	14,880	2,046	14,053	0,222
	b*	Ölands Vete	15,087	0,817	15,600	0,249	15,323	0,696	15,127	0,782	15,573	0,221	17,030	0,370
		Kallunda Varvete Evolutionar	17,110	0,405	17,153	0,261	13,487	1,580	14,473	1,474	13,370	2,732	15,160	1,000

## Appendix 4 : Results of the texture analysis for shortbreads, cookies and pasta

			Nor	mal	Sug	ar +	Butter +	/ sugar +	Butter + /	flour +	Butter -	/ flour -	Big pa	rticles
CO	OKIES	Cereals	Mean value	Standard deviation	Mean value	Standard deviation	Mean value	Standard deviation						
		Helkorn Vete	7,367	2,072	6,577	1,101	6,155	1,269	11,838	2,833	20,151	11,933	8,759	4,698
	Peak load (N)	Ölands Vete	7,182	2,329	10,700	2,409	8,282	2,290	24,647	7,869	8,871	3,282	9,026	0,806
		Kallunda Varvete Evolutionar	5,805	0,338	5,301	0,886	7,003	2,187	6,964	2,435	8,754	1,894	5,949	0,772
		Helkorn Vete	14,967	0,058	14,967	0,058	14,900	0,000	15,000	0,000	15,000	0,000	15,000	0,000
	Deformation peak (mm)	Ölands Vete	14,933	0,058	15,000	0,000	15,000	0,000	14,967	0,058	15,000	0,000	14,967	0,058
COMPRESSION		Kallunda Varvete Evolutionar	14,967	0,058	15,000	0,000	14,933	0,058	14,967	0,058	14,967	0,058	14,933	0,058
Commission		Helkorn Vete	6,300	1,455	5,756	0,661	5,513	1,138	9,449	1,868	10,240	5,874	7,317	3,802
	Final load (N)	Ölands Vete	6,204	1,796	8,513	1,106	6,957	1,580	18,822	3,730	6,833	2,329	7,173	0,676
		Kallunda Varvete Evolutionar	5,212	0,399	4,528	0,682	6,136	1,785	6,130	1,995	6,742	0,841	5,302	0,705
		Helkorn Vete	1,983	0,437	1,578	0,112	1,586	0,467	0,968	0,344	8,084	3,629	1,215	0,449
	Adhesive force (N)	Ölands Vete	1,482	0,615	2,253	0,432	3,373	3,949	1,223	1,615	2,910	1,614	2,339	0,163
		Kallunda Varvete Evolutionar	1,394	0,339	3,480	3,576	1,880	0,624	0,530	0,143	3,810	1,109	1,301	0,409
		Helkorn Vete	10,259	0,087	10,263	0,096	10,930	0,483	9,718	0,328	6,566	0,462	5,545	0,255
	Peak load (N)	Ölands Vete	4,032	0,437	4,077	0,664	8,052	0,137	7,681	0,272	6,658	0,315	6,764	0,173
		Kallunda Varvete Evolutionar	6,488	0,088	6,619	0,312	7,647	0,645	6,438	0,818	5,679	0,151	8,916	0,482
		Helkorn Vete	25,933	0,351	23,867	0,611	25,233	0,611	23,867	0,850	23,167	1,550	19,033	0,757
EXTENSION	Deformation peak (mm)	Ölands Vete	18,967	0,058	17,867	1,595	22,233	1,007	19,767	0,404	20,033	2,977	20,900	0,737
		Kallunda Varvete Evolutionar	21,467	0,208	21,500	1,249	19,167	5,787	19,300	1,493	21,233	1,405	21,100	1,000
		Helkorn Vete	10,175	0,091	10,156	0,072	10,838	0,495	9,707	0,441	6,518	0,472	5,583	0,345
	Final load (N)	Ölands Vete	3,954	0,434	3,981	0,663	7,983	0,107	7,378	0,337	6,365	0,145	6,720	0,156
		Kallunda Varvete Evolutionar	6,409	0,080	6,503	0,319	7,084	0,728	5,994	0,508	5,631	0,153	8,826	0,471
		Helkorn Vete	6,009	0,899	5,302	0,077	4,432	1,788	4,169	0,691	4,434	1,259	3,355	0,770
	Rupture load (N)	Ölands Vete	11,788	2,299	13,081	0,893	4,453	0,108	8,444	1,376	2,513	0,222	3,720	1,298
		Kallunda Varvete Evolutionar	27,900	9,118	4,432	0,394	2,392	0,088	7,912	2,552	2,359	0,064	2,865	0,385
RUPTURE		Helkorn Vete	2,133	0,651	2,033	0,058	0,013	0,006	1,667	0,513	1,833	0,289	1,433	0,289
	Deform rupture (mm)	Ölands Vete	6,167	0,929	4,967	1,274	2,067	0,808	4,533	1,429	1,000	0,000	2,333	0,764
		Kallunda Varvete Evolutionar	4,400	1,249	1,633	0,321	1,067	0,115	5,733	3,612	0,800	0,265	1,600	0,141
		Helkorn Vete	62,303	0,310	59,267	0,715	56,710	0,992	60,987	0,142	58,353	1,242	59,807	0,967
	U*	Ölands Vete	61.037	0,250	59,120	0,278	58,523	1,765	56,907	1.371	56,903	1.651	60,180	0,527
		Kallunda Varvete Evolutionar	59,590	1.149	60,673	1,287	58,293	0,330	59,440	1.840	56,887	1.463	59,563	0.558
		Helkorn Vete	5.627	0.042	5,387	0.385	5,790	0.480	5,940	0.066	5.640	0.161	6,193	0.336
COLOR	a*	Ölands Vete	5,750	0,406	5,933	0,500	5,470	0,304	5,517	0,436	5,270	0,183	5,807	0,031
		Kallunda Varvete Evolutionar	4,897	0,256	4,407	0,264	5,767	0.268	5,663	0,169	5.090	0.244	6.010	0,291
		Helkorn Vete	16.403	0.656	15,173	0.365	13,800	0.720	15,967	0.410	15,790	0.973	16.463	0.235
	b*	Ölands Vete	16,850	0,415	16,753	0,236	16.033	1,101	14,400	1.110	15,710	0.894	16,427	0.663
		Kallunda Varvete Evolutionar	14,130	1,250	15,863	0,290	15,213	0,203	16,247	1.080	14,400	0,782	16,237	0,360

			Norma	l Recipe	Hight p	articule	Sa	lt +	Sa.	lt ++	Olit	e oil+	Oli <del>v</del>	e oil++	Salt + /	Olive oil +	Salt ++ i	/ Olive oil	Salt + 7	Olive oil ++	Salt ++ /	Olive oil
FRESH	PASTA	Cereals	Mean	Standard	Mean	Standar	Mean	Standar	Mean	Standard	Mean	Standard	Mean	Standard	Mean	Standard	Mean	Standard	Mean	Standard	Mean	Standard
			Talue	deviation	Talue	d	Talue	d	Talue	deviation	Talue	deviation	Talue	deviation	Talue	deviation	Talue	deviation	Talue	deviation	Talue	deviation
		Helkorn Vete	4,742	0.737	10.636	0.171	10.425	0.413	6.752	0.381	7.262	0.235	11.342	0.766	9.458	0.217	10,219	0.142	10.741	0.410	3,261	0.303
-	Deak	Alanda Vata	7.314	0.268	8.043	0.367	8 6 6 0	0.304	8.819	0.117	8 179	0,060	8,808	0.233	7.010	0.052	7.693	0.396	8.093	0.548	8 760	0,000
	F CAR	orands vete	1,014	0,200	0,040	0,001	0,000	0,004	0,010	0,00	0,00	0,000	0,000	0,200	1,010	0,052	1,000	0,000	0,000	0,540	0,100	0,200
	1039 (M)	Kallunda Varvete	8 808	0.044	8 868	0.534	8482	0.496	10.896	0.172	6 702	0.140	9421	0.426	9.214	0.158	8.240	0.230	7 887	0.352	6.840	0.420
		Evolutionar	0,000	0,044	0,000	0,004	0,402	0,400	10,000	0,112	0,102	0,140	0,421	0,420	0,214	0,00	0,240	0,200	1,001	0,002	0,040	0,420
1		Helkorn Vete	27,167	1,904	23,167	0.451	29,367	0.635	25.633	1.063	26.567	1.242	33.000	1.664	28.633	1,193	28,600	0.700	27.367	0.513	29,300	0.520
EXTENS	Deforma	ölande Vote	25 733	0.764	25,733	0.907	27.533	1266	27.933	0.551	27 700	0.265	28 200	1 153	27,000	1 1 2 7	20,733	0.462	27.633	0.404	28 133	0.115
ION	tion	orands vete	20,100	0,104	20,100	0,001	21,000	1,200	21,000	0,001	21,100	0,205	20,200	1,00	21,000	1,161	22,100	0,402	21,000	0,404	20,100	0,10
(dough)	@PEAK (mm)	Kallunda Varvete Evolutionar	26,967	0,473	25,967	0,208	28,500	0,624	31,900	1,493	27,667	1,550	30,067	0,289	29,067	0,961	27,667	1,234	27,433	0,416	26,467	0,929
1		Helkorn Vete	4,432	0.723	10.457	0.119	10.021	0.333	6.401	0.426	7.020	0.299	11.074	0.789	9.318	0.210	9,914	0.154	10.472	0.458	9.043	0.292
1	Final	ölands Vete	6.923	0.265	7.604	0.335	8,293	0.293	8 555	0.094	7.840	0.086	8 580	0.246	6.651	0.030	7.388	0.391	7 711	0.526	8448	0.277
-	1	Vellos de Venece	0,020	0,200	1,004	0,000	0,200	0,200	0,000	0,004	1,040	0,000	0,000	0,240	0,001	0,000	1,000	0,001		0,020	0,440	0,011
	1040 (m)	Kanunda Varvete	8,347	0,086	8,367	0,492	8,227	0,526	10,551	0,101	6,440	0,108	9,085	0,415	8,971	0,208	7,947	0,236	7,664	0,309	6,666	0,421
		Evolutionar																				
		Helkorn Vete	17,315	5,613	25,809	4,495	22,612	4,256	18,467	2,868	14,535	0,487	13,461	0,778	14,867	0,463	13,713	2,816	14,293	3,568	14,971	2,256
1	Peak	ölands Vete	19.441	1.612	48.240	5.879	21.303	2,789	20.647	1.234	17.790	1.361	17.563	4,122	13.935	3.014	17.324	2.118	18.664	3.680	20.039	4,703
1	Land (M)	Rolling de Mariana																				
	iosa (m)	Kallunda Varvete	21,731	7.516	21,210	4.276	21.033	2,102	20.535	4.162	15.263	2.066	16.841	3.085	18.683	5.402	14.624	2.010	13,719	1.052	12.263	2,213
		Evolutionar		1		1								1								
1	n /	Helkorn Vete	15,000	0.000	15,000	0.000	15,000	0.000	14,967	0.058	15,000	0.000	15,000	0.000	15,000	0.000	15,000	0.000	15,000	0.000	15,000	0.000
	Detorma	ölande Vete	15,000	0.000	15,000	0.000	14,967	0.058	15,000	0.000	15,000	0,000	15,000	0.000	15,000	0.000	14,967	0.058	15,000	0.000	15,000	0,000
	tion	olands vete	15,000	0,000	15,000	0,000	14,001	0,050	15,000	0,000	15,000	0,000	15,000	0,000	15,000	0,000	14,301	0,050	15,000	0,000	15,000	0,000
	@PEAK (==)	Kallunda Varvete Evolutionar	14,967	0,058	15,000	0,000	14,967	0,000	15,000	0,000	15,000	0,000	14,967	0,058	15,000	0,000	15,000	0,000	15,000	0,000	15,000	0,000
Looion		Helkorn Vete	14,551	4,195	19,704	2,003	18,370	30,080	15,342	2,288	12,838	0,436	11,934	0,620	12,326	0,510	12,071	2,475	11,804	2,447	12,653	1,192
lgondel	Final	ölands Vete	13.886	3,432	30,569	2,667	18,286	2.403	17.219	1,199	15.274	0.924	14.694	2,131	12.284	2,338	14,768	10251.000	16,564	3,113	17.463	3.411
	Land (N)	Kallus da Vasurka				-,		-,								-,				-,		-1-11
	1030 (N)	Evolutionar	18,308	4,966	17,839	3,110	18,333	1,268	17,584	3,218	13,204	1,245	14,302	2,151	15,049	3,032	12,819	1,628	11,973	0,813	10,683	1,752
		Helkorn Vete	1,865	0,443	2,448	0,019	2,082	0,318	1,601	0,386	1,464	0,244	1,097	818,0	1,624	0,132	2,161	0,157	2,034	0,535	2,043	0,292
	Adhesiv	ölands Vete	2,120	0,344	2,255	0,344	2,355	0,062	2,438	0,043	2,245	0,531	2,123	0,294	1,675	0,344	2,093	0,293	1,269	0,402	2,729	0,618
	e Force (N)	Kallunda Varvete Evolutionar	2,935	1,284	1,805	0,799	2,371	0,079	2,303	0,292	2,351	0,206	1,972	0,570	2,426	0,137	1,782	0,620	2,370	0,179	2,100	0,217
		Helkorn Vete	6 104	0.508	11 172	0.147	10 582	0.584	8,363	0.436	7.329	0.131	10.865	1345	8 360	0.467	10 506	0.120	10 106	0.117	7.685	0.221
-		Manda Vite	0,104	0,240	9,019	0,141	9.202	0,504	7749	0,400	9.052	0,101	7.052	0.105	0,000	0.946	6,110	0,020	7.905	0,00	9,000	0,209
	Peak	olands vete	0,341	0,310	3,010	0,503	3,303	0,455	1,143	0,335	0,055	0,100	1,055	0,105	0,334	0,240	6,110	0,200	1,025	0,400	3,113	0,300
	load (N)	Kallunda Varvete Evolutionar	9,252	0,032	7,497	0,290	8,079	0,062	10,662	0,246	9,188	0,383	10,029	0,193	8,430	0,345	11,256	0,061	7,465	0,304	9,619	0,109
	Deforms	Helkorn Vete	21,333	0,666	27,900	0,173	27,567	0,231	25,133	0,586	24,733	0,473	28,967	1,026	24,533	0,351	28,233	0,379	28,467	1,242	23,388	0,115
EXTENS	Dervina	ölands Vete	25,233	1,069	25,233	0,757	27,100	0,529	24,533	0,153	24,633	0,379	23,500	0,200	26,367	0,751	22,033	0,777	25,500	1.015	26,233	0,802
ION (pasta)	@PEAK (==)	Kallunda Varvete Evolutionar	26,033	0,115	22,700	0,173	24,700	0,500	27,700	0,173	26,567	0,208	27,467	0,153	25,200	0,900	29,967	1,950	24,067	0,404	26,300	0,500
		Helkorn Vete	5,111	0,314	10,633	0,153	10,165	0,435	8,166	0,560	7,006	0,113	10,485	1,349	8,046	0,438	10.023	0,200	9,643	0,177	7,277	0,351
1		ölands Vete	7.956	0.438	8,394	0.463	8.681	0.403	7 101	0.462	7.636	0.163	6 701	0.124	8 550	0.310	5.745	0.324	7.545	0.346	8.661	0.366
1	Final	orando rece	1,000	0,400	0,004	0,400	0,001	0,400	1,101	0,402	1,000	0,100	0,101	0,124	0,000	0,010	2,142	0,024	1,242	0,040	0,001	0,000
	load (N)	Kallunda Varvete Evolutionar	8,900	0,100	6,883	0,353	7,549	0,155	10,136	0,206	8,642	0,334	9,387	0,179	7,984	0,182	10,833	0,103	7,047	0,155	9,267	0,099
		Helkorn Vete	62,213	0,108	51,273	2,526	52,817	1,951	45,290	1,201	55,087	3,090	51,000	6,170	55,663	2,053	57,377	5,686	52,557	1,155	51,953	0,950
		ölands Vete	52.677	3,414	52,587	1.128	49,770	1.244	52,943	3.001	52,477	1,760	55,457	0.817	53,707	1.524	51,997	1,704	57.243	4,619	54,797	0,720
1	17																					
	-	Kallunda Varvete Evolutionar	54,000	2,930	52,890	5,152	52,367	3,317	57,280	2,126	54,540	2,920	52,983	3,541	52,700	1,731	54,780	1,069	52,537	2,644	53,613	0,539
		Helkorn Vete	5,303	0,631	3,757	0,046	3,670	0,370	2,593	0,587	3,507	0,296	2,617	0,200	3,380	0,289	3,393	0,839	3,923	0,304	3,967	0,859
		ölands Vete	3,933	0,287	3,697	0,372	4,267	0,225	3,533	0,461	3,920	0,202	3,010	0,750	3,633	0,235	4,113	0,532	3,113	0,964	3,513	0,137
COLOR	9	Kallunda Varvete Evolutionar	3,653	0,516	3,453	0,161	3,447	1,195	3,267	0,330	3,700	0,392	3,200	1,012	3,700	0,072	2,823	0,168	3,603	0,450	3,470	0,238
		Helling Here	40.700	10.000	9.063	1000	0 777	1 100	5 5 5 3	0.604	9.040	1007	6 503	1404	9,600	0.630	9.000	0.707	10.040	1101	9669	0.000
		Helkorn Vete	13,133	10,600	3,061	1,289	3,111	1,186	5,551	0,624	3,240	1,091	6,521	1,126	3,603	0,619	3,880	2,121	10,813	1,134	3,663	2,236
		olands Vete	11,617	0,828	9,627	0,552	10,937	0,310	9,780	1,334	11,213	1,219	9,603	2,402	9,990	1,677	10,817	0,713	9,593	2,575	10,727	0,820
	Р.	Kallunda Varvete Evolutionar	10,267	1,868	7,643	1,529	9,363	2,727	11,237	1,260	10,370	0,575	9,930	1,516	10,110	0,287	7,993	0,787	10,027	0,595	10,583	0,736
-																			+			

### Appendix 5 : Results of the t-test for shortbreads, cookies and pasta

## a) By recipes

					COMP	RESSIUM	-									EXTENSION		_	_				NUP	TURE							-						
			Peak load ()	(N)	Defor	mation pea	ık (mm)		Final load (N	0	Adl	hesive force	(N)		Peak load (N	0	Defon	mation peak	(mm)	1	inal load (N)		Ru	pture load (	N)	Defo	rm rupture (	mm)		1.			a*			ь•	
				Nationea			Kalichea			Nationea			Kalonea			Kalonda			Kalighda			Nationea			Nationea			Kalonda			Nationea			Kalonda			Kaliunda
Cen	als	Helkorn	Olands	Varvete	Helkom	Olands	Varvete	Helkom	Olands	Varvete	Helkom	Olands	Varvete	Helkom	Olands	Varvete	Helkom	Olands	Varvete	Helkom	Olands	Varvete	Helkom	Olands	Varvete	Helkom	Olands	Varvete	Helkom	Olands	Varvete	Helkom	Olands	Varvete	Helkom	Olands	Varvete
		Vete	Vete	Evolutiona	Vete	Vete	Evolutiona	Vete	Vete	Evolutiona	Vete	Vete	Evolutiona	Vete	Vete	Evolutiona	Vete	Vete	Evolutiona	Vete	Vete E	volutiona	Vete	Vete	Evolutiona	Vete	Vete	Evolutiona	Vete	Vete	Evolutiona	Vete	Vete	Evolutiona	Vete	Vete	Evolutiona
	Mean value	10.423	14.25	7 10.360	15.000	15.000	0 15.000	8,912	12,211	9,349	0.655	0.236	1,908	7.411	8.694	6.727	20.333	21,200	20,800	7,222	8,407	6.493	31,445	23.683	18.844	0.900	1.767	1.600	59.207	56,760	61.297	6.570	5.877	5.943	16.280	15.087	17,110
	Standard																																				
Normal	deviation	4,444	4,93	1 3,004	0,000	0,000	0,000	3,125	4,005	2,299	0,265	0,160	1,025	0,430	0,268	0,064	0,709	0,436	0,361	0,413	0,190	0,036	3,695	10,177	3,324	0,100	0,306	0,265	1,570	1,113	0,293	0,293	0,536	0,391	0,271	0,817	0,405
	Significant	а	abdf	abc	a	a	a	da	abc	abc		8	a	a			a		ad	ad	ad			ab	80	ab	9	а	ab	8	a -	96	abc	de		8	a
	Mean value	10,298	12,45	8 6,771	14,967	14,967	7 14,933	9,140	10,701	6,220	2,306	1,758	1,373	7,491	8,400	5,673	22,333	21,933	21,933	7,381	8,259	5,597	10,181	7,274	13,194	1,567	1,967	0,900	59,553	58,783	58,333	8,193	5,570	6,443	17,973	15,600	17,153
Burney e	Standard																																				
butter +	deviation	2,421	1,03	5 0,550	0,058	0,058	8 0,058	2,023	0,976	0,494	0,170	0,708	0,523	0,915	0,734	0,367	0,351	0,777	0,569	0,913	0,729	0,381	1,345	1,795	1,365	0,379	0,551	0,346	1,348	0,196	0,811	0,587	0,157	0,101	0,404	0,249	0,261
	Significant	а	a	a	a	а	а	ab	a	80	bc	ac	a	ac	ace	ь	bc	а	ac	acd	ac	26	ь	a	ad	a	ace	ac	a	a	bc	ь	26	а	ь	а	a
	Mean value	12,558	16,47:	1 11,630	15,000	15,000	0 15,000	10,595	14,255	10,424	1,889	3,024	1,698	7,117	7,020	3,248	23,000	19,733	18,333	6,969	6,699	3,142	5,798	2,284	4,008	1,476	2,433	1,467	56,453	57,350	57,663	5,830	5,093	4,943	14,433	15,323	13,487
Sumar + / suma	Standard																																				
Contract of South	deviation	4,891	1,39	4 2,919	0,000	0,000	0,000	3,412	0,834	2,303	0,531	1,525	0,361	0,150	0,225	1,070	0,500	0,577	0,153	0,183	0,261	1,097	1,203	0,098	0,945	0,569	0,115	0,058	1,051	1,062	0,081	0,234	0,165	0,830	0,287	0,696	1,580
	Significant	а	đ	bc	а	a	а	ab	c	ab	be	ac	а	a	bc	c	be	bc	be	đ	boe	ь	c	bc	ь	ac	bog	а	bc	ac .	bc	cd	ь	ab	ce	a	a
	Mean value	18,586	29,70	1 29,136	15,000	15,000	0 14,967	15,827	22,590	22,465	0,091	0,006	1,388	11,626	4,868	6,048	23,600	18,200	18,967	11,272	4,565	5,734	6,811	14,296	7,326	0,800	1,000	1,367	58,890	55,737	58,037	5,597	5,967	5,423	14,877	15,127	14,473
Butter + / Sour-	Standard																																				
	deviation	4,063	15,24	5 13,304	0,000	0,000	0,058	3,303	9,026	8,264	0,079	0,004	0,859	0,136	1,147	0,189	0,819	0,985	0,404	0,064	1,219	0,153	3,777	4,732	2,151	0,100	0,100	0,451	0,817	1,135	4,025	0,071	0,576	0,462	0,240	0,782	1,474
	Significant	а	ace	de	а	a	a	ь	acd	abc	a	a	a	ć	Ы	ь	bc	bđ	bg	e	delg	bc	cb	a -	be	ad	eſ	ac	a	bcd	ac	cć	abd	da	c	a	a
	Mean value	11,851	5,68	5 5,897	14,967	14,933	3 14,900	6,632	4,837	5,039	2,649	1,538	7,897	5,829	5,770	7,084	23,400	20,700	20,800	5,791	5,714	7,023	4,975	10,997	12,751	0,500	1,033	0,633	52,643	55,570	51,537	6,777	5,413	6,900	14,880	15,573	13,370
Sugar + / flour -	Standard																																				
	deviation	4,144	2,08	1 2,321	0,058	0,058	8 0,000	1,646	1,572	1,464	0,249	0,491	7,574	0,259	0,155	0,160	1,652	1,572	1,400	0,258	0,163	0,165	1,383	4,752	2,798	0,346	0,551	0,289	3,476	0,351	5,252	0,140	0,072	1,175	2,046	0,221	2,732
	Significant	a	bde	a -	a	a	a	8	bde	c	bd	BC	a	DC	di	e	ace	acc	cceg	DC		c	CC	ac	cce	bcce	a	DC	acc	bce	ac	e	dis	20	abod	a	a
	Mean value	15,834	10,88	5 14,081	15,000	15,000	0 15,000	12,940	9,388	12,152	1,639	1,291	2,329	10,667	7,812	11,238	23,867	20,933	24,767	10,519	7,705	11,012	21,864	10,700	5,134	0,933	2,233	1,333	56,130	58,150	58,297	5,973	5,850	5,483	14,053	17,030	15,160
<b>Big particles</b>	Standard		3.95		0.000	0.000			2.252	1.261	0.010	0.000	0.004	0.164	0.247	0.004		0.453	0.001	0.000	0.050	0.540	2.245	2.226	4.742	0.001	0.040	0.050	0.001	4.369	2.244	0.076	0.470	0.005	0.000	0.070	1 000
	Senificant	3,000	3,63	U 1,003	0,000	0,000	0,000		3,333	1,301	0,810	0,208	0,221	0,104	0,347	0,504	0,000	0,155	0,981	0,238	0,359	0,346	3,243	2,320	1,712	0,321	0,043	0,252	0,301	1,209	2,201	0,276	0,173	0,285	60	0,370	1,000
	agniticant	4	401		4	4		40	ace	0	acce	DC	4	e	e		cce	<i>a</i> .			4	e	e	4	0	ac	48	4	80	ace	<i>a</i> .	82	00		ce	D	4
		Pe	ak load (N)		Deforma	ation peak (	COMPRE (mm)	SSION FI	nal load (N)	Г	Adhe	sive force (N	()	P	ak load (N)	Г	Deform	ation peak (r	mm)	R	nal load (N)	_	Rup	ture load (N	RUPT	URE Defor	m rupture (r	nm)	_	e.			COLOR a*	_		b*	
		Pe	ak load (N)	Kallunda	Deforma	ation peak (	COMPRE (mm) Kallunda	SSION Fi	nal load (N)	Kallunda	Adhe	sive force (N	i) Kallunda	P	ak load (N)	Kallunda	Deform	ation peak (r	mm) Kallunda	R	nal load (N)	Kallunda	Rup	ture load (N	RUPT	URE Defor	m rupture (r	nm) Kallunda		L*	Kallunda		COLOR a*	Kallunda		b*	Kallunda
Cerei	is	Pe	ak load (N) Ölands	Kallunda Varvete	Deforma	ation peak ( Ölands	COMPRE (mm) Kallunda Varvete	Helkom	nal load (N) Ölands	Kallunda Varvete	Adhe Helkom	sive force (N Ölands	() Kallunda Varvete	Pi	Ölands	Kallunda Varvete	Deform Helkom	Olands	mm) Kallunda Varvete	R	Olands	Kallunda Varvete	Rup	õlands	RUPT i) Kallunda Varvete	URE Defor Helkom	m rupture (r Ölands	nm) Kallunda Varvete	Helkom	L* Ölands	Kallunda Varvete	Helkom	COLOR a* Ölands	Kallunda Varvete	Helkom	b* Ölands	Kallunda Varvete
Cere	ls	Pe Helkom Vete	ak load (N) Ölands Vete	Kallunda Varvete Evolutionar	Deforma Helkom Vete	olands Vete	COMPRE (mm) Kallunda Varvete Evolutionar	Helkom Vete	Olands Vete	Kallunda Varvete volutionar	Adhe Helkom Vete	sive force (N Ölands Vete	() Kallunda Varvete volutionar	P Helkom Vete	ölands Vete	Kallunda Varvete ivolutionar	Deform Helkom Vete	Ölands Vete	mm) Kallunda Varvete Evolutionar	R Helkom Vete	ol load (N) Ölands X Vete Ev	Kallunda Varvete rolutionar	Rup Helkom Vete	õlands Vete	RUPT i) Kallunda Varvete Evolutionar	URE Defor Helkom Vete	m rupture (r Ölands Vete	nm) Kallunda Varvete Evolutionar	Helkom Vete	U* Ölands Vete	Kallunda Varvete Evolutionar	Helkom Vete	COLOR a* Ölands Vete	Kallunda Varvete Evolutionar	Helkom Vete	b* Ölands Vete	Kallunda Varvete Evolutionar
Cere	ls Mean value	Pe Helkom Vete 7,367	ölands Vete 7,182	Kallunda Varvete Evolutionar 5,805	Deforma Helkom Vete 14,967	Olands Vete 14,933	COMPRE (mm) Kallunda Varvete Evolutionar 14,967	Helkom Vete 6,300	Ölands Vete 6,204	Kallunda Varvete volutionar 5,212	Adhe Helkom Vete 1,983	olands Vete 1,482	() Kallunda Varvete Volutionar 1,394	Pi Helkom Vete 10,259	Ölands Vete 4,032	Kallunda Varvete Volutionar 6,488	Deform Helkom Vete 25,933	Ölands Vete 18,967	mm) Kallunda Varvete Volutionar 21,467	Fi Helkom Vete 10,175	ollands Vete 3,954	Kallunda Varvete rolutionar 6,409	Rup Helkom Vete 6,009	Ölands Vete 11,788	RUPT i) Kallunda Varvete Evolutionar 27,900	URE Defor Helkom Vete 2,133	m rupture (r Ölands Vete 6,167	nm) Kallunda Varvete Evolutionar 4,400	Helkom Vete 62,303	Člands Vete 61,037	Kallunda Varvete Evolutionar 59,590	Helkom Vete 5,627	COLOR a* Ölands Vete 5,750	Kallunda Varvete Evolutionar 4,897	Helkom Vete 16,403	b* Ölands Vete 16,850	Kallunda Varvete Evolutionar 14,130
Cere	is Mean value Standard	Pe Helkom Vete 7,367	ak load (N) Ölands Vete 7,182	Kallunda Varvete Evolutionar 5,805	Deforma Helkom Vete 14,967	ation peak () Ölands Vete () 14,933	COMPRE (mm) Kallunda Varvete Evolutionar 14,967	Helkom Vete 6,300	Olands Vete 6,204	Kallunda Vavete olutionar 5,212	Adhe Helkom Vete 1,983	olands Vete 1,482	4) Kallunda Varvete volutionar 1,394	Pi Helkom Vete 10,259	Ölands Vete 4,032	Kallunda Varvete Volutionar 6,488	Deform Helkom Vete 25,933	Ölands Vete 18,967	mm) Kallunda Varvete Svolutionar 21,467	Fille Helkom Vete 10,175	Olands (N) Olands Ev 3,954	Kallunda Varvete olutionar 6,409	Rup Helkom Vete 6,009	Olands Vete 11,788	RUPT I) Kallunda Varvete Evolutionar 27,900	URE Defor Helkom Vete 2,133	m rupture (n Ölands Vete 6,167	nm) Kallunda Varvete Evolutionar 4,400	Helkom Vete 62,303	L* Ölands Vete 61,037	Kallunda Varvete Evolutionar 59,590	Helkom Vete 5,627	COLOR a* Ölands Vete 5,750	Kallunda Varvete Evolutionar 4,897	Helkom Vete 16,403	b* Ölands Vete 16,850	Kallunda Varvete Evolutionar 14,130
Cerea	is Mean value Standard deviation	Pe Helkom Vete 7,367 2,072	ak load (N) Ölands Vete 7,182 2,329	Kallunda Varvete Evolutionar 5,805 0,338	Deforma Helkom Vete 14,967 0,058	olands Vete 14,933 0,058	COMPRE (mm) Kallunda Varwte Evolutionar 14,967 0,058	Helkom Vete 6,300 1,455	nal load (N) Ölands Vete 6,204 1,796	Kallunda Varvete volutionar 5,212 0,399	Adhe Helkom Vete 1,983 0,437	sive force (N Ölands Vete 1,482 0,615	() Kallunda Vavete volutionar 1,394 0,339	P Helkom Vete 10,259 0,087	Ölands Vete 4,032 0,437	Kallunda Varvete ivolutionar 6,488 0,088	Deform Helkom Vete 25,933 0,351	ATENSION ation peak (r Ölands Vete 18,967 0,058	mm) Kallunda Varvete Volutionar 21,467 0,208	Fi Helkom Vete 10,175 0,091	olands K Vete Ev 3,954	Kallunda Varvete olutionar 6,409 0,080	Rup Helkom Vete 6,009 0,899	Ölands Vete 11,788 2,299	RUPT i) Kallunda Vavete Evolutionar 27,900 9,118	URE Defor Helkom Vete 2,133 0,651	m rupture (r Ölands Vete 6,167 0,929	nm) Kallunda Varvete Evolutionar 4,400 1,249	Helkom Vete 62,303 0,310	L* Olands Vete 61,037 0,250	Kallunda Varvete Evolutionar 59,590 1,149	Helkom Vete 5,627 0,042	COLOR a* Ölands Vete 5,750 0,406	Kallunda Varvete Evolutionar 4,897 0,256	Helkom Vete 16,403 0,656	b* Ölands Vete 16,850 0,415	Kallunda Vavete Evolutionar 14,130 1,250
Cerea	is Mean value Standard deviation Significant	Pe Helkom Vete 7,367 2,072 a	ak load (N) Ölands Vete 7,182 2,329 a	Kallunda Vavete Evolutionar 5,805 0,338 a	Deforma Helkom Vete 14,967 0,058 a	olands Vete 14,933 0,058 a	COMPRE (mm) Kallunda Vavete Evolutionar 14,967 0,058 a	Helkom Vete 6,300 1,455 ab	Olands Vete 6,204 1,796 ab	Kallunda Varvete volutionar 5,212 0,399 ab	Adhe Helkom 1,983 0,437 a	sive force (N Ölands Vete B 1,482 0,615 a	i) Kallunda Varwte volutionar 1,394 0,339 ac	Helkom Vete 10,259 0,087 ac	Ölands Vete 4,032 0,437 a	Kallunda Varvete ivolutionar 6,488 0,088 a	Deform Helkom Vete 25,933 0,351 a	Attension ation peak (r Ölands Vete 18,967 0,058 a	mm) Kallunda Varvete Volutionar 21,467 0,208 a	Fi Helkom Vete 10,175 0,091 ac	hal load (N) Ölands Vete Ev 0,434 a	Kallunda Varvete olutionar 6,409 0,080 a	Rup Helkom Vete 6,009 0,899 a	Olands Vete 11,788 2,299 ac	RUPT Kallunda Vavete Evolutionar 27,900 9,118 a	URE Defor Helkom Vete 2,133 0,651 a	m rupture (r Ölands Vete 6,167 0,929 a	nm) Kallunda Vavete Evolutionar 4,400 1,249 a	Helkom Vete 62,303 0,310 a	L* Ölands Vete 61,037 0,250 a	Kallunda Varvete Evolutionar 59,590 1,149 abd	Helkom Vete 5,627 0,042 a	COLOR a* Ölands Vete 5,750 0,406 ab	Kallunda Vavete Evolutionar 4,897 0,256 a	Helkom Vete 16,403 0,656 ac	b* Ölands Vete 16,850 0,415 a	Kallunda Varvete Evolutionar 14,130 1,250 abc
Cere	is Mean value Standard deviation Significant Mean value	Pe Helkom Véte 7,367 2,072 a 6,577	ak load (N) Ölands Vete 2,329 a 10,700	Kallunda Vavete Evolutionar 5,805 0,338 a 5,301	Deforma Helkom Vete 14,967 0,058 a 14,967	olands Vete 14,933 0,058 a 15,000	COMPRE (mm) Kallunda Varvete Evolutionar 14,967 0,058 a 15,000	Helkom Vete 6,300 1,455 ab 5,756	Olands Vete 6,204 1,796 ab 8,513	Kallunda Varvete volutionar 5,212 0,399 ab 4,528	Adhe Helkom Vete 1,983 0,437 a 1,578	Olands Vete B 1,482 0,615 a 2,253	i) Kallunda Varwte volutionar 1,394 0,339 ac 3,480	P Helkom Vete 10,259 0,087 ac 10,263	01ands Vete 4,032 0,437 a 4,077	Kallunda Varvete ivolutionar 6,488 0,088 a 6,619	Deform Helkom Vete 25,933 0,351 a 23,867	Attension ation peak (r Olands Vete 18,967 0,058 a 17,867	mm) Kallunda Varvete volutionar 21,467 0,208 a 21,500	Fi Helkom Vete 10,175 0,091 ac 10,156	hal load (N) Ölands Vete Ev 0,434 a 3,981	Kallunda Varvete olutionar 6,409 0,080 a 6,503	Rug Helkom Vete 6,009 0,899 a 5,302	Olands Vete 11,788 2,299 ac 13,081	RUPT i) Kallunda Vavete Evolutionar 27,900 9,118 a 4,432	URE Defor Helkom Vete 2,133 0,651 a 2,033	m rupture (r Ölands Vete 6,167 0,929 a 4,967	nm) Kallunda Vavete Evolutionar 4,400 1,249 a 1,633	Helkom Vete 62,303 0,310 a 59,267	L* Ölands Vete 61,037 0,250 a 59,120	Kallunda Vavete Evolutionar 59,590 1,149 abd 60,673	Helkom Vete 5,627 0,042 a 5,387	COLOR a* Olands Vete 5,750 0,406 ab 5,933	Kallunda Vavete Evolutionar 4,897 0,256 a 4,407	Helkom Vete 16,403 0,656 ac 15,173	b* Ölands Vete 16,850 0,415 a 16,753	Kallunda Vavete Evolutionar 14,130 1,250 abc 15,863
Cere Normal Sugar +	s Mean value Standard deviation Significant Mean value Standard deviation	Pe Helkom Vete 7,367 2,072 a 6,577	ak load (N) Ölands Vete 2,329 a 10,700	Kallunda Varvete Evolutionar 5,805 0,338 a 5,301	Deforma Helkom Vete 14,967 0,058 a 14,967	ation peak ( Olands Vete 14,933 0,058 a 15,000	COMPRE (mm) Kallunda Varvete Evolutionar 14,967 0,058 a 15,000	ESION Fil Helkom Vete 6,300 1,455 ab 5,756	nal load (N) Ölands Vete 6,204 1,796 ab 8,513	Kallunda Varvete volutionar 5,212 0,399 ab 4,528	Adhe Helkom Vete 1,983 0,437 a 1,578	olands Vete B 1,482 0,615 a 2,253	() Kallunda Varvete volutionar 1,394 0,339 ac 3,480	P Helkom Vete 10,259 0,087 ac 10,263	01ands Vete 4,032 0,437 a 4,077	Kallunda Varvete volutionar 6,488 0,088 a 6,619	Deform Helkom Vete 25,933 0,351 a 23,867	Attension ation peak (r Olands Vete 18,967 0,058 a 17,867	mm) Kallunda Varvete volutionar 21,467 0,208 a 21,500	Fi Helkom Vete 10,175 0,091 ac 10,156	nal load (N) Ölands Vete Ev 3,954 0,434 a 3,981	Kallunda Varvete olutionar 6,409 0,080 a 6,503	Rug Helkom Vete 6,009 0,899 a 5,302	Olands Vete 11,788 2,299 ac 13,081	RUPT i) Kallunda Varvete Evolutionar 27,900 9,118 a 4,432	URE Defor Helkom Vete 2,133 0,651 a 2,033	m rupture (r Ölands Vete 6,167 0,929 a 4,967	nm) Kallunda Varvete Evolutionar 4,400 1,249 a 1,633	Helkom Vete 62,303 0,310 a 59,267	L* Ölands Vete 61,037 0,250 a 59,120	Kallunda Vavete Evolutionar 59,590 1,149 abd 60,673	Helkom Vete 5,627 0,042 a 5,387	COLOR a* Olands Vete 5,750 0,406 ab 5,933	Kallunda Vavete Evolutionar 4,897 0,256 a 4,407	Helkom Vete 16,403 0,656 ac 15,173	b* Ölands Vete 16,850 0,415 a 16,753	Kallunda Varvete Evolutionar 14,130 1,250 abc 15,863
Cere: Normal Sugar +	s Standard deviation Significant Mean value Standard deviation	Pe Helkom Vete 2,072 a 6,577 1,101	ak load (N) Ölands Vete 2,329 a 10,700 2,409	Kallunda Varvete Evolutionar 5,805 0,338 a 5,301 0,886	Deforma Helkom Vete 0,058 a 14,967 0,058	ation peak ( Ölands Vete 14,933 0,058 a 15,000 0,000	COMPRE (mm) Kallunda Varvete Evolutionar 14,967 0,058 a 15,000 0,000	Helkom Vete 6,300 1,455 ab 5,756 0,661	nal load (N) Ölands Vete 6 6,204 1,796 ab 8,513 1,106	Kallunda Varvete volutionar 5,212 0,399 ab 4,528 0,682	Adhe Helkom Vete 1,983 0,437 a 1,578 0,112	sive force (N Olands Vete B 0,615 a 2,253 0,432	() Kallunda Varvete volutionar 3,394 0,339 ac 3,480 3,576	P Helkom Vete 10,259 0,087 ac 10,263	Olands Vete 4,032 0,437 0,664	Kallunda Varvete kolutionar 6,488 0,088 a 6,619 0,312	Deform Helkom Vete 25,933 0,351 a 23,867 0,611	ATENSION ation peak (r Ölands Vete 18,967 0,058 a 17,867 1,595	mm) Kallunda Varvete Volutionar 21,467 0,208 a 21,500 1,249	File Helkom Vete 10,175 0,091 ac 10,156 0,072	nal load (N) Ölands K Vete Ev 3,954 0,434 a 3,981 0,663	Callunda Varvete olutionar 6,409 0,080 a 6,503 0,319	Rup Helkom Vete 6,009 0,899 a 5,302 0,077	Olands Vete 8 11,788 2,299 ac 13,081 0,893	RUP1 i) Kallunda Varvete Evolutionar 27,900 9,118 a 4,432 0,394	URE Defor Vete 2,133 0,651 a 2,033 0,058	m rupture (r Ölands Vete 6,167 0,929 a 4,967 1,274	nm) Kallunda Varvete Evolutionar 4,400 1,249 a 1,633 0,321	Helkom Vete 62,303 0,310 a 59,267 0,715	L* Ölands Vete 61,037 0,250 a 59,120 0,278	Kallunda Varvete Evolutionar 59,590 1,149 abd 60,673 1,287	Helkom Vete 5,527 0,042 a 5,387 0,385	COLOR a* Ölands Vete 5,750 0,406 ab 5,933 0,500	Kallunda Varvete Evolutionar 4,897 0,256 a 4,407 0,264	Helkom Vete 16,403 0,656 ac 15,173 0,365	b* Ölands Vete 16,850 0,415 a 16,753 0,236	Kallunda Varvete Evolutionar 14,130 1,250 abc 15,863 0,290
Cere: Normal Sugar +	Is Standard deviation Significant Mean value Standard deviation Significant Mean value	Pe Helkom Vete 7,367 2,072 a 6,577 1,101 a 5 5 5 5	ak load (N) Ölands Vete 2,329 a 10,700 2,409 a 9,292	Kallunda Varvete Evolutionar 5,805 0,338 a 5,301 0,886 a 3,002	Deforma Helkom Vete 14,967 0,058 a 14,967 0,058 a	ation peak () Ölands Vete 14,933 0,058 a 15,000 0,000 a 5,000	COMPRE (mm) Kallunda Varvete Evolutionar 14,967 0,058 a 15,000 a 15,000 a 14,932	ESSION Helkom Vete 6,300 1,455 ab 5,756 0,661 a 5,512	nal load (N) Ölands Vete B 6,204 1,796 ab 8,513 1,106 a 6,627	Kallunda Varvete kolutionar 5,212 0,399 ab 4,528 0,682 a 6,226	Adhe Helkom Vete 1,983 0,437 a 1,578 0,112 ab	Sive force (N Ölands Vete E 1,482 0,615 a 2,253 0,432 a 2,253	() Kallunda Varvete volutionar 1,394 0,339 ac 3,480 3,576 abc + sec	P. Helkom Vete 10,259 0,087 ac 10,263 0,096 ac	0/ands Vete 4,032 0,437 a 4,077 0,664 a	Kallunda Varvete kolutionar 6,488 0,088 a 6,619 0,312 a 2,642	Deform Helkom Vete 25,933 0,351 a 23,867 0,611 bc	xTENSION ation peak (r Ölands Vete 18,967 0,058 a 17,867 1,595 a 22,232	mm) Kallunda Vavete ivelutionar 21,467 0,208 a 21,500 1,249 a 3 9,152	Fi Helkom Vete 10,175 0,091 ac 10,156 0,072 ac 10,072 ac	Al Ioad (N) Ölands K Vete Ev 0,434 a 3,981 0,663 a 7,983	Kallunda Varvete olutionar 6,409 0,080 a 6,503 0,319 a 2,060	Rup Helkom Vete 6,009 0,899 a 5,302 0,077 a 4,42	oure load (N Ölands Vete	RUPT i) Kallunda Varvete Evolutionar 27,900 9,118 a 4,432 0,394 b 2,202	UKE Defor Vete 2,133 0,651 a 2,033 0,058 a 0,058	m rupture (r Ölands Vete 6,167 0,929 a 4,967 1,274 a 2,057	nm) Kallunda Vavete Evolutionar 4,400 1,249 a 1,633 0,321 ac	Helkom Vete 62,303 0,310 a 59,267 0,715 b 55,257	L* Ölands Vete 61,037 0,250 a 59,120 0,278 bc	Kallunda Varvete Evolutionar 59,590 1,149 abd 60,673 1,287 ad	Helkom Vete 5,627 0,042 a 5,387 0,385 ab	COLOR a Ölands Vete 5,750 0,406 ab 5,933 0,500 ab	Kallunda Varvete Evolutionar 4,897 0,256 a 4,407 0,264 ab	Helkom Vete 16,403 0,656 ac 15,173 0,365 ab	b* Ölands Vete 16,850 0,415 a 16,753 0,236 ab	Kallunda Varvete Evolutionar 14,130 1,250 abc 15,863 0,290 ac
Cere Normal Sugar +	Standard Standard deviation Significant Mean value Standard Standard	Pe Helkom Vete 7,367 2,072 a 6,577 1,101 a 6,155	ak load (N) Ölands Vete 2,329 a 10,700 2,409 a 8,282	Kallunda Varvete Evolutionar 5,805 0,338 a 5,301 0,886 a 7,003	Deforma Helkom Vete 14,967 0,058 a 14,967 0,058 a 14,960	ation peak () Ölands Vete 1 0,058 a 15,000 0,000 a 15,000	COMPRE (mm) Kallunda Vavete Evolutionar 14,967 0,058 a 15,000 0,000 a 14,933	5500N Fil Helkom Vete 6,300 1,455 ab 5,756 0,661 a 5,513	nal load (N) Ölands Vete E 6,204 1,796 ab 8,513 1,106 a 6,957	Kallunda Vavete volutionar 5,212 0,399 ab 4,528 0,682 a 6,136	Adhe Helkom 1,983 0,437 a 1,578 0,112 ab 1,586	sive force (N Otands Vete E 0,615 a 2,253 0,432 a 3,373	4) Kallunda Vavete volušonar 1,394 0,339 ac 3,480 3,576 abc 1,880	P Helkom Vete 10,259 0,087 ac 10,263 0,096 ac 10,930	Ak load (N) Ölands Vete 4,032 0,437 a 4,077 0,664 a 8,052	Kallunda Varvete ivolutionar 6,488 0,088 a 6,619 0,312 a 7,647	Deform Helkom Vete 25,933 0,351 a 23,867 0,611 bc 25,233	XTENSION ation peak (r Ölands Vete E 0,058 a 17,867 1,595 a 22,233	mm) Kallunda Vavete 21,467 0,208 a 21,500 1,249 a 19,167	Fi Helkom Vete 10,175 0,091 ac 10,156 0,072 ac 10,838	al load (N) Ölands Vete 0,434 0,434 0,663 0,663 0,981	Kallunda Varvete iolutionar 6,409 0,080 a 6,503 0,319 a 7,084	Rup Helkom Vete 6,009 a 5,302 0,077 a 4,432	ture load (N Ölands Vete g 2,299 ac 13,081 0,893 a 4,453	RUP1 Kallunda Vavete Evolutionar 27,900 9,118 a 4,432 0,394 b 2,392	URE Defor Vete 2,133 0,651 a 2,033 0,058 a 0,013	m rupture (n Ölands Vete 6,167 0,929 a 4,967 1,274 a 2,067	nm) Kallunda Vavete Evolutionar 4,400 1,249 a 1,633 0,321 ac 1,067	Helkom Vete 62,303 0,310 a 59,267 0,715 b 56,710	L* Ölands Vete 61,037 0,250 a 59,120 0,278 bc 58,523	Kallunda Varvete Evolutionar 59,590 1,149 abd 60,673 1,287 ad 58,293	Helkom Vete 5,627 0,042 a 5,387 0,385 ab 5,790	COLOR a* Ölands Vete 5,750 0,405 ab 5,933 0,500 ab 5,470	Kallunda Varvete Evolutionar 4,897 0,256 a 4,407 0,264 ab 5,767	Helkom Vete 16,403 0,656 ac 15,173 0,365 ab 13,800	b* Ölands Vete 16,850 0,415 a 16,753 0,236 ab 16,033	Kallunda Varwee Evolutionar 14,130 1,250 abc 15,863 0,290 ac 15,213
Cerea Normal Sugar + Buttler + / sugar	S Mean value Standard devlation Significant Mean value Standard devlation Significant Mean value Standard devlation	Pe Helkom Vete 7,367 2,072 a 6,577 1,101 a 6,155 1,269	ak load (N) Ölands Vete 2,329 a 10,700 2,409 a 8,282 2,290	Kallunda Varvete Evelusionar 5,805 0,338 a 5,301 0,886 a 7,003 2,187	Deforma Helkom Vete 14,967 0,058 a 14,967 0,058 a 14,900 0,000	ation peak () Ölands Vete () 14,933 0,058 a 15,000 0,000 a 15,000	COMPRE (mm) Kallunda Varvete 04,067 0,058 a 15,000 0,000 a 14,933 0,058	ESSION Fil Helkom Vete 6,300 1,455 ab 5,756 0,661 a 5,513 1138	nal load (N) Ölands Vete 6,204 1,796 ab 8,513 1,106 a 6,957 1,580	Xallunda Varvete volutionar 5,212 0,399 ab 4,528 0,682 a 6,136	Adhe Helkom Vese 1,983 0,437 a 1,578 0,112 ab 1,586 0,457	sive force (N Ölands Vete B 0,615 a 2,253 0,432 a 3,373 3,940	() Kallunda Vavete 1,394 0,339 ac 3,480 3,576 abc 1,880 0,524	P Helkom Vete 10,259 0,087 ac 10,253 0,096 ac 10,930 0,483	ak load (N) Ölands Vete 4,032 0,437 a 4,077 0,664 a 8,052 0,137	Kallunda Varvete volutionar 6,488 0,088 a 6,619 0,312 a 7,647 0,645	Deform Helkom Vete 25,933 0,351 a 23,867 0,611 bc 25,233 0,611	xtension ation peak (r Ölands Vete E 18,967 0,058 a 17,867 1,595 a 22,233 1,007	mm) Kallunda Vavete kolutionar 21,467 0,208 a 21,500 1,249 a 19,167 5,787	Fi Helkom Vete 10,175 0,091 ac 10,156 0,072 ac 10,838 0,495	al load (N) Ölands Vete 3,954 0,434 0,434 0,663 8 0,563 0,102	Kallunda Varvete Islutionar 6,409 0,080 a 6,503 0,319 a 7,084 0,728	Rus Helkom Vete 6,009 0,899 a 5,302 0,077 a 4,432 1,788	ture load (N Ölands Vete 8 2,299 ac 13,081 0,893 a 4,453 0,109	RUP1 i) Kallunda Vavete Evolutionar 27,900 9,118 a 4,432 0,394 b 2,392 0,088	URE Defor Helkorn Vete 2,133 0,651 a 2,033 0,058 a 0,013 0,005	m rupture (n Ölands Vete 6,167 0,929 a 4,967 1,274 a 2,067	nm) Kallunda Varvete Evolutionar 4,400 1,249 a 1,633 0,321 ac 1,067 0,115	Helkorn Vete 62,303 0,310 a 59,267 0,715 b 56,710 0,992	L* Ölands Vete 61,037 0,250 a 59,120 0,278 bc 58,523 1,765	Kallunda Varvete Evolutionar 59,590 1,149 abd 60,673 1,287 ad 58,293 0,330	Helkorn Vete 5,627 0,042 a 5,387 0,385 ab 5,790	COLOR a Ölands Vete 5,750 0,406 ab 5,933 0,500 ab 5,470 0,304	Kallunda Varvete Evolutionar 4,897 0,256 a 4,407 0,264 ab 5,767	Helkom Vete 16,403 0,656 ac 15,173 0,365 ab 13,800	b* Ölands Vete 16,850 0,415 a 16,753 0,236 ab 16,033	Kallunda Varvete Evolutionar 14,130 1,250 abc 15,863 0,290 ac 15,213 0,203
Cere: Normal Sugar + Butter + / sugar	is Mean value Standard deviation Significant Mean value Standard deviation Significant Mean value Standard deviation	Pe Helkom Vete 2,072 a 6,577 1,101 a 6,155 1,269 a	ak load (N) Ölands Vete 2,329 a 10,700 2,409 a 8,282 2,290 a	Kallunda Varvete Evolutionar 5,805 0,338 a 5,301 0,886 a 7,003 2,187 a	Deforma Helkom Vete 14,967 0,058 a 14,967 0,058 a 14,900 0,000 a	ation peak ( Ölands Vete 14,933 0,058 a 15,000 0,000 a 15,000 0,000 a	COMPRE imm) Kallunda Vavete Evolusionar 14,967 0,058 a 15,000 0,000 a 14,933 0,058 a	ESSION Fil Helkorn Vete 6,300 1,455 ab 5,756 5,756 0,661 a 5,513 1,138 a	nal load (N) Ölands Vete B 6,204 1,796 ab 8,513 1,106 a 6,957 1,580 a	Xallunda Varvete s,212 0,399 ab 4,528 4,528 6,136 6,136 1,785 ab	Adhe Helkom Vete 1,983 0,437 a 1,578 1,578 1,586 1,586 0,467 ab	sive force (N Ölands Vete 6 0,615 a 2,253 0,432 a 3,373 3,949 a	4) Kallunda Vavete volutionar 1,394 0,339 ac 3,480 3,576 abc 1,880 0,524	Pi Helkom Vete 10,259 ac 10,263 0,096 ac 10,930 0,483 a	ak load (N) Ölands Vete 4,032 0,437 a 4,077 0,664 a 8,052 0,137 b	Kallunda Varvete 6,488 0,088 a 6,619 0,312 a 7,647 0,645 ac	Deform Helkorn Vete 25,933 0,351 a 23,867 0,611 bc 25,233 0,611 0,611	XTENSION ation peak (r Člands Vete E 18,967 0,058 a 17,867 1,595 a 22,233 1,007 bc	mm) Kallunda Varved volutionar 21,467 0,208 a 21,500 1,249 a 19,167 5,787 a	Fi Helkom Vete 10,175 0,091 ac 10,156 0,072 ac 10,838 0,495 c	nal load (N) Ölands Vele 0,434 a 3,981 0,663 a 7,983 0,663 b	Kallunda Varvete 6,409 a 6,503 0,319 a 7,084 0,728 ac	Rus Helkorn Vete 6,009 a 5,302 0,077 a 4,432 1,788 ac	0ure load (N 0lands Vete 8 11,788 2,299 ac 13,081 0,893 a 4,453 0,108	RUP1 )) Kallunda Varvete Evolutionar 27,900 9,118 a 4,432 0,394 b 2,392 0,088 cd	URE Defor Vete 2,133 0,651 a 2,033 0,058 a 0,058 a 0,013 0,006	m rupture (n Ölands Vete 6,167 0,929 a 4,967 1,274 a 2,067 0,808 bc	nm) Kallunda Vavete Evolutionar 4,400 1,249 a 1,633 0,321 ac 1,067 0,115 bc	Helkom Vete 62,303 0,310 a 59,267 0,715 b 56,710 0,992 c	L* Ölands Vete 61,037 0,250 a 59,120 0,278 be 58,523 1,765 58,523	Kallunda Varvea 59,590 1,149 abd 60,673 1,287 ad 58,293 0,330 ac	Helkom Vete 5,627 0,042 a 5,387 0,385 ab 5,790 0,480 ab	COLOR a Ölands Vete 5,750 0,406 ab 5,933 0,500 ab 5,470 0,304 ab	Kallunda Vavete Evolusionat 0,256 a 4,407 0,264 ab 5,767 0,268 b	Helkom Vete 16,403 0,656 ac 15,173 0,365 ab 13,800 0,720 b	b* Ölands Vete 16,850 0,415 a 16,753 0,236 ab 16,033 1,101 ab	Kallunda Varwee Evolusionar 14,130 1,250 abc 15,863 0,290 ac 15,213 0,203 b
Cere: Normal Sugar + Butter + / sugar	s Mean value Standad deviation Significant Mean value Standad deviation Significant Mean value Standad	Pe Helkom Vete 7,367 2,072 a 6,577 1,101 a 6,155 1,269 a 11,838	ak load (N) Ölands Vete 2,329 a 10,700 2,409 a 8,282 2,290 a 24,647	Kallunda Varvete Evolutionar 5,805 0,338 a 5,301 0,886 a 7,003 2,187 a 5,964	Deforma Helkom Vete 14,967 0,058 a 14,967 0,058 a 14,900 0,000 a 15,000	ation peak ( Ölands Vete 14,933 0,058 a 15,000 0,000 a 15,000 0,000 a 14,967	COMPRE (mm) Kallunda Vavete Evolutionar 14,967 0,058 a 15,000 0,000 a 14,933 0,058 a 14,967	Fileson Fileson Vete 6,300 1,455 ab 5,756 0,661 a 5,513 1,138 a 9,449	nal load (N) Ölands Vete 5,204 1,796 ab 8,513 1,106 a 6,957 1,580 a 18,822	Xallunda Vavete volutionar 5,212 0,399 ab 4,528 0,682 a 6,136 1,785 ab 6,130	Adhe Helkom Vete 1,983 0,437 a 1,578 0,412 ab 1,586 0,467 ab 0,968	sive force (V Olands Vete B 0,615 a 2,253 0,432 a 3,373 3,949 a 1,223	() Kallunda Varvete volutionar 1,394 0,339 ac 3,480 3,576 abc 1,880 0,624 abc 0,524	P Helkom Vete 10,259 0,087 ac 10,263 0,096 ac 10,930 0,483 a 9,718	ak load (N) Ölands Vete 4,032 0,437 a 4,077 0,664 a 8,052 0,137 b 7,681	Kallunda Varvete kolutionar 6,488 a 6,619 0,312 a 7,647 0,645 ac 6,43	Deform Helkom Vete 25,933 0,351 a 23,867 0,611 bc 25,233 0,611 abc 23,867	xtension diands vete 18,967 0,058 a 17,867 1,595 a 22,233 1,007 bc 19,767	mm) Kallunda Vavete kvolutionar 21,467 0,208 a 21,500 1,249 a 19,167 5,787 a 19,300	File Helkom Vete 10,175 0,091 ac 10,156 0,072 ac 10,838 0,495 c 9,707	nal load (N) Ölands Vete 0,434 a 3,981 0,663 a 7,983 0,107 b 2,378	Kallunda Vavete kolutionar 6,409 0,080 a 6,503 0,319 a 7,084 0,728 ac 5,994	Rup Helkom Vete 6,009 0,899 a 5,302 0,077 a 4,432 1,788 ac 4,159	Aure load (N Ölands Vete g 11,788 2,299 ac 13,081 0,893 a 4,453 0,108 b 8,444	RUP1 Kallunda Varvete Evolutionar 27,900 9,118 a 4,432 0,394 b 2,392 0,088 cd 7,912	URE Defor Helkom Vele 2,133 0,651 a 2,033 0,058 a 0,013 0,006 b 1,567	m rupture (r Ölands Vete 6,167 0,929 a 4,967 1,274 a 2,067 0,808 bc 4,533	nm) Kallunda Varvete Evolutionar 4,400 1,249 a 1,633 0,321 ac 1,067 0,115 bc 5,733	Helkom Vete 62,303 0,310 a 59,267 0,715 b 56,710 0,992 c 60,982	L* Ölands Vete 61,037 0,250 a 59,120 0,278 bc 58,523 1,765 abc 56,07	Kallunda Vavete Evolutionar 59,590 1,149 abd 60,673 1,287 ad 58,293 0,330 ac 59,440	Helkom Vete 5,527 0,042 a 5,387 0,385 ab 5,790 0,480 ab 5,940	COLOR a* Ölands Vete S,750 0,406 ab S,933 0,500 ab S,470 0,304 ab S,512 S,512	Kallunda Varvete Evolutionar 4,897 0,256 a 4,407 0,264 ab 5,767 0,268 b 5,663	Helkom Vete 16,403 0,656 ac 15,173 0,365 ab 13,800 0,720 b 5,967	b* Olands Vete 16,850 0,415 a 16,753 0,236 ab 16,033 1,101 ab	Kallunda Varvete Evolutionar 14,130 1,250 abc 15,863 0,290 ac 15,213 0,203 b 15,247
Cere Normal Sugar + Butter + / sugar	s Mean value Standad deviation Significant Mean value Standad deviation Significant Mean value Standad Standad	Pe Helkom Vete 2,072 a 6,577 1,101 a 6,155 1,269 a 11,838	ak load (N) Ölands Vete 2,329 a 10,700 2,409 a 8,282 2,290 a 24,647	Kallunda Varvete Evolutionar 5,805 a 5,301 0,886 a 7,003 2,187 a 6,964	Deforma Helkom Vete 14,967 0,058 a 14,967 14,967 0,058 a 14,900 0,000 a 15,000	ation peak ( Olands Wete [ 14,933 0,058 a 15,000 0,000 a 15,000 0,000 a 14,967	COMPRE (mm) Varvete Evolutionar 14,967 0,058 a 15,000 0,000 a 14,933 0,058 a 14,967	SSION Fill Helkom Vete 6,300 1,455 ab 5,515 3,756 0,661 a 5,513 1,138 a 9,449	nal load (N) Ölands Vete 5 6,204 1,796 ab 8,513 1,106 a 6,957 1,580 a 18,822	Kallunda Varvete volutionar 5,212 0,399 ab 4,528 a 6,136 1,785 ab 6,130	Adhe Helkom Vete 1,983 0,437 a 1,578 0,112 ab 1,586 0,467 ab 0,968	sive force (N Olands Vete B 0,615 a 2,253 0,432 a 3,373 3,949 a 1,223	<ul> <li>Kallunda Vavete velutionar</li> <li>1,394</li> <li>0,339</li> <li>ac</li> <li>3,480</li> <li>3,576</li> <li>abc</li> <li>1,880</li> <li>0,624</li> <li>abc</li> <li>0,530</li> </ul>	P Helkom Vete 10,259 0,087 ac 10,263 0,096 ac 10,930 0,483 a 9,718	aik load (N) Ölands Vete 4,032 0,437 a 4,077 0,664 a 8,052 0,137 b 7,681	Kallunda Varvete volutionar 6,488 a 6,619 0,312 a 7,647 0,645 ac 6,438	Deform Helkom Vete 25,933 0,351 a 23,867 0,611 abc 25,233 0,611 abc 23,867	xtension ation peak (r Ölands Vete E 18,967 0,058 a 17,867 1,595 a 22,233 1,007 bc 19,767	mm) Kallunda Vavete volutionar 21,467 0,208 a 21,500 1,249 a 19,167 5,787 a 19,300	File Helkom Vete 10,175 0,091 ac 10,156 0,072 ac 10,838 0,495 c 9,707	Al load (N) Ölands K Vete K 0,434 a 3,981 0,663 a 7,983 0,107 b 7,378	Kallunda Varvete elutionar 6,409 0,080 a 6,503 0,319 a 7,084 0,728 ac 5,994	Rup Helkom Vete 6,009 a 5,302 0,077 a 4,432 1,788 ac 4,169	ture load (N Ölands Vete g 11,788 2,299 ac 13,081 0,893 a 4,453 0,108 b 8,444	RUP1 i) Kallunda Varvete Evolutionar 27,900 9,118 a 4,432 0,394 b 2,392 0,088 cd 7,912	URE Defor Helkom Vete 2,133 0,651 a 2,033 0,058 a 0,013 0,006 b 1,667	m rupture (r Ölands Vete 6,167 0,929 a 4,967 1,274 a 2,067 0,808 bc 4,533	nm) Vavete Evolutionar 4,400 1,249 a 1,633 0,321 ac 1,067 0,115 bc 5,733	Helkom Vete 62,303 0,310 a 59,267 0,715 b 56,710 0,992 c 60,987	L* Ölands Vete 61,037 0,250 a 59,120 0,278 bc 58,523 1,765 abc 56,907	Kallunda Varvete Evolutionar 59,590 1,149 abd 60,673 1,287 ad 58,293 0,330 ac 59,440	Helkom Vete 5,627 0,042 a 5,387 0,385 ab 5,790 0,480 ab 5,940	COLOR a* Olands Vete 5,750 0,406 ab 5,933 0,500 ab 5,470 0,304 ab 5,517	Kallunda Vavee Evolusionar 4,897 0,256 a 4,407 0,264 ab 5,767 0,268 b 5,663	Helkom Vete 16,403 0,656 ac 15,173 0,365 ab 13,800 0,720 b 15,967	b* Ölands Vete 16,850 0,415 a 16,753 0,236 ab 16,033 1,101 ab 14,400	Kallunda Vavete Evolusionar 14,130 1,250 abc 15,863 0,290 abc 15,213 15,213 0,203 b 16,247
Cerer Normal Sugar + Butter + / sugar Butter + / four	s Mean value Standard devlation Significant Mean value Standard devlation Significant Mean value Standard devlation Mean value	Per Helkom Vete 7,367 2,072 a 6,577 1,101 a 6,155 1,269 a 11,838 2,833	ak load (N) Ölands Vete 2,329 a 10,700 2,409 a 8,282 2,290 a 24,647 7,869	Kalunda Vavete Evolutionar 5,805 3,805 0,338 a 5,301 0,886 a 7,003 2,187 a 6,964 2,435	Deforma Helkom Vete 14,967 0,058 a 14,967 0,058 a 14,967 0,058 a 14,960 0,000	ation peak () Ölands Vete 14,933 0,058 a 15,000 0,000 a 15,000 0,000 a 14,967 0,058	COMPRE (mm) Kallunda Vavete Evolusionar 14,967 0,058 a 14,933 0,058 a 14,967 0,058	Fileson Fileson Vete 6,300 1,455 ab 5,756 0,661 a 5,513 1,138 a 9,449 1,868	nal load (N) Ölands Wete E: 6,204 1,796 ab 8,513 1,106 a 6,957 1,580 a 18,822 3,730	Kallunda Vavete volušonar 5,212 0,399 ab 4,528 0,682 a 6,136 1,785 ab 6,130	Adhe Helkom Vete 1,983 0,437 a 1,578 1,578 1,578 1,586 1,586 0,467 ab 0,968 0,968	sive force (N Člands Vete 6 1,482 0,615 a 2,253 0,432 a 3,373 3,949 a 1,223 1,615	<ul> <li>Kallunda Varvete volušenar</li> <li>1,394</li> <li>0,339</li> <li>ac</li> <li>3,480</li> <li>3,576</li> <li>abc</li> <li>0,524</li> <li>abc</li> <li>0,530</li> <li>0,143</li> </ul>	P Helkom Vete 10,259 0,087 ac 10,263 0,096 ac 10,930 0,483 a 9,718 0,328	aik load (N) Ölands Vete 4,032 0,437 a 4,077 0,664 a 8,052 0,137 b 7,681 0,272	Kallunda Varvete volutionar 6,488 a 6,619 0,312 a 7,647 0,645 ac 6,438 0,818	Deform Helkorn Vete 25,933 0,351 a 23,867 0,611 bc 25,233 25,233 0,611 abc 23,867 0,611	xtension ation peak (r Ölands Vete E 0,058 a 17,867 1,895 a 22,233 1,007 bc 19,767 0,404	mm) Kallunda Varvee kolusionar 21,467 0,208 a 21,500 1,249 a 19,167 5,787 a 19,300 1,493	Fi Helkom Vete 10,175 0,091 ac 10,156 0,072 ac 10,838 0,495 c 9,707 0,441	Al load (N) Olands & Ew 3,954 0,434 3,981 0,663 a 0,663 a 0,663 b 0,107 b 0,337	Kallunda Varvete olutionar 6,409 0,080 a 6,503 0,319 a 7,084 0,728 ac 5,994 0,508	Rup Helkom Vete 0,899 a 5,302 0,077 a 4,432 1,788 ac 4,169 0,691	Aure load (N Ölands Vete 11,788 2,299 ac 13,081 0,893 a 4,453 0,108 b 8,444 1,376	RUP1 i) Kallunda Varvete Evolutionar 27,900 9,118 a 4,432 0,994 b 2,392 0,088 cd 7,912 2,552	URE Defor Helkorn Vete 2,133 0,651 a 2,033 0,058 a 0,013 0,006 b 1,667 0,513	m rupture (r Ölands Vete 6,167 0,929 a 4,967 1,274 a 2,067 0,808 bc 4,533 1,429	nm) Kallunda Vavete Evolutionar 4,400 1,249 a 1,633 0,321 ac 1,067 0,115 bc 5,733 3,612	Helkom Vete 62,303 0,310 a 59,267 0,715 b 56,710 0,992 c 60,987 0,142	L* Ölands Vete 61,037 0,250 a 59,120 0,278 bc 58,523 1,765 abc 56,907 1,371	Kallunda Vavete Evolutionar 59,590 1,149 abd 60,673 1,287 ad 58,293 0,330 ac 59,440 1,840	Helkom Vete 5,627 0,042 a 5,387 0,385 ab 5,790 0,480 ab 5,940 0,066	COLOR a <sup>*</sup> Ölands Vete 5,750 0,406 ab 5,933 0,500 ab 5,470 0,304 ab 5,517 0,436	Kallunda Vavete Evolutionar 4,897 0,256 a 4,407 0,264 ab 5,767 0,268 b 5,663 0,169	Helkom Vete 16,403 0,656 ac 15,173 0,565 ab 13,800 0,720 b 13,967 0,410	b Ölands Vete 16,850 0,415 a 16,753 0,236 ab 16,033 1,101 ab 14,400 1,110	Kallunda Varwte Evolutionar 14,130 1,250 abc 15,863 0,290 ac 15,213 0,203 b 16,247 1,080
Cene Normal Sugar + Butter + / sugar Butter + / four	is Standard deviation Significant Mean value Standard deviation Significant Mean value Standard deviation Significant	Pe Helkom Vete 7,367 2,072 a 6,577 1,101 a 6,155 1,269 a 11,838 2,833 a	ak load (N) Ölands Vete 2,329 a 10,700 2,409 a 8,282 2,290 a 24,647 7,869 a	Kallunda Vavete Evelusionar 5,805 0,338 a 5,301 0,886 a 7,003 2,187 a 6,954 2,435 a	Deforma Helkom Vete 14,967 0,058 a 14,967 0,058 0,058 0,058 14,967 0,058 0,050 0,050 0,058 0,05	afon peak ( Ölands Vete 14,933 0,058 a 15,000 0,000 a 15,000 0,000 a 14,967 0,058 a	COMPRE (mm) Varvete Varvete Volusionar 14,967 0,058 a 15,000 0,000 a 14,933 0,058 a 14,967 14,967 0,058 a	File Helkom Vete 6,300 1,455 ab 5,756 0,661 a 5,513 1,138 a 9,49 9,49 1,868 bc	nal load (N) Ôlands Vete 6,204 1,796 ab 8,513 1,106 a 6,957 1,580 a 18,822 3,730 b	Xallunda Varvete olutionar 5,212 0,399 ab 4,528 0,682 a 6,136 5,130 6,130 5,130	Adhe Helkom Vete 1,983 0,437 a 1,578 0,112 ab 1,586 0,467 ab 0,467 ab 0,968 0,944 b	sive force (N Ölands Vete B 0,482 0,482 0,482 0,482 0,482 0,432 a 3,949 a 1,223 1,223 1,223 a	() Kallunda Varvete volutionar 1,394 0,339 ac 3,480 1,880 0,524 abc 0,524 abc 0,524 b	PHelkom Vete 10,259 0,087 ac 10,263 0,096 ac 10,930 0,483 a 9,718 0,328 c	ak load (N) Ölands Vete 4,032 0,437 a 4,077 0,664 a 8,052 0,137 b 7,681 0,272 b	Kallunda Varvete volutionar 6,488 a 6,619 0,312 a 7,647 0,645 ac 6,438 0,818 ad	Deform Helkorn Vete 25,933 0,551 a 23,867 0,611 bc 25,233 0,611 abc 23,867 0,651 bc	xtexsion ation peak (r Člands Vete E 0,058 a 17,867 1,595 a 22,233 1,007 bc 19,767 0,404 a	mm) Kallunda Varvete VoluGenar 21,467 0,208 a 21,500 1,249 a 19,167 5,787 a 19,300 1,493 a	Fi Helkom Vete 10,175 0,091 ac 10,156 0,072 ac 0,072 ac 0,072 ac 0,495 c 0,970 9,707 0,441 a	Al load (N) Člands Vete 3,954 0,434 3,981 0,663 a 7,983 0,107 b 0,107 b 0,337 bd	Kallunda Vavvete olutionar 6,409 0,080 a 6,503 0,319 a 7,084 0,728 ac 5,994 0,508 ad	Rus Helkom Vete 6,009 a 5,302 0,077 a 4,432 1,788 ac 4,159 0,651 ac	Dune load (N Ölands Vete 2,299 ac 13,081 0,893 a 4,453 0,108 b 8,444 1,376 c	RUP1 i) Kallunda Varvete Volusionar 27,900 9,118 a 4,432 0,394 b 2,392 0,088 cd 7,912 2,552 abd	URE Defor Helkorn Vete 2,133 0,651 a 2,033 0,058 a 0,013 0,006 b 1,667 1,651 a 0,513 a	m rupture (r Ölands Vete 6,167 0,929 a 4,967 1,274 a 2,067 0,808 bc 4,533 1,429 ac	nm) Kallunda Varvete Evolutionar 4,400 a 1,633 0,321 ac 1,067 0,115 bc 5,733 3,612 ac	Helkorn Vete 62,303 0,310 a 59,267 0,715 b 56,710 0,992 c 60,987 0,142 de	L* Ölands Vete 61,037 0,250 a 59,120 0,278 bc 58,523 1,765 abc 56,077 1,371 c	Kallunda Varvete Evolutionar 59,590 1,149 abd 60,673 1,287 ad 58,293 0,330 ac 59,440 1,840 acd	Helkom Vete 5,527 0,042 a 5,387 0,385 ab 5,790 0,480 ab 5,940 0,066 b	COLOR a Ölands Vete 5,750 0,406 ab 5,933 0,500 ab 5,470 0,304 ab 5,517 0,304 ab	Kallunda Vavete Evolutionar 4,897 0,256 a 4,407 0,264 ab 5,767 0,268 b 5,663 5,663 0,169 b	Helkom Vete 16,403 0,656 ac 15,173 0,365 ab 13,800 0,720 b 5 7 15,967 15,9410 0,410 ac	b* Ölands Vete 16,850 0,415 a 16,753 0,236 ab 16,033 1,101 ab 14,400 b	Kallunda Vavete Evolutionar 14,130 1,250 abc 15,863 0,290 ac 15,213 0,203 b 16,247 1,080 abc
Central Normal Sugar + Butter + / sugar Butter + / four	s Mean value Standard deviation Significant Mean value Standard deviation Significant Mean value Standard deviation Significant Mean value	Pe Helkom Vete 7,367 2,072 a 6,577 1,101 a 6,155 1,269 a 11,838 2,833 a 20,151	ak load (N) Ölands Vete 2,329 a 10,700 2,409 a 8,282 2,290 a 2,409 a 8,282 2,290 a 8,882 2,586 2,586 3 2,586 3 2,586 3 3 3 3 3 3 3 3 3 3 3 3 3	Kalunda Vavete Evolutionar 5,805 0,338 a 5,301 0,886 a 7,003 2,187 a 6,964 2,435 a 8,754	Deforma Helkom Vede 14,967 0,058 a 14,967 0,058 a 14,900 14,900 0,000 a 15,000 15,000	ation peak () Ölands Vete 14,933 0,058 a 15,000 0,000 a 15,000 0,000 a 14,967 0,058 a 15,000	COMPRE (mm) Kallunda Vavete EvoluSonar 14.967 0,058 a 0,058 a 0,058 a 14.967	Fileson Fileson Vete 6,300 1,455 ab 5,756 0,661 a 5,513 1,138 a 9,449 1,868 bc 10,240	nal load (N) Ölands Vete 6,204 1,796 ab 8,513 1,106 a 6,957 1,580 a 18,822 3,730 b 6,833	Kallunda Vavete s_212 0,399 ab 4,528 0,682 a 6,136 6,130 1,995 ab 6,742	Adhe Helkom Vete 1,983 0,437 a 1,578 0,112 ab 1,586 0,467 ab 0,968 0,968 0,968	sive force (N Ötands Vete B 0,615 a 2,253 0,432 a 3,373 3,949 a 1,223 1,615 a 2,910	4) Kallunda Vavwte volušonar 1,994 0,339 ac 3,480 1,880 1,880 0,524 abc 0,520 0,520 0,143 b	P. Helkom Vete 10,259 0,087 ac 10,263 10,263 10,263 10,930 0,483 a 9,718 0,328 c 5,566	ak load (N) Ölands Vete 4,032 0,437 a 4,077 0,664 a 8,052 0,137 b 7,681 0,272 b 6,658	Kallunda Varvete ivolutionar 6,488 a 6,619 0,312 a 0,645 a; 6,438 0,818 ad 5,679	Deform Helkorn Vete 25,933 0,511 a 23,867 0,611 abc 25,233 0,611 abc 23,867 0,850 be 23,167	XTENSION ation peak (r Ölands Vete E 0,058 a 17,867 1,595 a 22,233 1,007 bc 19,767 0,404 a 20,033	mm) Kallunda Vavete volutionar 21,467 0,208 a 21,500 1,249 a 19,167 5,787 a 19,300 1,493 a 21,233	Filekom Vete 10,175 0,091 ac 10,156 0,072 ac 0,091 0,091 ac 10,838 0,495 c 9,707 0,441 a 6,518	al load () Ólands & Ev 3,954 0,434 0,434 0,663 a 0,663 a 0,663 0,107 b 0,337 bd 6,365	Kallunda Varvete kolutionar 6,409 0,080 a 6,503 6,503 0,319 a 7,084 0,728 ac 5,994 0,508 ad 5,531	Rus Helkom Vete 0,009 a 5,302 0,077 a 4,432 1,788 ac 4,169 0,691 ac 4,434	2,re load (N Ölands Vete 2,299 ac 13,081 0,893 a 4,453 0,108 b 8,444 1,376 c 2,513	RUP1 i) Kallunda Varvete Evolutionar 27,900 9,118 a 4,432 0,394 b 2,392 0,088 cd 7,912 2,552 abd 2,359	URE Defor Helkorn Vete 2,133 0,651 a 0,058 a 0,058 a 0,013 0,006 b 1,667 0,513 a 1,833	m rupture (r Ölands Vete 6,167 0,929 a 4,967 1,274 a 2,067 0,808 bc 4,533 1,429 ac 1,000	nm) Kallunda Vavete Evolutionar 4,400 a 1,633 0,321 ac 1,067 0,115 bc 5,733 3,612 ac 0,800	Helkom Vete 62,303 0,310 a 59,267 0,715 b 56,710 0,992 c 60,987 0,142 de 58,353	L* Olands Vete 61,037 0,250 0 59,120 0,278 bc 58,523 1,765 abc 56,907 1,371 c 56,903	Kallunda Varvete Evolutionar 59,590 1,149 abd,673 1,287 ad 58,293 0,330 ac 59,440 1,840 acd 56,887	Helkom Vete 5,627 0,042 3,387 0,385 36 5,790 0,480 36 5,940 0,066 5,540	COLOR a Ölands Vete S,750 0,406 ab S,933 0,500 ab S,470 0,304 ab S,517 0,436 ab	Kallunda Varvete Evolutionar 4,897 0,256 a 4,407 0,264 ab 5,767 0,268 b 5,663 0,169 b 5,900	Helkom Vete 16,403 0,656 ac 15,173 0,365 ab 13,800 0,720 b 13,967 0,410 ac 0,410 ac	b* Olands Vete 16,850 0,415 a 16,753 0,236 ab 16,033 1,101 ab 16,033 1,101 ab 14,400 1,110 b	Kallunda Varvea 2014 5014 5014 5014 14,130 1,250 abc 15,863 15,863 15,213 0,200 ac 15,213 0,203 b 16,247 1,080 abc
Cene Normal Sugar + Butter + / sugar Butter + / four-	is Mean value Standard devlation Significant Mean value Standard devlation Significant Mean value Standard devlation Significant Mean value Standard devlation Significant Mean value Standard Significant Mean value Standard Significant Mean value Standard	Pe Helkom Vete 7,367 2,072 a 6,577 4 6,575 1,101 a 6,155 1,269 a 11,838 2,833 a 20,151	ak load (N) Ölands Vete 2,329 a 10,700 2,409 a 8,282 2,290 a 24,647 7,869 a 8,871	Kallunda Varvee Evolutiona 5,805 0,338 a 5,301 0,886 a 7,003 2,187 a 6,964 2,435 a 8,754	Deforma Helkom Vete 14,967 0,058 a 14,967 14,967 0,058 a 14,900 0,000 a 15,000 a 15,000	ation peak () Ölands Vete 14,933 0,058 a 15,000 0,000 a 14,967 0,058 a 15,000	COMPRE (mm) Kallunda Varvete Evolutionar 14,967 0,058 a 14,967 14,967 0,058 a 14,967 14,967	File Helkom Wete 6,300 1,455 ab 5,756 0,661 a 5,513 4 9,449 1,868 bc 10,240	nal load (N) Ôtands Vete 6,204 1,796 ab 8,513 1,106 a 6,957 1,580 a 18,822 3,730 b 6,833	Xallunda Varvete olu Gonar 5,212 0,399 ab 4,528 a 6,136 1,285 ab 6,130 1,995 ab 6,742	Adhe Helkom Vete 1,983 0,437 a 1,578 0,412 ab 0,467 ab 0,968 0,968 0,344 b 8,084	sive force (N Ölands Vete B 0,615 a 2,253 0,432 a 3,373 3,949 a 1,223 1,615 a 2,910	<ul> <li>Kallunda</li> <li>Vavete</li> <li>volutionar</li> <li>1,394</li> <li>0,339</li> <li>ac</li> <li>3,480</li> <li>3,576</li> <li>abc</li> <li>1,880</li> <li>0,624</li> <li>abc</li> <li>0,530</li> <li>0,143</li> <li>b</li> <li>3,810</li> </ul>	P. Helkom Vete 10,259 0,087 ac 10,263 ac 10,263 ac 10,930 0,483 a 9,718 0,483 c 6,566	ak load (N) Ölands Vete 4,032 0,437 a 4,077 0,664 a 8,052 0,137 b 7,681 0,272 b 6,658	Kallunda Varvete kvolušonar 6,488 0,088 a 6,619 0,312 a 7,647 0,645 ac 6,438 0,818 ad 5,679	Deform Helkom Vete 25,933 0,351 a 23,867 0,611 bc 25,233 0,611 abc 23,867 0,850 be 23,167	XTENSION ation peak (r Ölands Vete E 0,058 a 17,867 1,595 a 22,233 1,007 bc 19,767 0,404 a 20,033	mm) Kallunda Varvete volušonar 21,467 0,208 a 21,500 1,249 a 19,167 5,787 a 19,300 1,493 a 21,233	Fi Helkom Vete 10,175 ac 10,156 0,072 ac 0,072 ac 0,072 ac 0,495 c 9,707 0,441 a 6,518	Al load (N) Olands Vete 3,954 0,434 a 3,981 0,663 a 0,107 b 0,107 b 0,107 b 0,337 bd 6,365	Callunda Varvete olusionar 6,409 a 6,503 a 0,319 a 7,084 0,728 ac 5,994 0,508 ad 5,631	Rus Helkom Vete 6,009 a 5,302 0,077 a 4,432 4,432 4,169 0,691 ac 4,434	ture load (N Ölands Vete g 2,299 ac 13,081 0,893 a 4,453 b b 8,444 1,376 c 2,513	RUP1 i) Kallunda Vavete Evolutionar 27,900 9,118 a 4,432 0,394 b 2,392 0,088 cd 7,912 2,552 abd 2,359	URE Defor Helkom Vebe 2,133 0,651 a 2,033 0,058 a 0,013 0,013 0,013 0,013 1,667 0,513 a 1,833	m rupture (r Ölands Vete 6,167 0,929 a 4,967 1,274 a 2,067 0,808 bc 4,533 1,429 ac 1,000	nm) Kalunda Vavete Evolutionar 4,400 1,249 a 1,633 0,321 ac 1,067 0,115 bc 5,733 3,612 ac 0,800	Helkom Vete 62,303 0,310 a 59,267 0,715 b 56,710 0,992 c 60,987 0,342 de 58,353	L* Ölands Vele 61,037 0,250 a 59,120 0,278 bc 58,523 abc 56,907 1,371 c 56,903	Kallunda Varvete 59,590 1,149 abd 60,673 1,287 ad 58,293 0,300 ac 59,440 1,840 acd 56,887	Helkom Vete 5,627 a 5,387 0,385 ab 5,790 0,480 ab 5,940 0,066 b 5,640	COLOR a* Olands Vete 5,750 0,406 ab 5,933 0,500 ab 5,470 0,304 ab 5,517 0,436 ab 5,517	Kallunda Varvete Evolusionar 4,897 0,256 a 4,407 0,264 ab 5,767 0,268 b 5,663 0,169 b 5,090	Helkom Vete 16,403 0,656 ac 15,173 0,365 ab 13,800 0,720 b 15,967 0,410 ac 15,790	b* Olands Vete 16,850 0,415 a 16,753 16,033 1,101 ab 14,400 1,110 b 15,710	Kallunda Evolutionar 14.130 1.250 abc 15.863 0.290 ac 15.213 15.2
Cene Normal Sugar + Butter + / sugar Butter + / flour	s Mean value Standard devlation Significant Mean value Standard devlation Significant Mean value Standard devlation Standard devlation	Pe Helkom Vete 7,367 2,072 a 6,577 1,101 a 6,555 1,269 a 11,838 2,833 a 20,151 11,933	ak load (N) Ölands Vete 1 2,329 a 10,700 2,409 a 8,282 2,290 a 2,4,647 7,869 a 8,871 3,282	Kallunda Varvee Evolutiona 5,805 0,338 a 5,301 0,886 a 7,003 2,187 a 6,964 2,435 a 8,754 1,894	Deforma           Helkom           Vete           14,967           0,058           a           14,967           0,058           a           14,960           0,000           a           15,000           a           15,000           a           15,000	ation peak () Ölands Vete 1 14,933 0,058 a 15,000 0,000 a 14,957 0,058 a 15,000 0,000	COMPRE (mm) Kallunda Värvete Evolutionar 14,967 0,058 a 14,967 0,058 a 14,967 0,058 a	Fit           Helkom           Vete           6,300           1,455           ab           5,756           0,661           a           5,513           1,138           a           9,449           1,868           bc           10,240           5,874	nal load (N) Ölands Vete 6,204 1,796 ab 8,513 1,106 a 6,957 1,580 a 18,822 3,730 b 6,833 2,329	Xallunda Vavete volutionar 0,399 ab 4,528 0,682 a 6,136 1,785 ab 6,130 1,95 ab 6,742 0,841	Adhe Helkom Vete 2,983 0,437 a 2,578 0,457 ab 1,585 0,467 ab 0,968 0,968 0,968 0,968 0,968 0,968	sive force (N Ölands 2,482 0,615 a 2,253 0,432 a 3,373 3,949 a 1,223 1,614	<ul> <li>Kallunda Vavete volušonar 1,394</li> <li>0,339</li> <li>ac</li> <li>3,480</li> <li>3,576</li> <li>abc</li> <li>1,880</li> <li>0,624</li> <li>abc</li> <li>0,530</li> <li>0,530</li> <li>0,143</li> <li>b</li> <li>3,810</li> <li>1,109</li> </ul>	PHdkom Vete 10,259 ac 10,263 0,096 ac 10,930 0,483 a 9,718 0,328 c 6,566 0,462	ak load (N) Ölands Vete 4,032 0,437 a 4,077 0,664 a 8,052 0,137 b 7,681 0,272 b 6,658 0,315	Kallunda Vavves 6,488 0,088 a 6,619 0,312 a 7,647 0,645 ac 6,438 0,818 ad 5,679 0,151	Deform Deform Helkom Vete 25,933 0,351 a 23,867 0,611 bc 25,233 0,611 abc 25,233 0,611 bc 23,867 0,850 be 23,167 1,550	XTENSION ation peak (r Ölands Vete <u>E</u> 18,967 0,058 a 17,867 1,595 a 22,233 1,007 bc 19,767 0,404 a 20,033 2,977	mm) Kallunda Varvete VoluSonar 21,467 0,208 a 21,500 1,500 a 19,167 5,787 a 19,167 5,787 a 19,300 1,493 a 21,233	FileRom Vete 10,175 0,091 ac 10,156 0,072 ac 10,838 0,495 c 9,707 0,441 a 6,518 0,472	Al load (N) À loads & Ev Ev 0,434 a 0,663 a 0,107 b 0,337 bd 6,365 0,145	Kallunda Varvete elutionar 6,409 a 6,503 0,319 a 7,084 0,728 ac 5,994 5,994 3,0508 ad 5,631 0,153	Rup Helkom Vete 6,009 a 5,302 0,077 a 4,432 1,788 ac 4,432 4,169 0,691 ac 4,434 1,259	bure load (N Ölands Vete 11,788 2,299 ac 13,081 0,893 a 4,453 0,108 b 8,444 1,376 c 2,513 0,222	RUPT i) Kallunda Varvete Evolutionar 27,900 9,118 a 4,432 0,994 b 2,392 0,088 od 7,912 2,552 abd 2,359 0,064	URE Defor Helkom Vete 2,133 0,651 a 2,033 0,058 a 0,013 0,006 b 1,667 0,513 a 1,833 0,289	m rupture Ölands Vide 6,167 0,929 a 4,967 1,274 a 2,067 0,808 bc 4,533 1,429 ac 1,000 0,000	nm) Kallunda Vavete Evolusonar 1,249 a 1,633 0,321 ac 1,067 0,115 bc 5,733 3,612 ac 0,800 0,265	Helkom Vete 62,303 0,310 3 59,267 0,715 b 56,710 0,992 c 60,987 0,142 6e 58,353 1,242	L* Ôlands Vee 61,037 0,250 a 59,120 0,278 bc 58,523 1,765 abc 56,907 1,371 c 56,903 1,651	Kallunda Varvete 59,590 60,6737 1,149 abd 60,6737 3d 58,293 0,330 ac 59,440 1,840 acd 56,887 1,463	Helkom Vete 5,627 0,042 a 5,387 0,385 ab 5,790 0,480 ab 5,940 0,066 b 5,540 0,161	COLOR a Olands Vete 5,750 0,406 ab 5,933 0,500 ab 5,517 0,304 ab 5,517 0,304 ab 5,517 0,304 ab 5,517 0,304 ab 5,517 0,304 ab	Kallunda Varvete Evolusionar 4,897 0,256 a 4,407 0,264 ab 5,767 0,268 b 5,663 0,169 b 5,090 0,244	Helkom Vete 16,403 0,656 ac 15,173 0,656 ab 13,800 0,720 b 13,967 0,410 ac 15,790 0,973	b* Ölands Vete 16,850 0,415 a 16,753 0,236 ab 16,033 1,101 ab 14,400 1,110 b 15,710 0,894	Kallunda Varvete Evolusionat 14,130 1,250 abc 15,863 0,290 ac 15,863 0,290 ab 16,247 1,080 abc 14,400 0,782
Cene Normal Sugar + Butter + / sugar Butter - / four	is Mean value Standad devlation Significant Mean value Standad devlation Significant Mean value Standad devlation Significant Mean value Standad devlation Significant Significant Significant	Pe Helkom Vete 7,367 2,072 a 6,577 1,101 a 6,155 1,269 a 11,838 a 2,833 a 20,151 11,933 a	ak load (N) Ölands Vete 1 2,329 a 10,700 2,409 a 8,282 2,290 a 24,647 7,869 a 8,871 3,282 a	Kallunda Varete S.805 0,338 a 5,301 0,886 a 7,003 2,187 a 6,964 2,435 a 8,754 8,754 1,894 a	Deforma           Helkom         Vete           14,967         0,058           a         14,967           0,058         3           14,967         0,058           a         15,000           a         15,000           a         15,000           a         0,000           a         0,000	ation peak ( Ölands Vete 14,933 0,058 a 15,000 0,000 a 14,967 0,058 a 15,000 0,000 a 14,967 0,058 a 15,000 0,0058 a 15,000 0,0058 a 15,000 0,0058 a 15,000 0,000 a 15,000 0,0058 15,000 0,0058 15,000 0,0058 15,000 0,000 0,0058 15,000 0,0000 0,000 0,0000 0	COMPRE (mm) Kallunda Varvete Evolutisonat 14,967 0,058 a 14,967 0,058 a 14,967 0,058 a 14,967 0,058 a 14,967 0,058 a	5,513 1,455 3,755 3,755 5,755 0,661 2 1,138 3 9,449 1,868 bc 10,249 5,874 ac	nal load (N) Ôlands Vete 6,204 1,796 ab 1,796 a 5,106 a 6,957 1,580 a 18,822 3,730 b 3,730 b 3,730 b 3,232 a 2,329 a	Xallunda Varwes olutionar 5,212 0,399 ab 4,528 4,528 4,528 4,528 4,528 4,528 6,136 5,136 5,136 5,136 5,130 6,130 5,199 ab 6,130 0,841 b	Adhe Helkom 1,983 0,437 a 1,578 0,457 ab 0,467 ab 0,467 ab 0,467 ab 0,468 0,344 b 8,084 3,629 ab	sive force (N Ölands 1,482 0,615 a 2,253 0,432 a 3,373 3,949 a 1,615 a 2,910 1,614 a	() Kallunda Varvete volutiona 0,339 ac 3,340 3,375 abc 0,524 abc 0,530 0,143 b 3,810 1,109 c	P Helkom Vete 10,259 0,087 ac 10,263 10,930 10,930 0,483 a 9,718 0,328 c 5,566 0,462 b	ak load (N) Ölands Vete 4,032 0,437 a 4,077 0,664 a 8,052 0,137 b 7,681 0,272 b 6,658 0,315 c	Kallunda Varvete Volušena 6,488 0,088 a 6,619 0,312 a 7,647 0,645 ac 6,438 0,818 ad 5,679 0,151 bd	Beform Helkom Vete 25,933 0,351 a 23,867 0,611 bc 23,867 0,611 abc 23,867 0,611 abc 23,867 0,850 be be 1,550 ace	XTENSION XITENSION Clands Vete 18,967 0,058 a 17,867 17,867 1,595 a 22,233 1,007 bc 19,767 0,404 a 20,033 2,977 ac	nm) Kallunda Vavee volutionar 21,407 0,208 a 21,500 1,249 a 19,167 5,787 a 19,300 1,493 a 21,233 21,233	5 Helkom Vete 10,175 0,091 30,156 0,091 30,566 10,838 0,495 c 9,707 0,441 3 6,518 6,518 5,58 0,472 b	Al load (N) Clands Vete Vete 0,434 a 0,663 a,981 0,663 a,981 0,663 a,981 0,663 a,983 0,663 a,983 0,663 a,984 0,663 a,954 0,663 a,954 0,663 a,954 0,663 a,954 0,663 a,954 0,663 a,954 0,663 a,954 0,663 a,954 0,663 a,954 0,663 a,954 0,663 a,954 0,663 a,985 0,663 a,985 0,663 a,985 0,663 a,985 0,663 a,985 0,663 a,985 0,663 a,985 0,663 0,665 0	Kallunda Vavete iolutionari 6,409 a 6,503 0,319 a 0,728 ac 5,994 0,508 ad 5,591 0,153 bcd	Rup Helkom Vete 6,009 a 5,302 0,077 a 4,432 1,788 ac 4,169 0,691 ac 4,434 1,259 ac	bure load (N Ölands Vete 11,788 2,299 ac 13,081 0,893 a 4,453 0,108 b 8,444 1,376 c 2,513 0,222 de	RUP1 i) Kallunda Vavete Evolusionar 27,900 27,900 2,392 0,088 cd 7,912 2,552 abd 2,359 0,064 cd	URE Defor Helkom Vebe 2,133 0,651 a 2,033 0,058 a 0,013 0,006 b 1,667 0,513 a 1,833 0,289 a	m rupture (r Ölands Vete 6,167 0,929 a 4,967 1,274 a 2,067 0,808 bc 4,533 1,429 ac 1,629 0,000 bc	nm) Kallunda Vavete Evolutionar 4,400 1,249 a 1,633 1,633 0,321 ac 1,067 0,115 bc 5,733 3,612 ac 0,265 b	Helkom Vete 62,303 0,310 a 59,267 59,267 0,715 b 56,710 0,992 c 60,987 0,142 de 58,353 1,242 bce	L* Ölands Vete 61,037 0,250 a 59,120 0,278 bc 58,523 1,765 abc 56,907 1,371 c 56,903 1,651 bc	Kallunda Varvete 59,590 1,149 abd 66,673 1,287 ad 58,293 0,330 ac 59,440 1,840 acd 55,840 1,463 bce	Helkom Vete 5,527 0,042 a 5,387 0,385 ab 5,790 0,480 ab 5,940 0,066 b 5,540 0,066 b	COLOR a Olands Vete S,750 0,406 ab S,933 0,500 ab S,470 0,304 ab S,517 0,436 ab S,270 0,183 a	Kallunda Varvine Evolutionari 4,897 0,256 a 4,407 0,268 b 5,767 0,268 b 5,663 0,169 b 5,900 5,090	Helkom Vete 16,403 0,656 ab 13,800 0,720 b 13,967 0,410 ac 15,730 0,410 ac 15,730 0,973 abc	b* Olands Vete 16,850 0,415 ab 16,033 1,011 ab 14,400 1,110 b 14,400 0,894 ab	Evolutionar Evolutionar 14,130 1,250 abc 15,863 0,290 ac 15,213 0,203 b 16,247 16,247 16,247 1,080 abc 14,400 0,782 ab
Cene Normal Sugar + Butter + / sugar Butter + / flour	s Mean value Standard devlation Significant Mean value Standard devlation Significant Mean value Standard devlation Significant Mean value Standard devlation Significant Mean value	Pe Helkom Vete 7,367 2,072 a 6,577 1,101 a 6,555 1,269 a 11,838 2,833 a 20,151 11,933 a 8,759	ak load (N) Ölands Vete 2,329 a 10,700 2,409 a 8,282 2,290 a 24,647 7,869 a 8,871 3,282 a 9,025	Kalunda tvoiveta tvoiveta 0,338 a 5,301 0,886 a 2,038 2,187 a 5,964 2,435 a 8,754 a 8,754 a 8,754 a 3,949	Deforma Helkom Vete 14,967 0,058 a 14,967 14,967 0,000 a 15,000 a 15,000 a 15,000 a 15,000	ation peak ( Ölands Vete 14,933 0,058 3 15,000 0,000 3 14,967 14,967 0,0058 3 0,000 3 14,967 0,000 3 14,967	COMPRC (mm) Kallunda Varvek Varvek Volusionat 14,967 0,058 a 14,967 0,058 a 14,967 0,058 a 14,967 14,967	File Helkom Vete 6,300 1,455 ab 5,756 0,661 a 5,513 1,138 a 1,138 a 9,449 1,868 bc 10,240 5,874 ac 7,317	nal load (N) Ölands Vete 6,204 1,796 ab 8,513 1,106 a 5,957 1,580 9 18,822 3,730 b 6,833 2,399 a 7,173	Xallunda Vavee olutionar 5,212 0,399 ab 4,528 a 6,136 6,136 6,136 6,136 6,136 6,130 6,130 6,130 6,142 0,641 b 5,302	Adhe Helkom Vee 1,983 0,437 a 1,578 1,578 0,112 ab 1,586 0,467 ab 0,968 0,968 0,968 0,968 0,944 b 8,084 3,629 ab 1,215	sive force (N Of lands Vete 1,482 0,615 a 2,253 2,253 3,373 3,949 a 1,223 1,615 a 2,910 1,614 a 2,339	<ul> <li>Kallunda Vavela 1,994</li> <li>Vavela 1,994</li> <li>Vavela 3,940</li> <li>3,576</li> <li>3,480</li> <li>3,576</li> <li>3,576</li> <li>3,576</li> <li>3,576</li> <li>4,880</li> <li>0,524</li> <li>4,880</li> <li>0,524</li> <li>4,880</li> <li>0,530</li> <li>0,530</li> <li>0,530</li> <li>0,530</li> <li>1,880</li> <li>3,810</li> <li>1,109</li> <li>c</li> <li>1,301</li> </ul>	P Helkom Vete 10,259 ac 10,263 10,263 ac 10,930 0,483 a 9,718 c 6,566 0,462 b 5,545	ak load (N) Ôlands Vete 4,032 0,437 a 4,077 0,664 a 8,052 0,137 b 0,681 0,272 b 6,658 0,315 c 6,764	Kallunda Varvete kyolušenar 6,488 0,088 a 6,619 0,312 a 7,647 0,645 ac 6,438 0,818 ad 5,679 0,151 bd 8,916	Deform Helkom Vete 25,933 0,351 a 23,867 0,611 bc 25,233 0,611 abc 25,233 0,611 abc 23,867 23,867 1,550 ace 19,033	xtrension ation peak (r Õtands Vete [ 18,967 0,058 a 17,867 1,955 a 22,233 1,007 bc 0,404 a 20,033 2,977 ac	mm) Kallunda Vavete 21,467 0,208 a 21,500 1,249 a 19,167 3,787 a 2,797 a 2,797 a	Filekom Vete 10,175 0,091 ac 10,156 0,072 ac 10,838 0,495 c 0,441 a 6,518 0,472 b 5,583	Al load (N) Olands Vete 0,434 3,981 0,663 4 0,107 b 0,107 b 0,37 bd 6,365 0,145 c 6,720	Kallunda Vavete olutionar 6,409 0,080 a 6,503 a 7,084 0,728 ac 0,728 ac 5,994 0,508 ad 5,631 0,153 bod 8,826	Rug Helkom Vete 6,009 0,899 a 5,302 0,077 a 4,432 1,788 ac 4,159 ac 4,434 1,259 ac 3,355	oture load (N Ölands Vete 11,788 2,299 ac 13,081 0,893 a 4,453 0,108 b 4,453 0,108 b 8,444 1,376 c 2,513 0,222 de 3,720	RUPT i) Kallunda Varvete Evolusionar 27,900 9,118 a 4,432 0,088 cd 2,392 0,088 cd 2,359 0,068 2,359 0,064 cd 2,855	URE Defor Vete 2,133 0,651 a 0,058 a 0,005 b 0,005 b 1,667 0,513 a 1,833 0,283 a 1,833 0,283 a 1,433	m rupture (n Člands Vete 6,167 0,929 a 1,274 a 2,067 0,808 bc 4,533 1,429 ac 1,000 0,000 bc 2,333	nm) Kallunda Värvete Scolusional 4,400 4,400 4,400 0,321 ac 0,321 ac 0,321 bc 5,733 3,612 ac 0,800 0,265 b 1,600	Helkom Vete 62,303 0,310 3 59,267 0,715 b 56,710 0,992 c 60,987 0,142 de 58,353 1,242 bce 59,807	L* Ölands Veb 61,037 0,250 a 59,120 0,278 bc 58,523 1,765 abc 56,907 1,371 c 56,903 1,651 bc 60,180	Kallunda Varvete Evolusionat 59,590 1,149 abd 60,6737 ad 58,293 0,330 ac 59,440 59,440 1,840 acd 56,887 1,840 acd 56,887 1,840 acd 59,563	Helborn Vere 5,627 0,042 a 5,387 0,385 ab 5,790 0,480 5,940 5,940 5,940 5,940 5,940 5,940 5,940 5,940 5,940	COLOR a* Olands Vete 5,750 0,406 ab 5,933 0,500 ab 5,5470 0,304 ab 5,5270 0,436 ab 5,270 0,183 a 5,807	Kallunda Varvete Evolusiona 4,897 0,256 a 4,407 0,264 ab 5,767 0,268 b 5,563 0,169 b 5,090 0,244 a a 6,010	Helkom Vete 16,403 0,656 ac 15,173 0,365 0	b* Olands Vete 16,850 0,415 a 16,733 16,733 1,011 ab 14,400 11,110 b 15,710 0,894 ab 16,427	Kallunda Varwete Erolusionar Erolusionar abc 15,863 0,290 abc 15,213 b 16,247 1,080 abc 14,400 0,782 ab 16,237
Cener Normal Sugar + Butter + / sugar Butter + / four Butter - / four	s Mean value Standad devlation Significant Mean value Standad devlation Significant Mean value Standad devlation Significant Mean value Standad Standad Standad Standad Standad Standad Standad Standad	Pe Helkom Vete 2,072 a 6,577 1,001 a 6,555 1,269 a 3 1,838 2,833 a 2,833 a 2,051 20,555 11,933 a 3 8,759 8,759	ak load (N) Ölands Vete 2,329 a 10,700 2,409 a 8,282 2,290 a 24,647 7,869 a 8,871 3,282 a 9,026	Kallunda Varvea Solusona 5,805 0,338 a 5,301 0,886 a 7,003 2,187 a 6,954 2,435 a 8,754 1,894 a 3 5,949	Deforma Helkom Vete 14,967 0,058 a 14,967 0,058 a 14,967 0,000 a 15,000 0,000 a 15,000 0,000 a 15,000	ation peak ( Ölands Vete 14,933 0,058 a 15,000 0,000 a 14,967 0,058 a 15,000 0,000 a 14,967 0,058 a 15,000 0,000 a 14,967 0,058	COMPRE jmm) Kallunda Varvete VoluSona 14,967 0,058 a 15,000 0,000 a 14,933 0,058 a 14,967 0,058 a 14,967 0,058 a 14,967 0,058 a 0,057 a 0,058 a 0,058 a 0,058 a 0,058 a 0,058 a 0,058 a 0,058 a 0,058 a 0,058 a 0,058 a 0,058 a 0,058 a 0,058 0 0,058 0 0,058 0 0,058 0 0,058 0 0,058 0 0,058 0 0,058 0 0,058 0 0,058 0 0,058 0 0,058 0 0,058 0 0,058 0 0,050 0 0,050 0,000 0,050 0,00000000	SSION         Fi           Helkom         Vete           6,300         1,455           1,455         0,661           a         5,756           0,661         a           1,138         a           9,449         1,868           bc         10,240           5,874         ac           7,317         0,017	nal load (N) Ôlands Vete 6,204 1,796 a 8,513 1,106 a 6,957 1,580 a 18,822 3,730 b 6,833 2,329 a 7,175	Kallunda Varves olutionar 5,212 0,399 ab 0,682 a 6,136 5,130 1,995 ab 6,130 5,742 0,841 b 5,302	Adhe Helkom Vete 1,983 0,437 a 1,578 0,112 ab 1,586 0,467 ab 0,968 0,968 0,968 0,968 0,944 b 8,084 3,629 ab 1,215	sive force (V Olands Vete 6 0,615 0,482 0,615 0,432	0) Kallunda Vaveta 0,339 ac 0,339 ac 3,480 3,576 abc 0,524 abc 0,530 0,524 abc 0,530 0,143 b 1,109 c 1,109 c	P. Helkom Vete 10,259 0,087 ac 10,263 ac 10,930 0,483 a 9,718 0,328 c 6,566 0,462 b 5,545	ak load (N) Ôlands Vete 4,032 0,437 a 4,077 0,664 a 8,052 0,137 b 7,681 0,272 b 6,658 0,315 c 6,764	Kallunda Vaveta Vaveta 6,488 0,088 a 6,619 0,312 a 7,647 0,645 ac 6,438 0,818 ad 5,679 0,151 bd 8,916	Deform           Helkom           Vete           25,933           0,351           a           0,611           bc           25,233           0,611           abc           23,867           0,850           be           1,550           ace           19,033	XTENSION XTENSION 0lands Vete 18,967 0,058 a 17,867 1,595 a 22,233 1,007 bc 19,767 0,404 a 20,033 2,977 ac 20,900	mm) Kallunda Varvee Varvee 21,467 0,208 a 21,500 1,249 a 19,167 5,787 a 19,300 1,493 a 21,233 1,405 a 21,249 a 19,300 1,249 a 19,300 1,249 a 19,300 1,249 a 19,300 1,249 a 2,1,249 a 1,249 a 2,1,249 a a 2,1,249 a a 2,1,249 a a 2,1,249 a a 2,1,249 a a 2,1,249 a a 2,1,249 a a 2,1,249 a a 2,1,249 a a a a a a a a a a a a a	5 Helkom Vete 10,175 0,091 36 10,156 0,072 36 0,495 c 0,495 c 0,441 3 5,518 0,472 b 5,581 5,581	Al load (V) Olands Vete 2,954 0,434 a 3,981 0,663 a 7,983 0,107 b 0,107 b 0,337 bd 6,365 0,145 c 6,720	Kallunda Varvete olutionar 6,409 0,080 a 6,503 0,319 a 7,084 0,728 ac 5,994 0,728 ac 5,994 0,508 ad 5,631 0,153 bcd 8,826 8,826	Rup Helkom Vete 6,009 0,899 a 5,302 0,077 a 4,432 1,788 ac 4,434 4,169 0,691 ac 4,434 1,259 ac 3,355	Aure load (N Ölands Vete 11,788 2,299 ac 13,081 0,893 a 4,453 0,108 b 8,444 1,376 c 2,513 0,222 de 3,720	RUP1 () Kallunda Varvete Volusional 9,118 a 4,432 0,394 b 2,392 0,088 cd 7,912 2,552 abd 2,359 0,064 cd 2,359 0,064	URE Defor Helkorm Vete 2,133 0,651 a 0,058 a 0,013 0,006 b 1,667 0,513 a 1,833 0,289 a 1,433 0,289 a	m rupbure (r Ölands Vete 6,167 0,929 a 4,967 1,274 a 2,067 0,808 bc 1,429 ac 1,429 ac 1,000 0,000 bc 2,333	nm) Kallunda Varvee Evolutionat 4,400 1,249 a 1,633 0,321 ac 1,067 0,115 bc 5,733 3,612 ac 0,800 0,265 b 1,000 1,000 0,265 b	Helkom Vete 62,303 0,310 3 59,267 0,715 b 56,710 0,992 c 6 60,987 0,142 de 58,353 1,242 bce 59,807	L* Otands Vete 61,037 0,250 a 59,120 0,278 bc 58,523 1,765 abc 56,907 1,371 c 56,903 1,651 bc 60,100 c	Kallunda Varvete Solutionat 59,590 1,149 abd 60,673 1,287 ad 58,293 0,330 ac 59,440 1,840 acd 56,887 1,463 boe 59,563	Helkom Vete 5,627 0,042 a 5,387 0,385 ab 5,790 0,480 ab 5,940 0,065 b 5,540 0,161 ab 6,193	COLOR a Olands Vete S,750 0,406 ab S,933 0,500 ab S,470 0,304 ab S,517 0,436 ab S,270 0,183 a 3 a 5,270 0,183 a b S,270 0,185 a b S,270 0,185 ab S,807	Kallunda Varvete Evolusionai 4,897 0,256 a 4,407 0,264 ab 5,767 0,268 b 5,663 0,169 b 0,268 b 0,169 b 0,264 a 0,264 a 0,266 0,268 b 0,266 a 0,026 a 0,020 a 0,026 a 0,020 a 0,020 a 0,020 0,00000000	Helkom Vete 16,403 0,655 ac 15,173 0,365 ab 13,800 0,720 b 13,967 0,410 4 15,790 0,973 abc 16,463	b* Olands Vete 16,850 0,415 a 16,033 16,033 1,101 ab 14,400 1,110 14,400 0,894 ab 15,710 0,894 ab	Kallunda Varvete Feolusionar 14,130 1,250 abc 15,863 0,290 ac 15,213 0,203 b 16,247 1,080 abc 16,247 1,080 abc 16,247 1,080 abc 16,247 1,080 abc
Cere Normal Sugar + Butter + / sugar Butter + / four Butter - / four	s Mean value Standard deviation Significant Mean value Standard S	Per Helkom Vete 7,367 2,072 a 6,577 1,101 a 6,155 1,269 a 11,883 a 20,151 1,933 a 8,759 4,698	ak load (N) Olands Vete 2,329 a 10,700 2,409 a 8,282 2,290 a 24,647 7,869 a 8,871 3,712 3,712 3,712 3,700 3,871 3,700 3,800 3,7000 3,7000 3,7000 3,70000000000	Kallunda Varvete Evolutionar 5,805 0,338 a 5,301 0,886 a 0,886 a 2,033 2,187 a 6,964 2,435 a 8,754 1,894 a 5,949 0,772	Deforma Helkom Vete 14,967 0,058 a 14,967 0,058 a 14,967 0,000 a 15,000 a 15,000 a 15,000 a 0,000 a 0,000	afion peak ( Ôlands Vete 14,933 0,058 a 15,000 0,000 a 14,967 0,058 a 15,000 0,000 a 14,967 0,058	COMPRC jmm) Xalunda Varvete a 14,957 0,058 a 14,957 0,058 a 14,957 0,058 a 14,957 0,058 a 14,957 0,058 a 14,957 0,058 a 14,957 0,058 a 14,957	SSION Fill Helkom Vete 6,300 1,455 ab 5,756 0,661 a 5,513 1,138 a 9,449 1,868 bc 10,240 5,874 ac 7,317 3,802 3,802	nal load (N) Olands Wete 5,204 1,796 ab 8,513 1,106 a 6,957 1,580 a 18,822 3,730 b 6,833 2,329 a 7,173 0,676	Xallunda Varves 5,212 0,399 ab 4,528 0,682 a 6,136 6,136 1,785 ab 6,136 1,785 ab 6,136 5,302 0,682 4,528 1,995 ab 6,142 0,682 1,995 ab 6,742 0,841 b 5,302 0,705	Adhe Helkom Vete 1,983 0,437 a 1,578 0,112 ab 0,467 ab 0,965 0,964 b 8,084 3,629 ab 1,215 0,449	sive force (N Ölands Vete 0,615 a 2,253 0,432 a 3,373 3,373 3,373 1,615 a 2,910 1,614 a 2,339 0,163	<ul> <li>Kallunda Vavete</li> <li>Vavete</li> <li>Vavete</li> <li>1,994</li> <li>1,994</li> <li>3,576</li> <li>ac</li> <li>3,480</li> <li>0,524</li> <li>abc</li> <li>0,524</li> <li>abc</li> <li>0,524</li> <li>abc</li> <li>0,5143</li> <li>b</li> <li>3,810</li> <li>1,109</li> <li>c</li> <li>1,301</li> <li>0,409</li> </ul>	PHelkorn Vete 10,259 0,087 ac 10,263 0,096 ac 10,930 0,483 a 9,718 0,328 c 6,566 0,462 b 5,545 0,255	ak load (N) Ölands Vete 4,032 0,437 a 4,077 0,664 a 8,052 0,137 b 7,681 0,272 b 6,658 0,315 c 6,754 0,173	Kallunda Varveta 6,488 0,088 a 6,519 0,312 a 0,312 a 0,645 ac 6,438 ad 5,679 0,515 bd 8,915 bd 8,915	Deform Helkorn Vete 25,933 0,351 a 23,867 0,611 bc 23,867 0,611 abc 23,867 0,850 be 23,167 1,550 ace 19,033 0,757	xtension ation peak (r Ölands Vete 18,967 0,058 a 17,867 1,595 a 22,233 1,007 bc 19,767 0,404 a 20,033 2,977 ac 20,900 0,737	mm) Kallunda Varvete Varvete Varvete Varvete 21,467 0,208 a 1,249 a 19,167 5,787 a 19,300 1,493 a 21,233 1,405 a 21,100 1,000	Filekom Vete 10,175 0,091 ac 10,156 0,072 ac 10,838 0,495 c 0,495 c 0,441 a 6,518 0,472 b 5,583 0,345	Al load (N) Olands Vete 3,954 0,434 a 3,981 0,663 a 0,663 a 0,663 a 0,663 a 0,107 b 0,337 bd 6,365 0,145 c 6,220 0,155	Callunda Varveta olutiona 6,409 0,080 a 5,503 7,084 0,728 ac 5,994 0,508 ad 5,631 0,153 bcd 8,826 0,471	Rup Helkom Vete 6,009 0,899 a 5,302 0,077 a 4,432 1,788 ac 4,434 1,259 ac 3,355 0,770 0,770	Aure load (N Ôlands Vete 2,299 ac 13,081 13,083 a 4,453 0,108 b 8,444 1,376 c 2,553 0,222 de 3,720 1,298	RUP: () Kallunda Varvete Varvete Varvete 27,900 9,118 a 4,432 0,394 b 2,392 0,088 cd 2,359 0,064 cd 2,865 0,385 0,385	URE Defor Helkcorn Vete 2,133 0,651 a 0,058 a 0,058 a 0,058 a 0,013 0,006 b 1,667 0,513 a 1,833 0,289 a 0,289	m rupture (n Ölands Vete 6,167 0,929 a 4,967 1,274 a 2,067 0,808 bc 4,533 1,429 ac 3,000 0,000 bc 2,333 0,764	nm) Kallunda Varete Solusiona 4,400 1,249 a 1,633 0,321 ac 0,321 bc 5,733 3,612 ac 0,800 0,265 b 1,600 0,141	Helkom Vete 62,303 0,310 a 59,267 0,715 56,710 0,992 c 60,992 c 60,987 0,142 de 58,353 1,242 bce 59,807 0,967	L* Otands Vete 61,037 0,250 a 59,120 0,278 bc 58,523 1,765 56,907 1,371 c 56,903 1,651 bc 60,180 0,527 0,527	Kallunda Varwete Evolutionar 59,590 1,149 abd 1,287 ad 58,293 0,330 ac 59,440 1,840 acd 56,887 1,463 bce 59,563 0,558	Helkom Vete 5,627 0,042 a 5,387 0,385 ab 5,790 0,480 ab 5,940 0,066 b 5,640 0,066 b 5,640 0,0161 ab 6,193 0,336	COLOR a Olands Vete 5,750 0,405 ab 5,933 0,500 ab 5,470 0,304 ab 5,517 0,436 ab 5,517 0,436 ab 5,270 0,436 ab 5,270 0,405 ab 5,470 0,405 ab 5,470 0,405 ab 5,470 0,405 ab 5,470 0,405 ab 5,470 0,405 ab 5,470 0,405 ab 5,470 0,405 ab 5,470 0,405 ab 5,470 0,405 ab 5,470 0,304 ab 5,517 0,405 ab 5,470 0,304 ab 5,517 0,436 ab 5,517 0,436 ab 5,270 0,405 ab 5,517 0,436 ab 5,270 0,436 ab 5,270 0,304 ab 5,270 0,436 ab 5,270 0,436 ab 5,270 0,436 ab 5,270 0,045 ab 5,270 0,436 ab 5,270 0,048 ab 5,270 0,048 ab 5,000 0,048 ab 5,000 0,048 ab 5,000 0,048 ab 5,000 0,048 ab 5,000 0,048 ab 5,000 0,048 ab 5,000 0,048 ab 5,000 0,00	Xallunda Vavete Evolutionar 4,897 0,256 a 4,407 0,264 b 5,767 0,268 b 5,663 0,169 b 5,690 0,244 a 6,010 0,241	Helkom Vete 16,403 0,656 ac 15,173 0,365 ab 13,800 0,720 b 13,800 0,720 b 13,800 0,720 b 13,800 0,720 b 15,790 0,410 ac 16,463 16,463 0,235	b Ölands Vete 16,850 0,415 a 16,753 0,236 ab 16,033 1,101 ab 16,033 1,101 ab 16,033 1,101 ab 16,033 1,101 ab 16,033 1,101 ab 16,033 1,101 ab 16,033 1,101 ab 16,033 1,101 ab 16,033 1,101 ab 16,033 1,101 ab 16,033 1,101 ab 16,033 1,101 ab 16,033 1,101 ab 16,033 1,101 ab 16,033 1,101 ab 16,033 1,101 ab 16,033 1,101 ab 16,033 1,101 ab 16,033 1,101 1,001 1,100 1,100 1,100 1,100 1,100 1,100 1,100 1,100 1,100 1,100 1,100 1,100 1,000 1,100 1,100 1,100 1,100 1,100 1,100 1,100 1,100 1,100 1,000 1,100 1,100 1,100 1,000 1,100 1,00	Kallunda Evolutionar 14,130 1,250 abc 15,863 0,290 ac 15,213 0,203 b 16,247 1,080 abc 14,400 0,782 ab 16,237 0,360

		Pe	ar Ioad I		Derorma	ation @PI			aai load j	na (	P 6	Far load		Derorma	tion CPL		F 1	Deol lea			esite Fore	ce m	- P	ean load i	<b>FH</b>	Uerorma	NUON @PE		F1	nal load   l			L		1	a		1	D.	X
Cereals		Helkorn Vete	ölands Vete	Kallunda Varvete Evolutiona	Helkorn Vete	ölands Vete	Kallunda Varvete Evolution																																	
Harmal	Mean value	4,742	7,314	8,808	27,167	25,733	26,967	4,432	6,923	8,347	17,315	19,441	21,731	15,000	15,000	14,967	14,551	13,886	18,308	1,865	2,120	2,935	6,104	8,347	9,252	21,333	25,233	26,033	5,111	7,956	8,900	62,213	52,677	54,000	5,303	3,933	3,653	13,733	11,617	10,267
Desina	Standard	0,737	0,268	0,044	1,904	0,764	0,473	0,723	0,265	0,086	5,613	1,612	7,516	0,000	0,000	0,058	4,195	3,492	4,966	0,449	0,344	1,284	0,508	0,310	0,032	0,666	1,069	0,115	0,314	0,438	0,100	0,108	3,414	2,930	0,631	0,287	0,516	10,600	0,828	1,868
necipe	Significant	9	٥d	9	ac	af	90	9	٥d	əf	٩b	acd	abc	9	0	0	əb	acd	abc	ab	٥b	0	0	adhi	9	9	ace	əh	9	acd	əd	9	abd	0	9	ab	ab	0	0	abd
	Mean value	10.696	8.043	8,868	29,167	25,733	25,967	10.457	7.604	8.367	25,809	48.240	21,210	15.000	15.000	15.000	19,704	30,569	17.839	2,448	2.255	1.805	11.172	9.018	7.497	27.900	25,233	22,700	10.699	8.394	6.883	51,273	52,587	52,890	3,757	3.697	3,453	9.067	9.627	7.643
mgac	Standard	0,171	0,367	0,534	0,451	0,907	0,208	0,119	0,335	0,492	4,435	5,879	4,276	0,000	0,000	0,000	2,003	2,667	3,110	0,019	0,344	0,799	0,147	0,503	0,290	0,173	0,757	0,173	0,153	0,469	0,353	2,526	1,128	5,152	0,046	0,372	0,161	1,289	0,552	1,529
particule	Significant	ь	acf	ь	9	ac	9	ь	ac	acf	9	ь	90	3	9	0	9	ь	ac	3	3	9	ь	ach	ь	ь	abe	c	ь	ad	bk	bd	0	0	acf	ab	9	bd	bc	ad
	Mean value	10,425	8,660	8,482	29,367	27,533	28,500	10,021	8,293	8,227	22,612	21,303	21,033	15,000	14,367	14,967	18,370	18,286	18,333	2,082	2,355	2,371	10,582	9,303	8,079	27,567	27,100	24,700	10,165	8,681	7,543	52,817	43,770	52,367	3,670	4,267	3,447	9,777	10,937	9,363
Salt +	Standard	0,413	0,304	0,436	0,635	1,266	0,624	0,333	0,293	0,526	4,256	2,789	2,102	0,000	0,058	0,000	30,080	2,403	1,268	0,318	0,062	0,079	0,584	0,459	0,062	0,231	0,529	0,500	0,435	0,409	0,155	1,951	1,244	3,317	0,370	0,225	1,195	1,186	0,310	2,727
1	Significant	be	bcef	bd	3	ad	be	bd	cb	acf	ad	ad	9	9	3	3	90	c	9	30	3	3	ьdi	ce	bd	ь	· c	ь	bd	3	be	be	bc	3	bcdf	9	ab	be	3	bdc
	Mean value	6,752	8,819	10,896	25,633	27,933	31,900	6,401	8,555	10,551	18,467	20,647	20,595	14,967	15,000	15,000	15.342	17,219	17.584	1,601	2,438	2,303	8,969	7,749	10,662	25,133	24,533	27,700	8,166	7,101	10,136	45,290	52,943	57,280	2,593	3,533	3,267	5,557	9,780	11,237
Salt ++	Standard	0,381	0,117	0,172	1.069	0.551	1,493	0.426	0.094	0,101	2,868	1,234	4,162	0,058	0.000	0.000	2,288	1,199	3,218	0.386	0.043	0,292	0.496	0.395	0.246	0,586	0,153	0.173	0,560	0.462	0.206	1,201	3,001	2,126	0.587	0.461	0,330	0.624	1,334	1,260
1	Significant	cf	bca	c		bd	dq	c	ь	Ь	ac	3	٥d	9	9	9	acd	ć	ac	90	9	9	cfm	dfaii	c	c	ae	d	ce	cef	c	cf	900	9	bce	30	ab	cf	30	bc
	Mean value	7.262	8,179	6,702	26,567	27,700	27.667	7.020	7.840	6.440	14.535	17,790	15,263	15.000	15.000	15.000	12.838	15.274	13.204	1.464	2.245	2.351	7.329	8.053	9,188	24,733	24,633	26.567	7.006	7.696	8.642	55.087	52,477	54,540	3.507	3,920	3,700	9,240	11.213	10.370
Olive oil+	Standard	0.295	0.060	0.140	1.242	0.265	1.550	0.299	0.086	0,108	0.487	1.361	2.066	0.000	0.000	0.000	0.436	0.924	1.245	0.244	0.531	0.206	0.131	0,188	0.383	0.473	0.379	0.208	0.113	0.169	0.334	3.030	1,760	2.920	0,296	0.202	0.392	1.097	1,219	0.575
1	Significant	df	fh	əf	cd	bcd	cehi	c	cef	d	bcd	30	cd	3	3	9	bc	ce	c	bc	30	9	ch	əfi	af	c	3	ea	c	de	dai	adea	ace	9	ba	ac	-	b	ac	acd
	Mean value	11.342	8,808	9.421	33.000	28,200	30.067	11.074	8,580	3.085	13.461	17.563	16.841	15.000	15.000	14.967	11.934	14.634	14.302	1.097	2,123	1.972	10.865	7.053	10.023	28,967	23,500	27.467	10.485	6,701	9.387	51.000	55.457	52,983	2.617	3.010	3,200	6.527	3,603	9,930
Olive oil++	Standard	0.766	0.233	0.426	1.664	1.153	0.289	0.789	0.246	0.415	0.778	4,122	3.085	0.000	0.000	0.058	0.620	2,131	2,151	0.878	0.234	0.570	1.345	0.105	0.193	1.026	0.200	0.153	1.349	0.124	0.179	6,170	0.817	3.541	0.200	0.750	1.012	1,126	2,402	1.516
1	Significant	bi	ы	6	be	df	fgh	bfa	ь	90	bcd	30	əd	9	3	3	bc	ce	ad	90	9	3	bfiik	bak	e	ь	bfa	d	bdef	bf	f	adefa	de	3	ach	30	ab	df	30	acd
	Mean value	9,458	7.010	9,214	28,633	27.000	29,067	9,318	6.651	8,971	14.867	13,935	18.683	15,000	15.000	15,000	12.926	12,284	15.049	1.624	1.675	2,426	8,360	8,934	8,430	24,533	26.367	25,200	8.046	8,550	7.984	55,663	53,707	52,700	3,380	3,633	3,700	9,603	9,990	10,110
Salt + / Olive oil +	Standard deviation	0,217	0,052	0,158	1,193	1,127	0,961	0,210	0,030	0,208	0,463	3,014	5,402	0,000	0,000	0,000	0,510	2,338	3,032	0,132	0,344	0,137	0,467	0,246	0,345	0,351	0,751	0,900	0,498	0,310	0,182	2,053	1,524	1,731	0,289	0,235	0,072	0,679	1,677	0,287
	Significant	h	d	əd	əd	əd	bghj	ef	а	ec	ac	ce	ad	٩	а	۵	bc	de	ac	bcd	ac	۵	chi	hel	əd	c	ce	abe	cf	٩	hg	bg	ac	۵	bci	bc	3	ь	ac	ac
Salt as J	Mean value	10,213	7,633	8,240	28,600	22,733	27,667	3,314	7,388	7,947	13,713	17,324	14,624	15,000	14,367	15,000	12,071	14,768	12,813	2,161	2,033	1,782	10,506	6,110	11,256	28,233	22,033	29,367	10,023	5,745	10,833	57,377	51,337	54,780	3,393	4,113	2,823	3,880	10,817	7,333
	Standard	0,142	0,336	0,230	0,700	0,462	1,234	0,154	0,391	0,236	2,816	2,118	2,010	0,000	0,058	0,000	2,475	1,251	1,628	0,157	0,233	0,620	0,120	0,230	0,061	0,379	0,777	1,350	0,200	0,324	0,103	5,686	1,704	1,063	0,839	0,532	0,168	2,727	0,713	0,787
onic on	Significant	ei	adgh	q	ad	f	ach	dq	ade	f	bc	de	cd	3	3	3	bc	ce	cde	3	ac	3	dj	i	9	ь	df	dfgh	d	9	i	adefg	ace	3	bch	30	Ь /	adefg	ac	- d
Saltad	Mean value	10,741	8,093	7,887	27,367	27,633	27,433	10,472	7,711	7,664	14,293	18,664	13,719	15,000	15,000	15,000	11,804	16,564	11,973	2,094	1,263	2,370	10,106	7,825	7,465	28,467	25,500	24,067	9,643	7,545	7,047	52,557	57,243	52,537	3,923	3,113	3,603	10,813	9,593	10,027
Oline oil ee	Standard	0,410	0,548	0,352	0,513	0,404	0,416	0,458	0,526	0,309	3,568	3,680	1,052	0,000	0,000	0,000	2,447	3,113	0,813	0,535	0,402	0,179	0,117	0,408	0,304	1,242	1,015	0,404	0,177	0,346	0,155	1,155	4,619	2,644	0,304	0,364	0,450	1,134	2,575	0,595
onre on	Significant	be	adeghij	ь	cd	bde	cejk	ь	abdef	f	bcd	96	cd	9	9	٩	bd	ce	cde	ac	bc	9	mlk	ik	ь	ь	acq	ь	d	de	k	bq	ace	9	fgi	ac	ab	( b /	ac	ac
Salt and	Mean value	9,261	8,760	6,840	29,300	28,133	26,467	9,043	8,448	6,666	14,971	20,039	12,263	15,000	15,000	15,000	12,653	17,463	2,054	2,043	2,729	2,100	7,685	9,113	9,619	23,388	26,233	26,300	7,277	8,661	9,267	51,953	54,797	53,613	3,967	3,513	3,470	9,663	10,727	10,583
Oline oil e	Standard	0,303	0,203	0,420	0,520	0,115	0,929	0,292	0,277	0,421	2,256	4,709	2,219	0,000	0,000	0,000	1,192	3,411	1,752	0,292	0,618	0,217	0,221	0,308	0,109	0,115	0,802	0,500	0,351	0,366	0,099	0,950	0,720	0,539	0,859	0,137	0,238	2,236	0,820	0,736
Onte on .	Significant	qh	bcfj	hf	ac	bde	aik	e	bf	d	bcd	30	bd	3	3	3	bc	ce	bde	ad	3	0	ghi	d	hf	c	ac	ach	c	0	fi	bg	ac	0	adegi	ac		adefg	ac	90

## b) By cereals

				Normal			Butter +		8	utter + / suga	t-	8	utter + / flour	r+	S	ugar + / flour	-		<b>Big particles</b>	[]
		Cereals	Mean value	Standard deviation	Significant	Mean value	Standard deviation	Significant												
		Helkom Vete	10,423	4,444	а	10,298	2,421	ab	12,558	4,891	ab	18,586	4,063	а	11,851	4,144	а	15,834	5,666	а
	Peak Load (N)	Ölands Vete	14,257	4,931	а	12,458	1,035	а	16,471	1,394	а	29,701	15,245	а	5,685	2,081	а	10,885	3,850	а
		Kallunda Varvete																		1
		Evolutionar	10,360	3,004	а	6,777	0,550	ь	11,630	2,915	ь	29,136	13,304	а	5,897	2,321	a	14,081	1,603	a
		Helkom Vete	15,000	0,000	а	14,967	0,058	а	15,000	0,000	a	15,000	0,000	а	14,967	0,058	a	15,000	0,000	а
	Deformation peak (mm)	Olands Vete	15,000	0,000	а	14,967	0,058	а	15,000	0,000	а	15,000	0,000	а	14,933	0,058	a	15,000	0,000	a
		Kallunda Varvete																		1
COMPRESSION		Evolutionar	15,000	0,000	а	14,933	0,058	а	15,000	0,000	a	14,967	0,058	а	14,900	0,000	a	15,000	0,000	a
		Helkom Vete	8,912	3,125	a	9,140	2,023	ab	10,595	3,412	a	15,827	3,303	a	6,632	1,646	a	12,940	4,404	a
	Final load (N)	Olands Vete	12,211	4,005	a	10,701	0,976	a	14,255	0,834	a	22,590	9,026	a	4,837	1,572	a	9,388	3,353	a
		Kallunda Varvete																		1
		Evolutionar	9,349	2,299	a	6,220	0,494	ь	10,424	2,303	a	22,465	8,264	a	5,039	1,464	a	12,152	1,361	a
		Helkom Vete	0,655	0,265	a	2,306	0,170	a	1,889	0,531	a	0,091	0,079	a	2,649	0,249	a	1,639	0,816	ab
	Adhesive force (N)	Otands vete	0,236	0,160	a	1,758	0,708	a	3,024	1,525	a	0,006	0,004	a	1,538	0,491	ь	1,291	0,208	a
		Kallunda Varvete	1 000	1.025		4.373	0.533		1 600	0.001		4 300	0.050		7.007	3 6 3 4		2.220	0.004	
		Evolutionar Helices Mate	1,908	1,025	a	1,3/3	0,523	a	1,698	0,361	a	1,388	0,859	a	7,897	7,574	D	2,329	0,221	D
		Allowed Vete	7,411	0,430	a	7,491	0,915	ab	7,117	0,150	a	11,626	0,136	a	5,829	0,259	a	10,667	0,164	-
	Peak load (N)	Change Vete	8,634	0,268	D	8,400	0,734		7,020	0,225		4,868	1,147	D	5,770	0,155		7,812	0,347	•
		Kallunda Varvete Biolutionar	6 333	0.054		6.673	0.267		3.349	1.070		6.040	0.190		7.094	0.150		11.330	0.004	
		Helioses Mate	0,727	0,004		3,073	0,307		3,240	1,070		0,040	0,103		7,004	0,100	0	22,007	0,304	6
		Ölandis Vete	20,333	0,709		22,333	0,351		23,000	0,500		23,600	0,819		23,400	1,652		23,867	0,666	
EXTENSION	Deformation peak (mm)	Kallunda Vasata	21,200	0,430	4	21,333	9,111	4	19,733	0,377		10,200	0,365		20,700	1,372		20,933	0,155	
		Evolutionar	20,800	0.361		21 933	0.569		18 333	0.153		18.967	0.404		20,800	1 400		24 767	0.981	
		Helicom Vete	7 222	0,412		7 391	0.913	-	6 969	0,193		11 222	0.064		5 791	0.258		10 519	0,302	
		Ölands Vete	8.407	0,413		8 259	0,729		6,699	0.261		4 565	1 219		5 714	0,163		7 705	0,250	
	Final load (N)	Kallunda Varvete	4,447	0,130		6,233	0,723		0,000	0,202		4,303			4,144	0,103		1,103	6,233	
		Evolutionar	6.493	0.036	a	5.597	0.381	ь	3.142	1.097	ь	5.734	0.153	ь	7.023	0.165	ь	11.012	0.548	6
		Helkom Vete	31.445	3,695	a	10 181	1 345	ab	5 798	1 203	a	6.811	3 777		4.975	1 383	a	21.864	3.245	
		Ölands Vete	23,683	10.177	ab	7,274	1,795	3	2,284	0.098	ь	14 296	4,732		10,997	4,752	ab	10,700	2 326	ь
	Rupture load (N)	Kallunda Varvete						-			-			-						
		Evolutionar	18,844	3,324	ь	13,194	1,365	ь	4,008	0,945	a	7,326	2,151	a	12,751	2,798	ь	5,134	1,712	c
RUPTURE		Helkom Vete	0.900	0.100	а	1.567	0.379	а	1,476	0.569	ab	0.800	0,100	а	0.500	0.346	a	0.933	0.321	a
		Ölands Vete	1,767	0,306	ь	1,967	0,551	а	2,433	0,115	a	1,000	0,100	a	1,033	0,551	a	2,233	0,643	а
	Deform rupture (mm)	Kallunda Varvete																		
		Evolutionar	1,600	0,265	ь	0,900	0,346	a	1,467	0,058	ь	1,367	0,451	a	0,633	0,289	а	1,333	0,252	a
		Helkorn Vete	59,207	1,570	ab	59,553	1,348	а	56,453	1,051	а	58,890	0,817	а	52,643	3,476	a	56,130	0,301	а
		Ölands Vete	56,760	1,113	а	58,783	0,196	а	57,350	1,062	a	55,737	1,135	d.	55,570	0,351	а	58,150	1,269	а
	• ·	Kallunda Varvete																		
		Evolutionar	61,297	0,293	ь	58,333	0,811	а	57,663	0,081	а	58,037	4,025	ab	51,537	5,252	а	58,297	2,281	a
		Helkom Vete	6,570	0,293	ab	8,193	0,587	a	5,830	0,234	a	5,597	0,071	a	6,777	0,140	ь	5,973	0,276	а
0108		Ölands Vete	5,877	0,536	а	5,570	0,157	ь	5,093	0,165	ь	5,967	0,576	а	5,413	0,072	ab	5,850	0,173	a
	-	Kallunda Varvete																		( T
		Evolutionar	5,943	0,391	ь	6,443	0,101	c	4,943	0,830	ab	5,423	0,462	а	6,900	1,175		5,483	0,285	a
		Helkom Vete	16,280	0,271	a	17,973	0,404	a	14,433	0,287	a	14,877	0,240	a	14,880	2,046	a	14,053	0,222	a
	b*	Ölands Vete	15,087	0,817	ab	15,600	0,249	ь	15,323	0,696	а	15,127	0,782	а	15,573	0,221	a	17,030	0,370	ь
		Kallunda Varvete																		1
		Evolutionar	17,110	0,405	ь	17,153	0,261	а	13,487	1,580	a	14,473	1,474	а	13,370	2,732	a	15,160	1,000	ab

				Normal			Sugar +		B	rtter + / sugar	r+	Bu	rtter + / flour	+	B	utter - / flour			Big particles	
		Cereals	Mean value	Standard deviation	Significant															
		Helkorn Vete	7,367	2,072	а	6,577	1,101	ab	6,155	1,269	а	11,838	2,833	а	20,151	11,933	а	8,759	4,698	ab
	Peak load (N)	Ölands Vete	7,182	2,329	а	10,700	2,409	а	8,282	2,290	а	24,647	7,869	а	8,871	3,282	а	9,026	0,806	а
		Kallunda Varvete																		
		Evolutionar	5,805	0,338	а	5,301	0,886	b	7,003	2,187	а	6,964	2,435	а	8,754	1,894	а	5,949	0,772	b
		Helkorn Vete	14,967	0,058	а	14,967	0,058	а	14,900	0,000	а	15,000	0,000	а	15,000	0,000	а	15,000	0,000	а
	Deformation peak (mm)	Ölands Vete	14,933	0,058	а	15,000	0,000	а	15,000	0,000	а	14,967	0,058	а	15,000	0,000	а	14,967	0,058	а
		Kallunda Varvete																		
COMPRESSION		Evolutionar	14,967	0,058	a	15,000	0,000	а	14,933	0,058	а	14,967	0,058	а	14,967	0,058	а	14,933	0,058	а
		Helkorn Vete	6,300	1,455	а	5,756	0,661	а	5,513	1,138	а	9,449	1,868	a	10,240	5,874	а	7,317	3,802	ab
	Final load (N)	Olands Vete	6,204	1,796	а	8,513	1,105	b	6,957	1,580	а	18,822	3,730	b	6,833	2,329	а	7,173	0,676	а
		Kallunda Varvete																		
		Evolutionar	5,212	0,399	a	4,528	0,682	a	6,136	1,785	a	6,130	1,995	a	6,742	0,841	a	5,302	0,705	D
		Helkorn Vete	1,983	0,437	a	1,578	0,112	a	1,585	0,467	a	0,968	0,344	а	8,084	3,629	a	1,215	0,449	a
	Adhesive force (N)	Olands Vete	1,482	0,615	а	2,253	0,432	а	3,373	3,949	а	1,223	1,615	а	Z,910	1,614	а	2,339	0,163	D
		Kallunda Varvete	1 204	0.330		2.400	3.636	-	1 000	0.004		0.520	0.142		2.010	1.100		1 202	0.000	
		Evolutionar Valkets Vata	1,394	0,339	a	3,480	3,375	a	1,880	0,624	a	0,530	0,143	a	5,810	1,109	a	1,301	0,409	3
		Alanda Vata	4 033	0,087		4.077	0,050		8,053	0,465		7,691	0,328	-	0000,0	0,462	30	3,343	0,233	-
	Peak load (N)	Valluada Vasuata	4,032	0,437		4,077	0,004		0,032	0,157		7,001	0,272		0,030	0,313		0,704	0,175	
		Kallunda varvete	6 / 99	0.000		6 610	0.212	-	7 647	0.645		6.439	0.919		5 670	0.151		9 010	0.492	
		Helkorn Vete	25 933	0,065		23,867	0,512		25 233	0,643		23,867	0,850	3	23,167	1 550	3	19,033	0,462	
		Ölands Viete	18 967	0,058		17 867	1 505		22 223	1,007		19 767	0.404		20,033	2 977		20,900	0,737	
EXTENSION	Deformation peak (mm)	Vallunda Varuata	20,207	0,030	-	21,001	4,000	-		2,007	-	20,000	0,101		20,000			20,000	4,141	
		Evolutionar	21.467	0.208		21 500	1 249		19.167	5.787	ab	19 300	1 493	ь	21 233	1.405		21.100	1.000	
		Helkorn Vete	10.175	0.091	а	10.156	0.072	a	10.838	0.495	а	9,707	0.441	a	6,518	0.472	ab	5,583	0.345	а
		Ölands Vete	3,954	0,434	b	3,981	0,663	b	7,983	0,107	b	7,378	0,337	b	6,365	0,145	а	6,720	0,156	b
	Final load (N)	Kallunda Varvete																		
		Evolutionar	6,409	0,080	c	6,503	0,319	c	7,084	0,728	ь	5,994	0,508	c	5,631	0,153	ь	8,826	0,471	c
		Helkorn Vete	6,009	0,899	а	5,302	0,077	а	4,432	1,788	ab	4,169	0,691	а	4,434	1,259	а	3,355	0,770	а
	Durature land (b)	Ölands Vete	11,788	2,299	b	13,081	0,893	ь	4,453	0,108	а	8,444	1,376	ь	2,513	0,222	а	3,720	1,298	а
	Nupture load (N)	Kallunda Varvete																		
RUPTURE		Evolutionar	27,900	9,118	ab	4,432	0,394	а	2,392	0,088	b	7,912	2,552	ab	2,359	0,064	а	2,865	0,385	а
norronz		Helkorn Vete	2,133	0,651	а	2,033	0,058	ab	0,013	0,006	а	1,667	0,513	а	1,833	0,289	а	1,433	0,289	а
	Deform rupture (mm)	Ölands Vete	6,167	0,929	b	4,967	1,274	а	2,067	0,808	b	4,533	1,429	а	1,000	0,000	b	2,333	0,764	а
		Kallunda Varvete																		
		Evolutionar	4,400	1,249	ab	1,633	0,321	b	1,067	0,115	b	5,733	3,612	а	0,800	0,265	b	1,600	0,141	а
		Helkorn Vete	62,303	0,310	a	59,267	0,715	а	56,710	0,992	а	60,987	0,142	а	58,353	1,242	а	59,807	0,967	а
	L*	Olands Vete	61,037	0,250	ь	59,120	0,278	а	58,523	1,765	а	56,907	1,371	b	56,903	1,651	а	60,180	0,527	а
		Kallunda Varvete																		
		Evolutionar	59,590	1,149	b	60,673	1,287	a	58,293	0,330	a	59,440	1,840	b	56,887	1,463	a	59,563	0,558	a
		Helkorn Vete	5,627	0,042	а	5,387	0,385	а	5,790	0,480	а	5,940	0,066	а	5,640	0,161	a	6,193	0,336	а
COLOR	a*	Olands Vete	5,750	0,405	а	5,933	0,500	а	5,470	0,304	а	5,517	0,436	а	5,270	0,183	ab	5,807	0,031	a
		Kallunda Varvete							6.969					_						
		Evolutionar Valkets Vete	4,897	0,256	0	4,407	0,264	a	5,767	0,268	3	5,663	0,169	a	5,090	0,244	0	5,010	0,291	a
		Alande Vete	16,403	0,656	a	15,173	0,365	a	15,800	0,720	a .	15,967	0,410	a	15,/90	0,973	a 	16,463	0,235	a
	b*	Vianus Vete	16,850	0,415	a	16,753	0,236	0	16,033	1,101	a	14,400	1,110	a	15,710	0,894	a	16,427	0,663	d
		Kallunda Varvete	14 130	1 250		15 863	0.200		15 212	0.202		16 247	1,090		14.000	0.793		16 227	0.350	
		croistional	14,130	063,4	đ	13,005	0,230	4	213,61	0,205	đ	10,247	1,080	đ	14,400	0,782	4	10,237	0,300	4

					EXTE	INSION (a	lough)								C(	DMPRESS	iON (dou	apj								EXTI	ENSION ()	pasta]								COLOR				
		Pe	ak load (	N)	Deforma	tion @PE	(AK (mm)	Fi	inal load (	N)	Pe	ak load (l	N)	Deforma	tion @PE	AK (mm)	Fi	inal load (	(N)	Adhe	sive Forc	e (N)	P	eak load (	(N)	Deform;	ation @PE	(AK (mm)	Fi	) beol lea	N)		Ľ.			٩.			ь.	
Cereal		Helkorn Vete	ölands Vete	Kallunda Varvete Evolutiona	Helkorn Vete	ölands Vete	Kallunda Varvete Evolution	Helkorn Vete	ölands Vete	Kallunda Varvete Evolutiona	Helkorn Vete	ölands Vete	Kallunda Varvete Evolutio																											
	Mean value	4,742	7.314	8,808	27,167	25,733	26,967	4,432	6,923	8,347	17,315	19,441	21,731	15,000	15,000	14,967	14,551	13,886	18,308	1,865	2,120	2,935	6,104	8,347	9,252	21,333	25,233	26,033	5,111	7,956	8,900	62,213	52,677	54,000	5,303	3,933	3,653	13,733	11,617	10,267
Normal Recipe	Standard deviation	0,737	0,268	0,044	1,304	0,764	0,473	0,723	0,265	0,086	5,613	1,612	7,516	0,000	0,000	0,058	4,135	3,492	4,366	0,449	0,344	1,284	0,508	0,310	0,032	0,666	1,063	0,115	0,314	0,438	0,100	0,108	3,414	2,930	0,631	0,287	0,516	10,600	0,828	1,868
	Significant	a -	ь	c	3	3			ь	e	9	3	2	3	3	3	3	3		3		3		ь	c	3	ь	ь	3	ь	ь	3	ь	ь		ь	ь	3	3	9
	Mean value	10,696	8,043	8,868	29,167	25,733	25,367	10,457	7,604	8,367	25,809	48,240	21,210	15,000	15,000	15,000	19,704	30,563	17,839	2,448	2,255	1,805	11,172	9,018	7,497	27,900	25,233	22,700	10,699	8,394	6,883	51,273	52,587	52,890	3,757	3,697	3,453	9,067	9,627	7,643
Hight particule	Standard deviation	0,171	0,367	0,534	0,451	0,907	0,208	0,119	0,335	0,492	4,495	5,879	4,276	0,000	0,000	0,000	2,003	2,667	3,110	0,019	0,344	0,799	0,147	0,503	0,290	0,173	0,757	0,173	0,153	0,469	0,353	2,526	1,128	5,152	0,046	0,372	0,161	1,289	0,552	1,529
	Significant	3	ь	Ь	9	ь	ь	9	ь	ь	0	σ	e	3	9	9	9	ь	c	9	9	9	9	ь	c .	9	ь	c	9	ь	<u>د</u>	9	9	9		9	9	9	3	9
	Mean value	10,425	8,660	8,482	29,367	27,533	28,500	10,021	8,293	8,227	22,612	21,303	21,099	15,000	14,367	14,967	18,370	18,286	18,333	2,082	2,355	2,371	10,582	9,303	8,079	27,567	27,100	24,700	10,165	8,681	7,543	52,817	43,770	52,367	3,670	4,267	3,447	9,777	10,937	9,363
Salt +	Standard deviation	0,413	0,304	0,436	0,635	1,266	0,624	0,333	0,293	0,526	4,256	2,789	2,102	0,000	0,058	0,000	30,080	2,403	1,268	0,318	0,062	0,079	0,584	0,453	0,062	0,231	0,523	0,500	0,435	0,403	0,155	1,951	1,244	3,317	0,370	0,225	1,135	1,186	0,310	2,727
	Significant	3	b	ь	3	3	9	9	ь	ь	9	9	9	3	9	9	3	3	9	9	9	0	0	ь	c	۵	9	ь	0	ь	c	3	0	9	0	9	٩	9	0	0
	Mean value	6,752	8,819	10,896	25,633	27,933	31,900	6,401	8,555	10,551	18,467	20,647	20,595	14,967	15,000	15,000	15,342	17,219	17,584	1,601	2,438	2,303	8,969	7,749	10,662	25,133	24,533	27,700	8,166	7,101	10,136	45,290	52,943	57,280	2,593	3,533	3,267	5,557	9,780	11,237
Salt ++	Standard deviation	0,381	0,117	0,172	1,069	0,551	1,493	0,426	0,094	0,101	2,868	1,234	4,162	0,058	0,000	0,000	2,288	1,199	3,218	0,386	0,043	0,292	0,496	0,395	0,246	0,586	0,153	0,173	0,560	0,462	0,206	1,201	3,001	2,126	0,587	0,461	0,330	0,624	1,334	1,260
	Significant	a -	ь	. c	9	ь	c		ь	- C	9	3	9	3	3	3	3	3	3	3	3	9		ь	c .	0	3	ь	3	3	ь	3	ь	ь	9	9	3	3	ь	Ь
	Mean value	7,262	8,179	6,702	26,567	27,700	27,667	7,020	7,840	6,440	14,535	17,790	15,263	15,000	15,000	15,000	12,838	15,274	13,204	1,464	2,245	2,351	7,323	8,053	3,188	24,733	24,633	26,567	7,006	7,696	8,642	55,087	52,477	54,540	3,507	3,320	3,700	3,240	11,213	10,370
Olive oil+	Standard deviation	0,295	0,060	0,140	1,242	0,265	1,550	0,299	0,086	0,108	0,487	1,361	2,066	0,000	0,000	0,000	0,436	0,324	1,245	0,244	0,531	0,206	0,131	0,188	0,383	0,473	0,379	0,208	0,113	0,169	0,334	3,090	1,760	2,920	0,296	0,202	0,392	1,097	1,219	0,575
	Significant	0	ь	0	9	0	9	9	Ь	9	0	ь	ъb	0	9	9	0	Ь	ab	9	ab	ь	0	ь	- C	0	9	ь	0	ь	<ul> <li>c</li> </ul>	9	9	9	9	9	۵.	9	0	9
	Mean value	11,342	8,808	9,421	33,000	28,200	30,067	11,074	8,580	9,085	13,461	17,563	16,841	15,000	15,000	14,967	11,934	14,694	14,302	1,097	2,123	1,972	10,865	7,053	10,029	28,967	23,500	27,467	10,485	6,701	9,387	51,000	55,457	52,983	2,617	3,010	3,200	6,527	3,603	9,930
Olive oil++	Standard deviation	0,766	0,233	0,426	1,664	1,153	0,289	0,789	0,246	0,415	0,778	4,122	3,085	0,000	0,000	0,058	0,620	2,131	2,151	0,878	0,234	0,570	1,345	0,105	0,193	1,026	0,200	0,153	1,343	0,124	0,179	6,170	0,817	3,541	0,200	0,750	1,012	1,126	2,402	1,516
	Significant	3	b	ь	3	ь	ab	9	ь	ь	9	9	0	2	9	9	9	3	9	9	ab	ь	9	ь	9	9	ь	9	9	ь	9	3	9	9		9	9	9	ab	b
	Mean value	9,458	7,010	3,214	28,633	27,000	29,067	9,318	6,651	8,971	14,867	13,935	18,683	15,000	15,000	15,000	12,926	12,284	15,049	1,624	1,675	2,426	8,360	8,934	8,430	24,533	26,367	25,200	8,046	8,550	7,984	55,663	53,707	52,700	3,380	3,633	3,700	9,603	9,990	10,110
Salt + / Olive oil +	Standard deviation	0,217	0,052	0,158	1,193	1,127	0,961	0,210	0,090	0,208	0,463	3,014	5,402	0,000	0,000	0,000	0,510	2,338	3,032	0,132	0,344	0,137	0,467	0,246	0,345	0,351	0,751	0,900	0,498	0,310	0,182	2,053	1,524	1,731	0,289	0,235	0,072	0,679	1,677	0,287
	Significant	3	ь	3	3	3	3	3	ь	3	9	9	9	3	3	3	3	3	3	3	3	ь	0	9	3	0	ь	ab	3	3	3	3	3	3	9	9	3	3	3	3
	Mean value	10,213	7,693	8,240	28,600	22,733	27,667	9,914	7,388	7,947	13,713	17,324	14,624	15,000	14,367	15,000	12,071	14,768	12,819	2,161	2,093	1,782	10,506	6,110	11,256	28,233	22,033	29,967	10,023	5,745	10,833	57,377	51,337	54,780	3,393	4,113	2,823	3,880	10,817	7,993
Salt ++ / Olive oil ++	Standard deviation	0,142	0,396	0,230	0,700	0,462	1,234	0,154	0,391	0,236	2,816	2,118	2,010	0,000	0,058	0,000	2,475	1,251	1,628	0,157	0,293	0,620	0,120	0,230	0,061	0,379	0,777	1,950	0,200	0,324	0,103	5,686	1,704	1,069	0,839	0,532	0,168	2,727	0,713	0,787
	Significant	9	ь	Ь	а	ь			ь	ь	9	9	9	9		9	9	9		9		3		ь	e (	9	ь	9	a	ь	6	9	3		ab	9	ь	ab	3	Ь
	Mean value	10,741	8,093	7,887	27,367	27,633	27,433	10,472	7,711	7,664	14,293	18,664	13,719	15,000	15,000	15,000	11,804	16,564	11,973	2,034	1,263	2,370	10,106	7,825	7,465	28,467	25,500	24,067	3,643	7,545	7,047	52,557	57,243	52,537	3,923	3,113	3,603	10,813	9,593	10,027
Salt + / Olive oil ++	Standard deviation	0,410	0,548	0,352	0,513	0,404	0,416	0,458	0,526	0,309	3,568	3,680	1,052	0,000	0,000	0,000	2,447	3,113	0,813	0,535	0,402	0,179	0,117	0,408	0,304	1,242	1,015	0,404	0,177	0,346	0,155	1,155	4,613	2,644	0,304	0,364	0,450	1,134	2,575	0,535
	Significant	9	b	b	9	9		9	ь	ь	9	9	9	9	9	9	9	9		ab		b	9	ь	Ь	9	b	ь	9	b	ь	9	9			9	9	9	9	
	Mean value	9,261	8,760	6.840	29,300	28,133	26,467	9.043	8,448	6,666	14,971	20.039	12.263	15.000	15.000	15.000	12.653	17.463	2.054	2.043	2,729	2,100	7.685	9,113	9,619	23.388	26.233	26,300	7.277	8.661	9,267	51,953	54,797	53.613	3,967	3,513	3,470	9,663	10,727	10,583
Salt ++ / Olive oil +	Standard deviation	0,303	0,203	0,420	0,520	0,115	0,929	0,292	0,277	0,421	2,256	4,709	2,219	0,000	0,000	0,000	1,192	3,411	1,752	0,292	0,618	0,217	0,221	0,308	0,103	0,115	0,802	0,500	0,351	0,366	0,033	0,950	0,720	0,539	0,859	0,137	0,238	2,236	0,820	0,736
	Significant	3	3	ь	3	30	<u>د</u>	3	-	ь	3	3	3	3	3	3	3	3	3	3	3	3	3	ь	ь	3	ь	ь	3	ь	ь	3	ь	зb	3	3	3	3	3	3