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ECONOMIC IMPACT OF SOYBEEN-FREE FEEDING ON LAYING HENS

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Abstract: It is important to try to find alternative ways of feeding, to try to replace the feedstuff coming from overseas. This way, farmers can save money, and animal breeders can support their plant grower colleagues by buying domestic products. With this, we can also help the environment by not importing large amount of grains, and reducing the ecological footprint. It was examined how soybean and soybean-free feeding affected the laying hens, in terms of productivity, death loss, dirty eggs rate and broken/waste egg rate. Our main goal was to examine the economic impact, of the above-mentioned ways of feeding. The investigation has been done in two separate farms, with the same technology used in the barns, and the same Lohmann Brown Classic laying hens, with a similar stock density. The research proved that soybean-free feeding has much better economic outcome, than the regular feeding with the use of soybeans. The imported soybeans (from America) were replaced by domestically purchased sunflower meal. With the use of sunflower, the farms' economic status got better, and the logistics were easier to handle. Millions of forints were saved, just by the feeding method. On top of this, the ecological footprint had been decreased, as the material of the feedstuff were bought domestically, and long transportation was not required. Added values, such as the statement of "GMO-free product" were created thanks to this soybean-free feeding method.

Keywords: laying hen, soybean-free, feeding, economic impact

1. Introduction

Most of farmers in Hungary use soybean in their feedstuff, to achieve the required amount of protein needed for optimal and high-quality production. Because of its favorable characteristics, soy is widely used as the main protein source in our global feed and food supply, think of its inclusion in poultry feed (Ito, 2021). Since it is so useful and available, the poultry industry has little interest in finding alternatives. Therefore, there has not been a lot of work on other ingredients that may be adequate substitutes for soy (Hermes, 2011). It is a great source of protein for human and animal consumption as well, but it can be replaced. Soybean meal remains sovereign, but it can be easily replaced when other protein sources can offer a more profitable solution – it only takes knowledge and experience (Mavromichalis, 2022). Providing laying hens with a soy-free diet is possible; but alternative, more expensive, sources of protein are needed in order for the animals to maintain the same performance levels (Dijkslag, 2016). Majority of soybean that are produced, are grown with genetically modified seeds. In addition, soybean production in some parts of the world brings with it significant sustainability concerns, as it's associated with destruction of natural grasslands and deforestation (Hein, 2021). Other than that, soy free feeding can increase the revenue of the farmers greatly (Lourenco et al, 2019). There are some economic, ecological and heath drawbacks to feeding and eating soybeans (Ridley, 2021). Soybean can be replaced with sunflower meal, without compromising the quality and production of the flock (Murru and Calvo, 2020). There are several ways producers could maximize their income and decrease the ecological footprint. Poultry feed in Hungary receives the largest amount of soybean feed (300 thousand tons), followed by pig and cattle feed (Agrárszektor, 2019). The leading soybean producer of the world is United States. The distance the product has to travel through is really far. Buying and feeding local grains, which have much less of an economic and harmful environmental effect, as the long distances are eliminated, therefore the transportation which is needed is much shorter (Castanheira and

Freire, 2013). Replacing soybean and imported feedstuff domestically can increase the farmer's revenues. Shorter distances are needed for the transportation of the grains, with that cheaper prices can be achieved. Nowadays, people are more environmentally friendly, and want to be more conscious about not polluting the world too much. People are more and more health conscious as well, which brings us to the point of consuming cleaner foods. Health-conscious individuals make big effort to eat the right foods from right places. Eliminating the soybean, which is genetically modified, and replacing it with the non-genetically modified sunflower meal, beyond the health advantages, lets us increase the prices of the marketed eggs, and makes the actual production cheaper by buying the feedstuff from the domestic market. Among the several specific alternative protein sources sunflower meal seems to be the most promising.

2. Materials and methods

The Lohmann Brown 'Classic' is used in every corner of the globe and has been highly successful due to its ability to provide an efficient layer that is adaptable to varying production systems and styles of the market. Our examinations were done with two flocks at two different farms. The first farm we did our research at, is located in Rúzsa, Hungary. This village is 34 kilometres from the 3rd biggest city in Hungary, called Szeged. This company was founded in 2014. The early stages in the company's life, the hens were transported to the farm at around 20 week-old age for egg production. Since 2018, the rearing of day-old chicks are done by the company. The company houses around 40.000 laying hens. The second company is located in Abony (Pest County), around 50 kilometres far from Kecskemét. This farm was founded in 2016. The farm does not rear day old chicks, but he buys the 16 weeks old laying hens. The farm houses around 23.000 laying hens. Both farms use the Lohmann Brown classic type laying hens for production.

During our research two different flocks were compared. These flocks were housed in similar environments, in two separate barns. In both farms the cages are called colony 86 enriched cages from the Italian company Valli. These cages are equipped with perches, artificial grass, claw grinder, side feeders, and a spiral inside feeder, to ensure a nice and effective environment for the hens and for the production. The flock gets 16 hours of light a day, which is achieved by LED lights, from Dilaco lighting company. The lights are dimmable, which means, the flock does not get full light immediately. The barns have a light intensity of 25-30 lux.

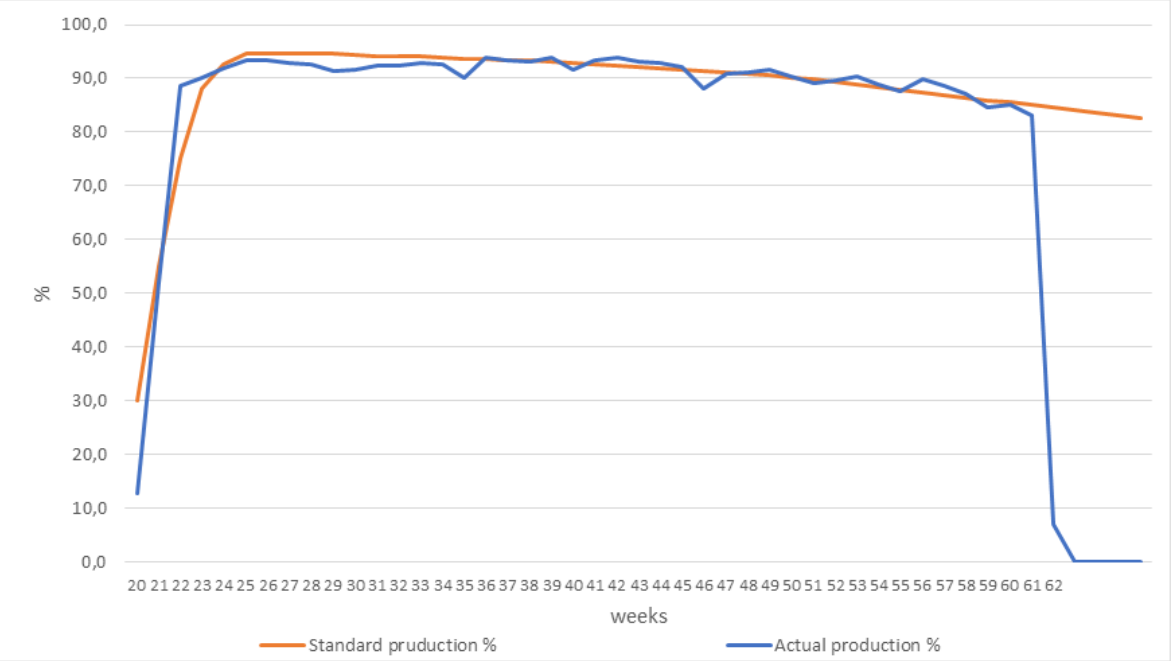
The feeding is done with the side and inside feeders. Those are filled at separate times. During the examination, two phase feeding method was applied. In the first phase of feeding, layer 1 type feed was fed to the flock. This feedstuff was given from the 20th until the 42nd week of age. The second phase with layer 2 type was done from their 43rd, until the age of 62 weeks old. In one barn soybeans were replaced with sunflower meal, to get the optimum results in production. The flock in Abony was the one, where the feeding with soy took place. Tunnel ventilation system is used on the farm, to ensure even air flow in the barns. Our examination were done between the flock's 20th until their 62nd week of age, from 2021 February to 2022 August.

Every day, data was written down in the farm's notebook. Whole weeks of egg production was recorded in the file, from which, the actual production in % is visible on chart. The dirty (with manure) and waste eggs were separately recorded daily into the farm's notebooks as well. At the end of the week, these were added up, divided by the whole week's egg production, and times by 100 to get the percentage of the dirty and waste eggs of the week.

3. Results

On the *Figure 1*, we can see a line, called "standard production". These numbers are from the breeder's Lohmann brown classic handbook. This can be seen in percent as well and it is a speculation, of how the flock should perform ideally. *Figure 1* represents the production of the flock in Rúzsa, which was fed without the use of any soybeans.
We can see that the production was near the standard production line. The production did not decrease, or increase significantly. The increase in the first part of the period can be attributed to the age of the flock, and the start of the feeding period. There are some crashes in the 25th and 26th week, which can be attributed to the malfunction of the feeder line (for few hours). From their 60th week, the production decreased significantly. This change in production occurred, because of the moulting of the flock, as the feedstuff, light and water was reduced significantly.

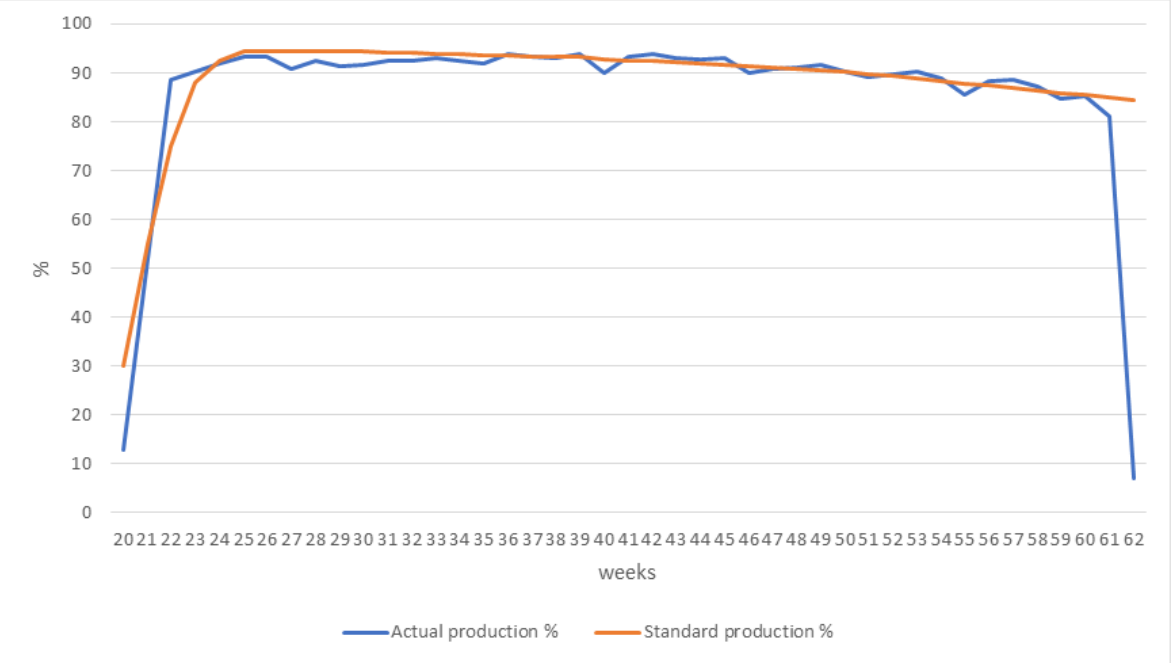
Figure 1: Egg production results of soy-free feeding technology



Source: own research

Figure 2 is based on the results collected the farm in Abony. The red line indicates the standard production in percent, which means, that would be the optimal production ratio for the Lohman Brown classic hybrids. On the left side, from 0-100 we can see the percentage of the production. The bottom line, from 20-62 indicates the age of the flock in weeks.
These hens were able to produce according to the standards as well. From the flock's 20th week, we can see big increase in production as well, like in *Figure 1*. Some crashes of production occurred here as well for unknown reasons. We can see that the replacement of soy did not make considerable impact on the egg production.

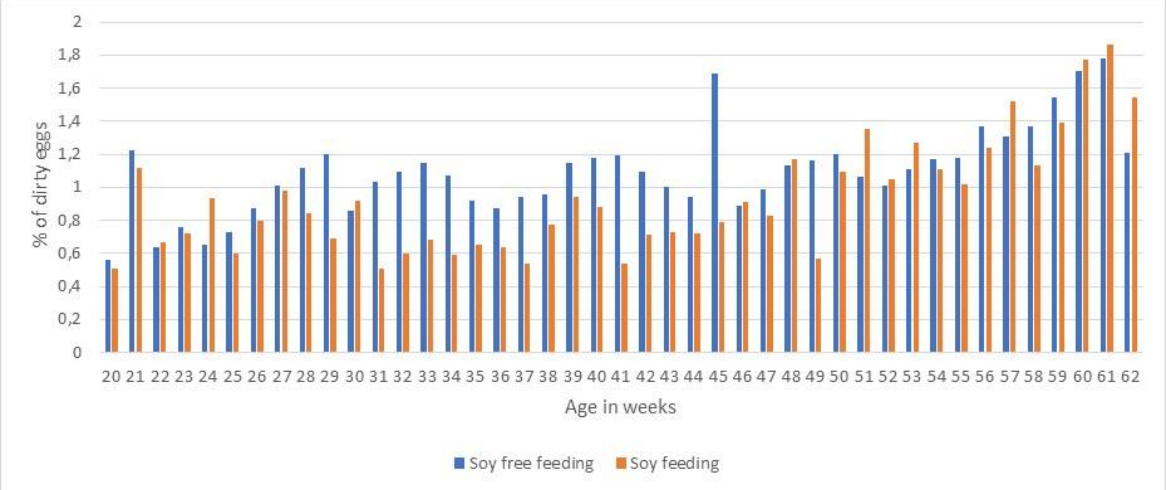
Figure 2: Egg production results of soybean feeding technology



Source: own research

The dirty egg rate date of the two flocks are on *Figure 3*, as there are bigger differences shown, unlike in production. *Figure 3* only includes the eggs which had been contaminated with feces of the hen. Dirty eggs have less value than the clean eggs, but more value than the broken eggs. Blue lines indicate the soy free fed stock. The orange lines indicate the other farm, where soy in the hen's diet was used. The rate of dirty eggs were higher in the case of soy free fed flock. Around 0.5% increase in dirty eggs were visible during the period of 30-46 weeks of age. Feeding soy free requires a change in feed components. Around 14-15 weeks the rate of dirty eggs was more crucial, where roughly 0.5% difference was shown, which is not too much, but still visible.

***Figure 3*: Rate of dirty eggs in soy free feeding and soy feeding**

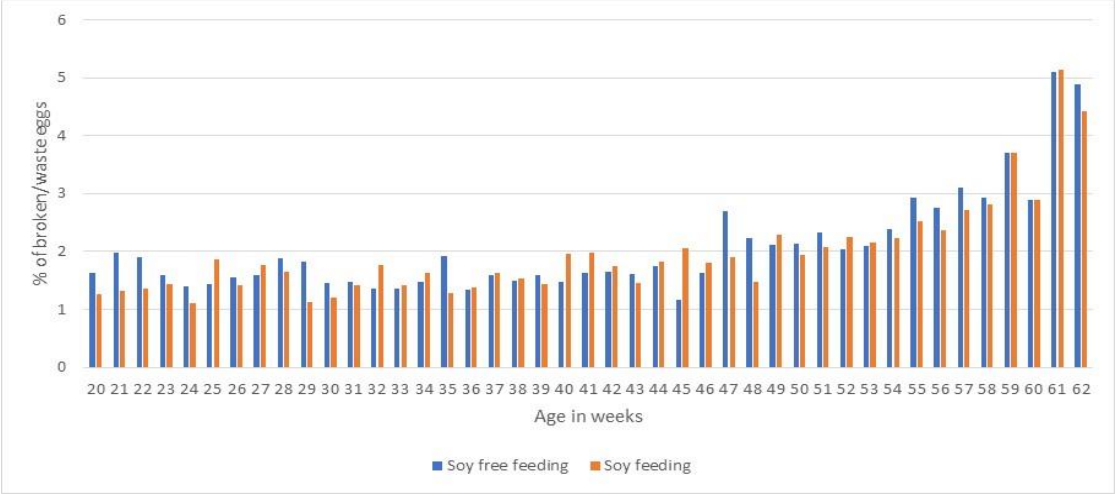


Source: own research

Regarding the broken and waste eggs we have three groups. These eggs cannot be marketed for a full price, as they are damaged. There are some eggs, which are damaged by the beak of the hens. These eggs are still eatable and do not have any quality problem with

the egg white and yolk. When the shell is cracked, and the shell membrane is damaged, problems like rotting can occur. These cracked eggs cannot be marketed for consumption, as it can start to rot, or in some cases worms can start develop inside of them. There is the last group which are the waste eggs. This means, the shape of the egg is completely broken, and the egg white and yolk is coming out of the shell. These waste eggs can only be marketed for animal consumption in barrels. *Figure 4* shows all of the above-mentioned egg groups are listed and the two flocks are compared.

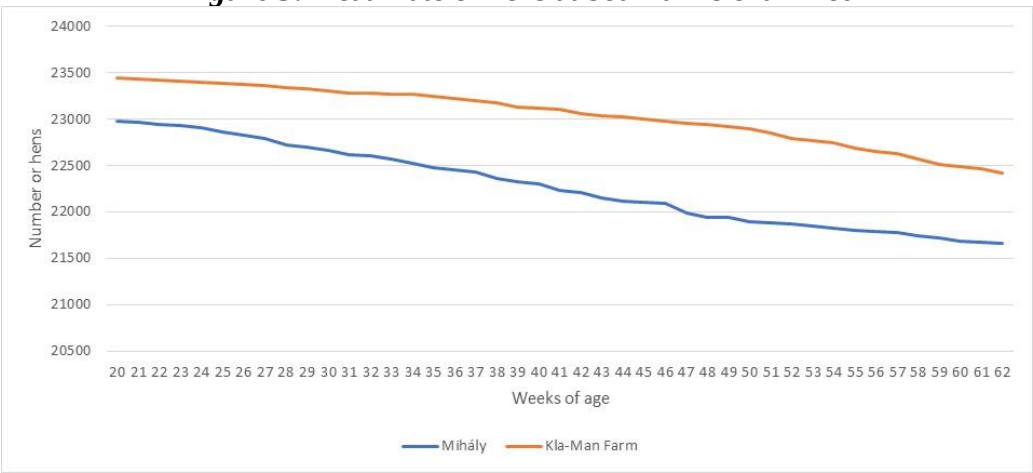
Figure 4: The rate of broken and waste eggs in soy free feeding and soy feeding



Source: own research

We can see that there is no significant difference between the two flock's broken egg rates. On average, negligible differences can be seen when comparing the two ways of feeding. As the hens are getting older, the size of the eggs start to become bigger and bigger, until a certain extent. The eggs are growing in size, bigger surface area is available therefore the fragility of the shell is increasing. From the 47th week, we can see this phenomenon appear on the chart as well.

Figure 5: Death rate of hens at both farms examined



Source: own research

On *Figure 5* the death rates of the two different flocks are projected. The death rate at both farms were favourable, high death count did not occur suddenly. The bird count is slowly decreasing, due to the death of the hens that is what the lines are showing. Mihály's

farm (soy fed) had a slightly worst death rate between the 27th and 50th week, than the soy free fed Kla-Man farm flock. These numbers (1315 and 1041 hens) are not significant, when we look at the starting population.

4. Discussion

Our research topic was regarding the question of feeding laying hens with, or without the use of soybeans. We were curious about how much of a difference it makes, when it comes to changing the protein source in the feedstuff. As we know, soybeans make up most of the protein content in the laying hen's feedstuff, which is very much needed for a good production. These beans are coming from the American continent, which is far from Europe. Sunflower was the perfect component to replace the soy. The main research goal was to successfully change the feedstuff, so that it can be more profitable for the farmers. It was examined and found that the production between the two flocks (soy and soy free feeding) did not have significant differences. It was great to see that the change in the feedstuff did not affect the flock's overall production. We can see in the examination results, that the rate of dirty eggs were more common in case of the soy free fed flock. Some weeks, nearly 1% difference were shown in the results (lowest result was 1.17% and 5.13% the highest). This means that the production was similar, but the dirty eggs were more in case of the soy free feeding, which means the top-quality marketable eggs were less. Regarding the death rate and broken eggs rate, no significant differences were shown. The difference in shipping costs results in an indirect competitive advantage. This is shown in the fact that the cost of the substitute input material is lower.

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