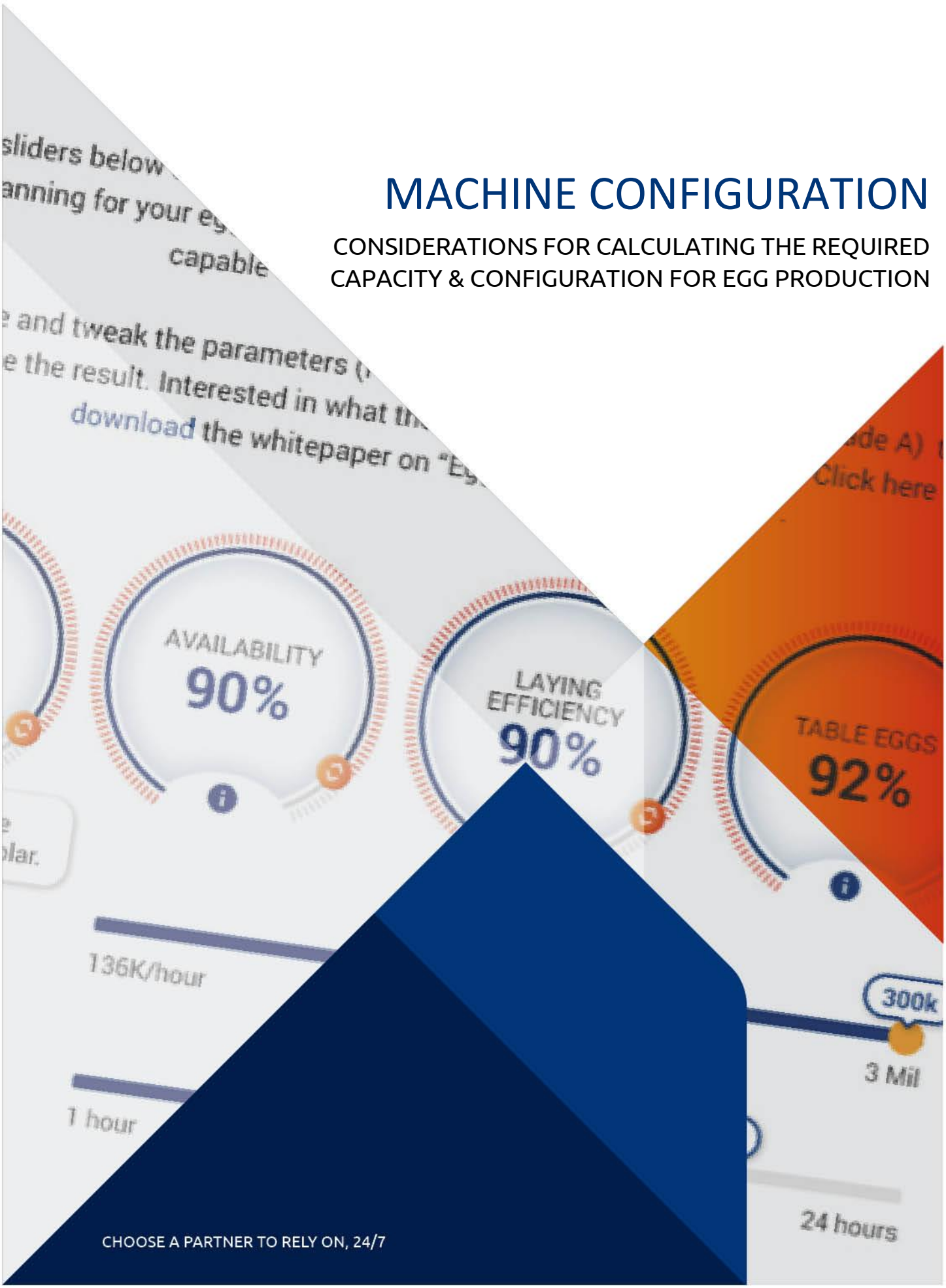
MOBA

MACHINE CONFIGURATION

CONSIDERATIONS FOR CALCULATING THE REQUIRED CAPACITY & CONFIGURATION FOR EGG PRODUCTION



CHOOSE A PARTNER TO RELY ON, 24/7

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INTRODUCTION

When it comes to choosing the right machine for a certain situation, many factors can influence the outcome. Normally, the calculation looks simple: divide the number of eggs that will be handled per day by the intended number of working hours and this results in the required capacity per hour. As long as results are rounded a little upwards, this may be sufficient for many situations, but a little more accurate calculation may in many cases also lead to different conclusions.

THE VARIOUS FACTORS IN DETAIL

Difference between in- and offline situations

If a grader is directly connected to the chicken houses, this is referred to as “inline”. If an egg packing station receives its eggs from elsewhere and is using a loader, this is referred to as an ‘’offline’’ situation. In an inline situation the calculation is influenced by the amount of eggs that the layers (chickens) are producing. Per hundred layers less than hundred eggs are produced. And this number varies throughout the lifecycle of the hens. This effected is calculated as “laying efficiency”.

Laying efficiency

Laying efficiency in an inline operation

The starting point is the number of layers. In order to calculate the number of eggs per day, the number of layers needs to be multiplied with the laying efficiency. And since we want to calculate the required machine capacity, we need to take the peak performance of the flock into account. If hens are laying the maximum amount of eggs, we want the equipment to cope with this.

Laying efficiency = Number of eggs per day / Number of layers

Factors improving the laying efficiency

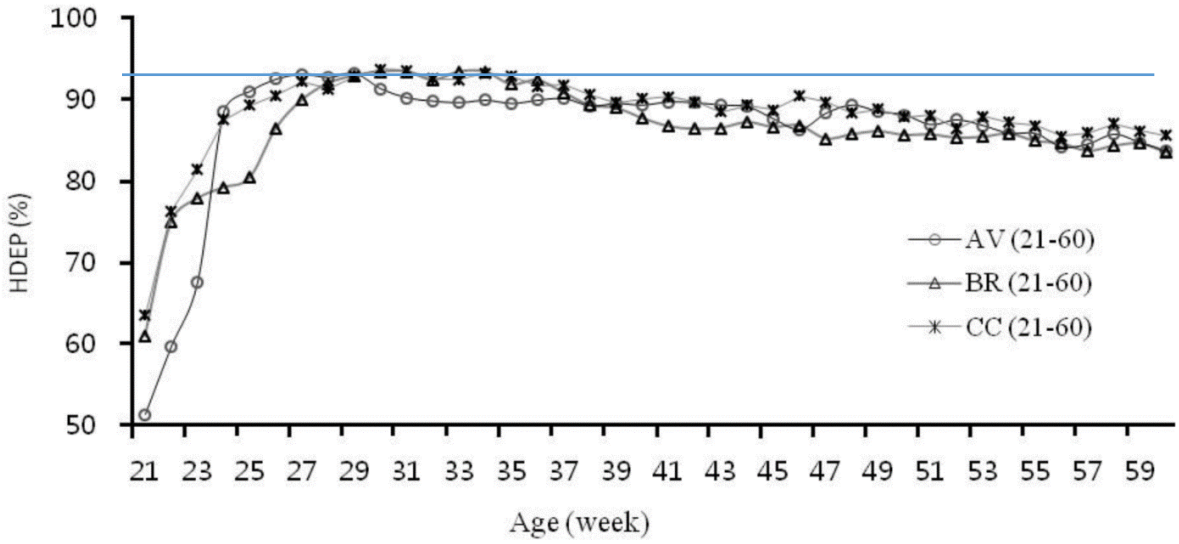
- Genetic quality of the layers
- Perfect health conditions of layers
- Perfect farming conditions such as feeding, drinking and environmental conditions

Factors decreasing laying efficiency

- Less efficient genetic type of layer
- Age of flock
- Errors in feeding, drinking, ventilation systems
- Diseases

Below, a laying efficiency graph of various flocks is shown. The figure comes from a study on different housing systems titled “Comparison of Aviary, Barn and Conventional Cage Raising of Chickens on Laying Performance and Egg Quality” by M. Ahammed, B. J. Chae, J. Lohakare, B. Keohavong, M. H. Lee, S. J. Lee, D. M. Kim, J. Y. Lee1, S. J. Ohh*.

This article shows HDEP (Hen Day Egg Production or laying efficiency) versus different housing systems (AV=Aviary, BR=Barn, CC=Conventional Cage). It shows that at the peak of the production the Laying Efficiency is in this example around 93%. Refer to the supplier of your layers for exact details. With the advisor on the Moba website, this number can be varied between 70% and 100%. A good default value to start with is somewhere between 90% and 95% for most commercial flocks.



Laying efficiency in an offline operation

In most cases, the laying efficiency is not used in an offline situation. The packing station simply calculates the number of eggs shipped by the various farms. In that case, set the laying efficiency to 100%.

If the packing station is also owner of the farms, it might want to take the laying efficiency into account. The number of layers are known and by setting this parameter just as described in the online paragraph above, a realistic number of eggs will be calculated.

Fill rate

Fill rate in an inline operation

After the above calculation, we know how many eggs per day need to be handled by the egg grader. The next thing to consider is the fact that the eggs need to be guided onto the egg grader. This happens via a so-called accumulator. This is in fact a belt that conveys the eggs into channels with the purpose of filling the rollers of the grader as efficiently as possible. Some pressure is needed to push the eggs onto the rollers but at the same time the pressure should not exceed a limit that would damage weak shelled eggs. This is a fine balance between optimizing machine utilisation and keeping the number of machine-generated micro cracks to a minimum. The better an accumulator is designed and controlled, the more pockets on the rollers are filled with eggs while maintaining a good quality level. Also, the system that controls the egg conveyors from the layer houses is of enormous influence on the number of pockets actually filled with eggs, also referred to as fill rate.

Fill rate = number of eggs / number of roller positions
(Measured over a certain time of operating the egg grader)

Factors improving fill rate

- Well distributed egg flow across the accumulator
- Speed control system on conveyors in layer houses
- More pressure on eggs (by increasing speed of accumulator; too much pressure will result in more cracked eggs)

Factors decreasing fill rate

- Too many starts/stops in incoming egg conveyor systems
- Unevenly distributed eggs across accumulator (too many eggs at one side of accumulator)
- Many fluctuations in egg density on incoming egg conveyors
- Less pressure on the eggs (but this improves egg handling)

If the fill rate is 90%, this means that 10% of the rollers is left empty. Moba accumulators can realize fill rates up to 98% with perfect egg handling.

At this moment, we know how many eggs really need to be graded and by taking the fill rate into account, we come up with the net capacity of the machine. Example: If a machine is designed at a capacity of 100,000 eggs per hour but the fill rate is only 90%, it means that the net production capacity for that particular situation is only 90,000 eggs per hour.

Fill rate in an offline operation

In an offline operation, a loader is used to load eggs from trays onto the rollers of the egg grader. This process normally leaves no gaps at all. This would result in a 100% fill rate. In trays from farms, an incidental missing egg, stuck egg or broken egg will not make it to the rollers. Also during supply shifts (going from one batch of a certain egg supplier to the next), sometimes the machine runs empty for a very brief period. This is not needed because of technical reasons but if the operator needs to get the pallets and bring them to the machine or the machine is running empty, for instance in a shift from barn eggs to free range eggs, it is realistic to expect this to happen now and then.

In a well-managed offline operation, the fill rate can easily be above 99%, but for a starting calculation leaving it at 95% is a safe choice.

Availability

The next effect to take into account is the availability of the equipment. Of course, the purpose is to have the equipment running continuously, but there are always reasons why an egg grader comes to a stop now

and then. If the machine comes to a stop, this also means that the net production capacity decreases. This is expressed by multiplying the capacity calculated so far by a factor called “availability”.

There are 2 main reasons for stopping the machine that are connected to the actions of the operators:

1. In case of an offline configuration: the loader. On a loader, wrongly loaded stacks of trays, sticking eggs (a leaking egg glues itself to the tray), extreme amounts of liquid blocking the suction heads, etc., can cause the loader to stop. If paper trays are used, also too much liquid on trays can cause the trays to deform and not support the eggs anymore. The damaged stack, trays or eggs need to be removed before starting the loader again. This creates incidental downtime to the machine.

2. The packing lanes of the machine. Many reasons for stopping the packing lane can occur there, such as a missing pack, a damaged pack that is unable to close properly, an empty shell or damaged egg blocking the receiver sets and of course the time needed to adjust the packing lane for a next product with a different pack type and different dimensions. Here, an interesting factor comes into play**: the number of available packing lanes**. If a packing lane needs to stop, it does not necessarily mean that the complete egg grader has to stop. As long as there are other destinations available for these eggs, the grader can continue without the loss of productivity.

   Some customers stop the machine to set it up for a new production run with new products, while others do this while the machine is running. This can only be done if eggs of a particular grade have more destinations on the machine than only the packing lane that is re-programmed. For that reason, it is advisable to have a few more packing lanes available for changing products. Once the newly programmed lane is in operation, the old lane handling the same weight grade of eggs can be switched off and re-programmed for a next change, etc., etc. Also, multiple lanes handling the same product ensure that a missing pack or similar error does not immediately lead to a complete machine stop.

The availability number (also referred to as “up-time”) varies therefor very strongly per situation and is an excellent indicator of how well an egg grader is managed. As a rule of thumb, we can say the following:

Availability	Inline operation	Offline operation
<70%	Can definitely be improved	Can be improved
70%..80%	Can be improved	If many product and egg type changes occur, this might be acceptable. Efficiently managed operations even under difficult circumstances are able to reach beyond 80%, so maybe there is room for improvement
80%..85%	Likely there is room to improve	Acceptable
85%..90%	Acceptable	Good
90%..95%	Good	Very good
95%..100%	Excellent	Excellent

Machine capacity calculation based on laying efficiency, fill rate and availability

Based on the above knowledge, the calculation for machine capacity is:

$$\text{Required grader capacity} = \frac{\text{(Nr of Layers * Laying efficiency)}}{\text{(Fill rate * Availability * Planned production hours)}}$$

Example: If 1 million eggs need to be handled in 9 running hours, the sample calculation with default parameters results in 1,000,000 * 93% / 95% * 90% * 9 = 120,858 eggs/hour. This means that the Moba Omnia PX 350 is the first machine that fits this requirement.

Table eggs

Often, Moba receives the question how many eggs suitable for retail will be produced by the Omnia. This number will be lower than the 120,858 eggs per hour since in this production flow there are also eggs not suitable for consumption, the so-called offgrades.

Offgrades can be cracked, leaking or dirty eggs and also eggs with a certain blood content inside the egg. In some machines human candlers judge the eggs by visual inspection and in high-end machines automatic detection systems are used to detect one or more specific types of offgrades. The table egg % is the amount of all incoming eggs that is suitable for consumption. This is also often referred to as “Grade A” percentage.

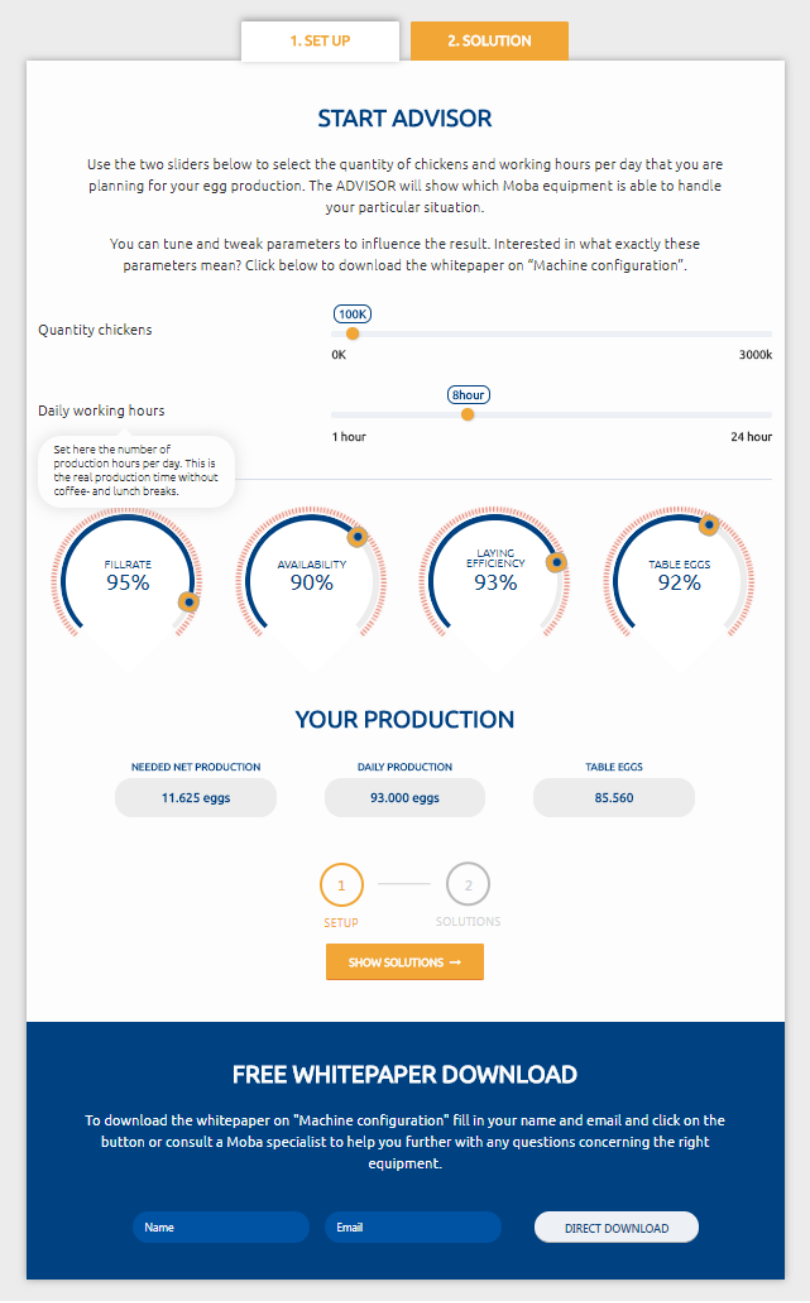
$$\text{Table egg \%} = \frac{\text{Eggs suitable for consumption}}{\text{Total eggs}}$$

This table egg percentage is strongly dependent on the quality of the incoming eggs and the allowed offgrade percentages in the products. In many countries, this is protected by law and often in the range of ca 5%. Furthermore, many customers of packing stations aim for the highest product quality and therefor want all offgrades out. Although automatic detection systems will do a much better job than human candlers, still the removal of all offgrades is impossible. Even the best detection systems work with statistical models that will fail now and then and can never guarantee a 100% detection sensitivity.

Example: Suppose 7% offgrades come into the egg grader and products are programmed in such a way that in the output 4% remains. This means sensitivity settings and upgrading are arranged in such a way by the operator that only 3% of the offgrades are removed from the retail products and 4% remains. This means that out of every 100 eggs coming into the egg grader, 3 are removed. In this example, the table egg % will be 97% since 97 out of every 100 eggs will make it to the final retail products.

Working with the on-line advisor

In order to convert the above theory into a convenient tool, Moba uses the “Advisor” on its website. Go to www.moba.net and scroll down to the product advisor. Enter the amount of layers (chickens) and the daily working hours that you are planning to run the equipment.



The advisor will immediately calculate the required net production, the daily production of eggs and how many table eggs may be expected. This depends of course on all the discussed factors which can be attuned to your needs. Next, click on tab 2 or the “Show Solutions” button in order to see an overview of the Moba portfolio.

Tables in the "Solutions" section will show the complete Moba grader and farm packer portfolio. All machines that have a capacity large enough to handle your amount of eggs will be marked as "Suitable". This means in principle the top one is the most economical solution. Based on your input, at the top our very best solution for your needs is shown for further information.

If the amount of eggs would allow the application of a farm packer, this will also be shown as "suitable". A farm packer will only make the eggs transportable in order to send them to an offline packing station elsewhere. Still, all calculations can be followed, since farm packers also work with a fill rate, availability and laying efficiency. Even from the amount of eggs, a best guess for table eggs will be calculated.

If you are living in the Americas, both Moba and Diamond farm packers are promoted, while living in any other part of the world the Moba farm packers are offered.

Tip: *If you are planning to use a farm packer but the capacity is insufficient, please note that it is common practice to use multiple farm packers in parallel for handling larger volumes of eggs. Please consult our sales network for further information.*

Number of packing lanes

Some further information is needed for determining the required amount of packing lanes for a certain grader configuration. In the table below, you will see the best selling configuration per egg grader type as well as the minimum and maximum range of packing lanes that are normally sold per grader type.

Automatic graders	Available as	Capacity	Average #pkl	Range #pkl
Prima 2000		20,000	4	2..8
Moba 2500		30,000	6	2..8
Omnia 85	XF	30,000	6	4..8
Omnia 125	XF	45,000	8	6..10
Omnia 170	XF / FT	60,000	10	6..14
Omnia 250	XF / FT / PX	90,000	12	8..14
Omnia 330	XF / FT	120,000	14	8..20
Omnia 350	PX	126,000	14	8..20
Omnia 500	FT	180,000	18	14..22
Omnia 530	PX	190,000	18	14..22
Omnia 700	PX	250,000	22	18..26

The column “Average #pkl” shows the best selling configuration while “Range #pkl” refers to the range of packing lanes normally sold for a certain machine type.

Reasons to buy a machine with the number of packing lanes chosen lower than average:

- Only 4 weight grades XL, L, M, S without further split-up in weights
- Relatively low number of different products
- Relatively low number of different pack types
- Relatively low number of product changes during the day
- No different egg types such as cage / barn / free range / organic
- No inkjet at all or only very limited different texts on eggs or packs

Reasons to buy a machine with the number of packing lanes higher than average:

- More weight grades than 4
- Additional grading functions such as
    - Batching
    - Mixed weight
    - Fill weight / Fill count
    - Colour sorting
- Different products each with different characteristics such as
    - Pack type
    - Upgrade setting
    - Colour settings
    - Inkjet texts
- Different egg types such as cage / barn / free range / organic

Our sales representatives will discuss your various requirements of grading eggs on a personal basis and come to an exact advice on the number of lanes.