

COMPLETE PACKAGING LINES FOR LEAFY GREENS

Everything you need to know about processing and packaging leafy greens in all kinds of packaging and packaging materials

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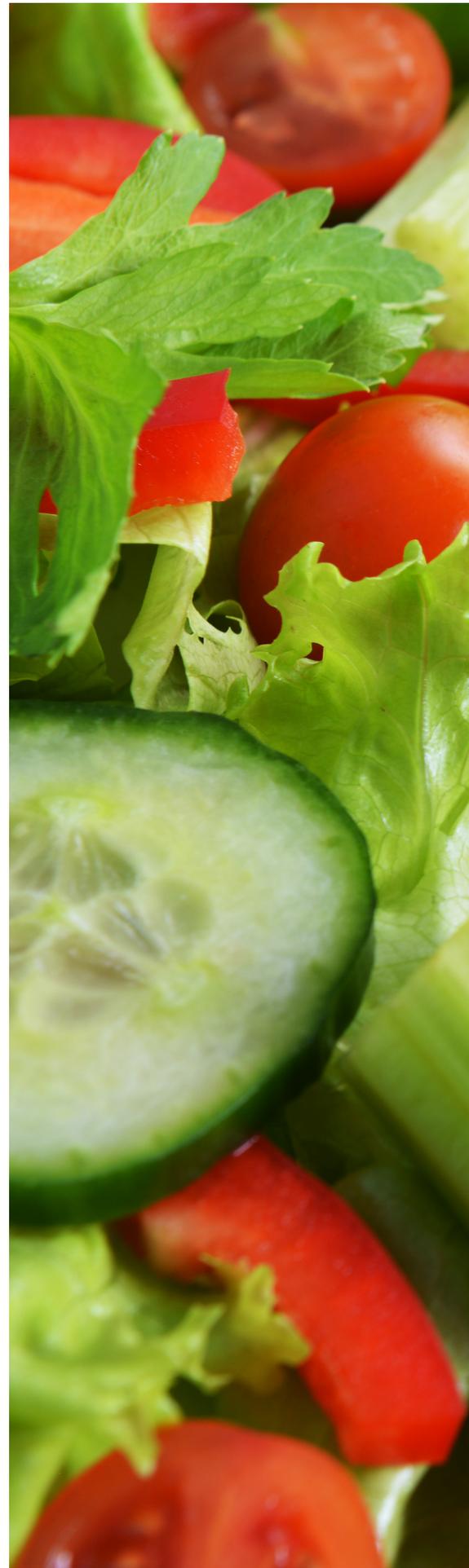
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PREAMBLE

This e-book has been compiled to provide insight into the processing and packaging of leafy greens. While compiling this book, the experiences of customers and suppliers have been combined. Therefore, all advice in this e-book is meant as a guideline and not as a definitive solution. To find the right solution for your product, we advise you to contact one of the experienced consultants of JASA Packaging Solutions.



1. LEAFY GREENS: A PREMIUM PRODUCT



The diversity in leafy greens is tremendous, and the demand for this product is on the rise. In 2024, leafy greens ranked as the 3th most eaten vegetable by Americans [1]. Consumers are opting for convenience and are seeking healthier foods, and with that, the popularity of romaine lettuce, arugula, and other leafy greens is growing.

Before leafy greens are conveniently packaged and placed in the refrigerator, they have already traveled across conveyor belts, through machines, and past robots. Leafy greens form a fragile product requiring an appropriate packaging process. The packaging of leafy greens also plays a significant role in extending its shelf life, keeping its quality high, and making it attractive to consumers.

JASA Packaging Solutions is an expert in the field of complete packaging lines for leafy greens; this e-book explains the packaging process of leafy greens and the selection process to determine the optimal packaging line.

1.1 GREENHOUSES & LEAFY GREENS

In recent years, **greenhouses** and **vertical agriculture** have become immensely popular. There are many advantages in these forms of agriculture over traditional agriculture:

1. Leafy greens can be grown in any location
2. It offers more control over (the quality of) the product
3. You can grow leafy greens all year round
4. Efficient use of water and labor
5. Nutrient retention
6. Protection against extreme weather conditions
7. Less dependent on the climate
8. Crop cycles are faster, resulting in twice the productivity
9. Exclusion of contamination by, for example, bird droppings and other natural elements
10. Higher output in a smaller area can be achieved

Greenhouses are particularly suitable for growing leafy greens, as this enables a clean product to be produced. In greenhouses, leafy greens can be grown in any place; hence, it only needs transportation over short distances to reach the consumer. Due to the explosive growth of greenhouses, there is a high demand for high-quality packaging lines to package all these leafy greens quickly and adequately.

Greenhouse-grown leafy greens are more delicate and fragile than those who come from the field. This must be taken into account when choosing a packaging line.



1.2 FROM LEAFY GREENS TO PACKAGING

Before leafy greens reach the packaging, the following steps are completed:

1. Seed is germinated
2. Transplanting
3. Grows (indoors, average 28 days)
4. Is harvested
5. May be cooled
6. May be washed and dried
7. May be mixed (Spring Mix, Asian Blend)
8. Is weighed
9. The packaging is filled
10. The packaging is closed
11. A label may be placed
12. An expiration date and LOT code is printed on the package
13. The packaging is automatically placed in boxes
14. The box is palletized
15. The pallet is ready for transport to the distribution centers and/or consumers.



1.3 THE IMPORTANCE OF HIGH-QUALITY PACKAGING

Leafy greens are a fragile product that is protected by the packaging. This requires not only the proper packaging but also **the correct process**. Mindful of the product, the right machinery should be chosen, and the packaging line should be built in such a way that it ensures hygiene and protects the fragile product. The range of leafy greens is diverse and vast. **Therefore, the packaging must be of high quality and have the right look & feel to appeal to the consumer.**



1.4 TRENDS IN THE LEAFY GREENS INDUSTRY

The leafy greens industry needs **flexibility in packaging** to keep up with trends in shapes, sizes, and materials. In recent years, the demand for **sustainable packaging** has been increasing, for example, in the sense of packaging with less packaging material, recyclable material, but also single-person packaging and meal kits are in vogue to reduce food waste.

Apart from considering the consumer's wishes, a packaging line should also meet the customer's requirements in terms of **quality, speed, and flexibility**.

The market is also demanding **innovative packaging solutions**, and at JASA, we see an increasing demand for **automation and robotization**.

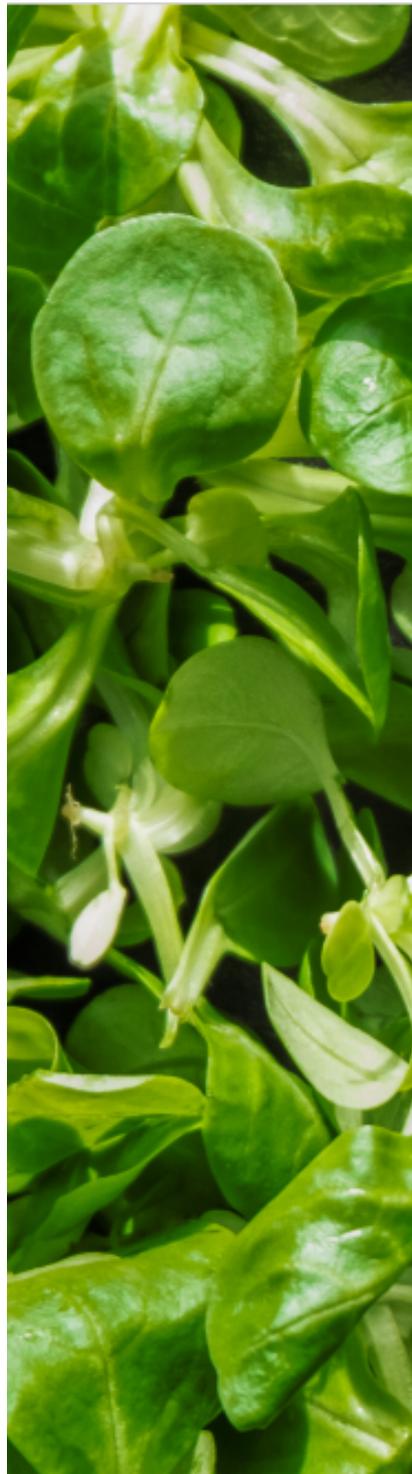


2. LEAFY GREEN VARIETIES AND THEIR PACKAGING



2.1 TYPES OF LEAFY GREENS

A whole coleslaw, a bag of arugula, or romaine lettuce as part of a meal salad. Leafy greens are found in all shapes and sizes. These **different types of leafy greens require different packaging types, sizes, materials, and packaging lines.**



2.2 PACKAGING TYPES AND SIZES

There are 6 different packaging types for leafy greens, all of which are suitable for direct printing or labeling:

1. Bag packaging

These packaging units are suitable for both single and mixed varieties of leafy greens and range in size from 3 to 16 ounces. Large packaging is also possible, which for example, is suitable for the catering industry.



2. Top seal trays

This tray packaging is sealed with a top seal. The packaging ranges in size from 3 to 16 ounces and is suitable for combining with a sleeve. Another possibility is to close this packaging with a separate lid, after the top seal. This makes the packaging reclosable.



3. Tray with a loose lid

With this packaging, the tray is closed with a separate lid. The packaging ranges from 4 to 20 ounces and can be combined with a label or sleeve.



4. Clamshell (tray with hinged lid)

This packaging is closed with a lid that is attached to the tray. The packaging ranges from 4 to 20 ounces and can be combined with a label or sleeve.



5. Tray with flow wrap

To a minor degree, you still find trays with a flow wrap around them. This is a separate tray that will be filled, and after that wrapped around with a film, just like with bag packaging.



6. Meal-kit

This type of packaging can contain various ingredients, such as corn and chicken, as part of a meal salad. The packaging ranges in size from 4 to 20 ounces and is compatible with a sleeve.



2.3 (SUSTAINABLE) PACKAGING MATERIALS

When choosing (sustainable) packaging material, 3 factors are at play:

1. Type of packaging
2. Thinner films
3. Mono-material

2.3.1 TYPE OF PACKAGING

After deciding on the most suitable packaging, we consider the **packaging material**. The two go hand in hand, as the type of packaging is the first and easiest step to save material and thus keep costs low and use the most sustainable packaging possible. This is also noticeable in the packaging from the chapter above: reducing per packaging type 4 (clamshell) to 3 (tray with loose lid), 2 (top seal tray), and 1 (bag packaging), less and less plastic is used.

When choosing the suitable packaging, factors considered include:

1. The packaging layout for processing, e.g., the option to de-nest the trays.
2. The use of printed or unprinted film
3. Whether or not a label is added

Furthermore, **micro-perforation** is an option: micro-perforated packaging creates a controlled atmosphere in the packaging, supporting the leafy greens' extended shelf life. You can also opt for packaging under a protective atmosphere and to vacuum large packagings.

Due to the current (sustainability) developments in the market, a top seal is often chosen when packing trays. Compared to a tray with a lid, this **saves up to 40% material**. Also, bag packaging is on the rise; up to today, this is the packaging with the least plastic included. Also, the production of the bag packaging is simpler, the costs are lower, and with the right printing, the **appearance** can be really stylish.

2.3.2 THINNER FILMS

The use of plastic can be reduced by packaging with thinner films. Thinner films retain the advantages of plastic packaging but reduce the amount of plastic. The packaging line must be equipped to optimally process the thinner films. This can be done by **optimizing the sealing systems, filling methods, and film throughput.**

2.3.3 MONO MATERIAL

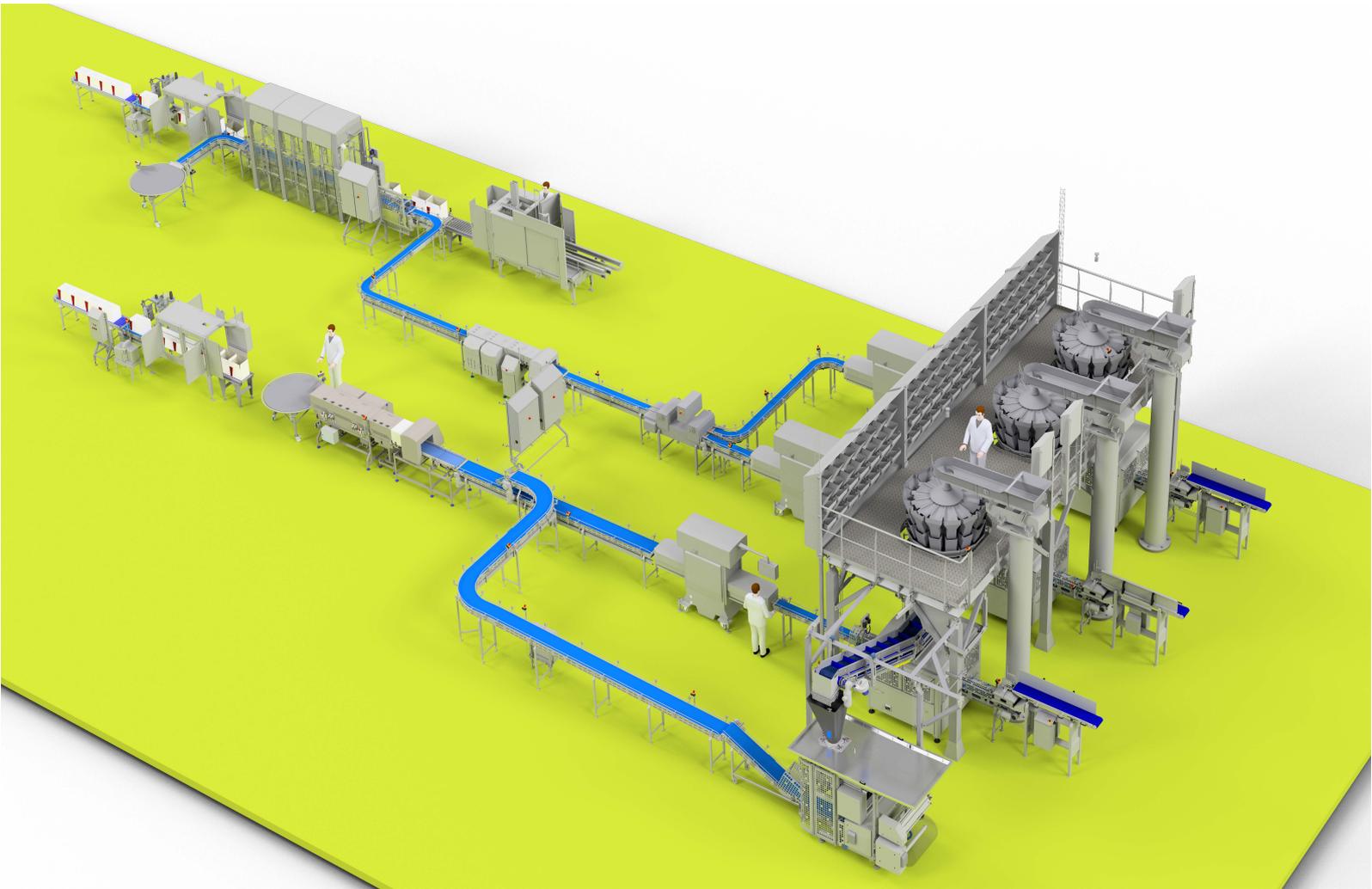
Mono-materials are increasingly used, as they are more suitable for **recycling**. Laminated films consist of multiple layers of plastics and therefore cannot be recycled effectively. Mono-material, in turn, is well suited for recycling.



Plastic packaging materials can therefore be used in the most sustainable way possible. Admittedly, plastic does not always have the best reputation, but it offers excellent (sustainable) advantages in terms of:

1. Hygiene
2. Long shelf life
3. Fuel reduction
4. Less food waste.

3. THE PACKAGING PROCESS



The choice of a packaging line has a significant impact on a company. With the proper line, a company can **save time and man-hours**. The **ROI** on a packaging line is easy to calculate, and with today's operating speeds, it soon becomes interesting. And by choosing a **flexible packaging line** that can easily be changed in terms of packaging size and material, the company is **prepared for the future**.

3.1 FROM MANUAL TO AUTOMATED PACKAGING

The trade-off between continuing to manually package or investing in (fully) automated packaging is based on several factors:

1. Scarcity on the labor market
2. Volume
3. Cost and time efficiency
4. Ergonomics
5. Utilization

Often it pays to switch from manual to automated packing starting from about 1 ha (2 acres) Depending of greenhouse-grown leafy greens. Depending on the type of packaging, there are different ways to start with automation, like the use of a de-nesting system, hand weighing equipment and topseal equipment.



3.2 COMPONENTS OF A PACKAGING LINE

After harvesting, the leafy greens are transported on a conveyor belt from the greenhouses to the process and packaging line, which can comprise various components required for the product. **Depending on the product, volume, packaging, and customer requirements, we can identify the following components of a packaging line.**

Cooling

Leafy greens are harvested at ambient temperatures, after which the product is cooled to 2 to 4 degrees Celsius. This can be done in two ways. The first option is a cooling tunnel, which saves energy since a limited space needs to be cooled. The other option is to cool the entire area from the harvest point, thus cooling the product during the transportation and packaging process.

Washing, drying and mixing.

The possibilities of washing, drying, and mixing are very **product-specific**. If required, leafy greens can be washed and dried in special tunnels built for fragile products. Leafy greens can also be transported through a UV-C tunnel. Through special lighting, disinfection takes place in a protected environment. Bacteria and viruses are quickly deactivated. **Different leafy greens varieties can be mixed depending on the customer's wishes, from 50/50 blends to any other ratio and up to 7 varieties.**

Product scanning

To ensure good quality, the product can be scanned or checked for foreign products, such as rock wool, sand, or pebbles, and on defects such as brown spots, rot and damage. For this purpose, **vision scanning** is used. The lettuce passes through a large tunnel where a camera scans for unknown material, which is then removed. This technique is not suitable for all types of leafy greens.

De-nesting

In the case of scale or tray packaging, a de-nester is added to the packaging line to de-nest the trays at high speed and supply them to the filling station. Therefore, the trays must be developed for de-nesting. **This is one reason for the timely involvement of a specialist in the process.**

Weighing

In general, a weight between 4 and 16 ounces is chosen for leafy greens packaging. Larger weights are possible, for example, for the foodservice industry. **When choosing the weight, it is essential to look to the future.** For instance, packing 5 ounces may be the norm today, but this might become 9 ounces in the future. The packaging line can be set up accordingly to allow a different weight to be packed with the same line in the future.

The choice of weigher depends on the required output weight. **Also, different products may require different weighers.** In this respect, it is essential to consider the setting of the weigher and that the proper configuration is chosen to ensure that the leafy greens are processed smoothly throughout the system.

For leafy greens packaging lines, JASA works with **multi-head weighers**. A multi-head weigher sets a target weight based on multiple partial weights. For example, 14 heads are available, from which the 4 closest to the target weight are chosen.



Filling station

In the filling station, the leafy greens enter the tray. The trays are fed into a rotating carousel, where they are filled with the correct portion per tray by the weigher. **The compression system ensures that the leafy greens are delicately pressed in several steps to reduce their volume.** When choosing the filling station, it is important to consider which tray will be used to determine which **toolsets** are required. The toolset can be easily changed in a short time and without tools.



Modified Atmosphere Packaging (MAP)

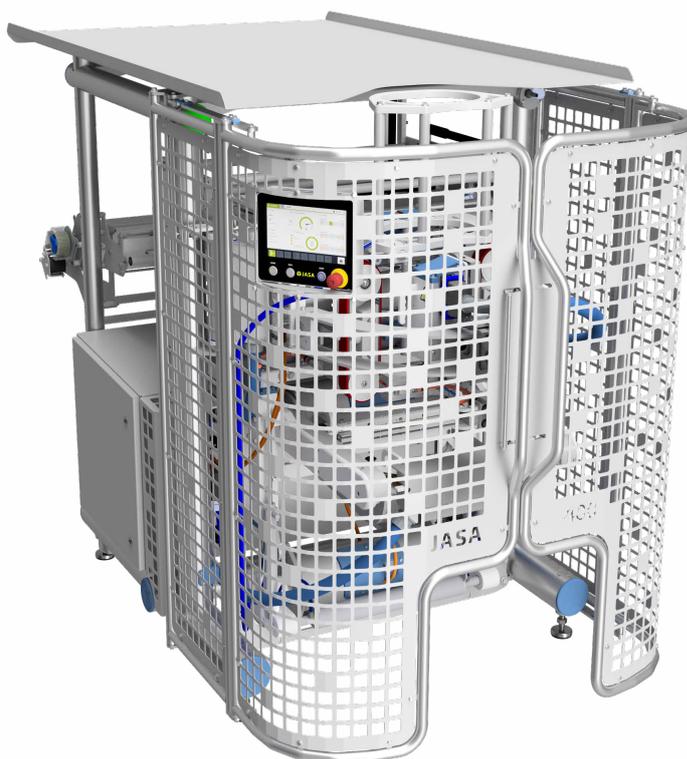
More can be put into a package than just leafy greens. Modified Atmosphere Packaging (MAP) involves packaging lettuce under a protective atmosphere where gas is injected into the package. **This is a proven effective way to extend the shelf life of leafy greens.** MAP generally uses three gases: carbon dioxide, nitrogen, and oxygen. Although it is possible to use other gases. The gases used are often mixed in certain proportions.

Top sealing or lidding

With tray packaging, the most common choice nowadays is to seal the package using a top seal film on the top. This film can be resealable or feature a peel-off window. Another possibility is to automatically press a lid on the tray. Automatically closing a hinged lid is also one of the options.

Vertical bagger

A vertical bagger, also called a vertical form, fill and seal machine, is used to automatically bag leafy greens. The bag shape is made from a flat roll of film. This film can be either imprinted or unprinted. When the leafy greens drop into the bag from the weigher, the bag has already formed and is closed by applying a final seal.



Metal detection, x-ray & check weigher

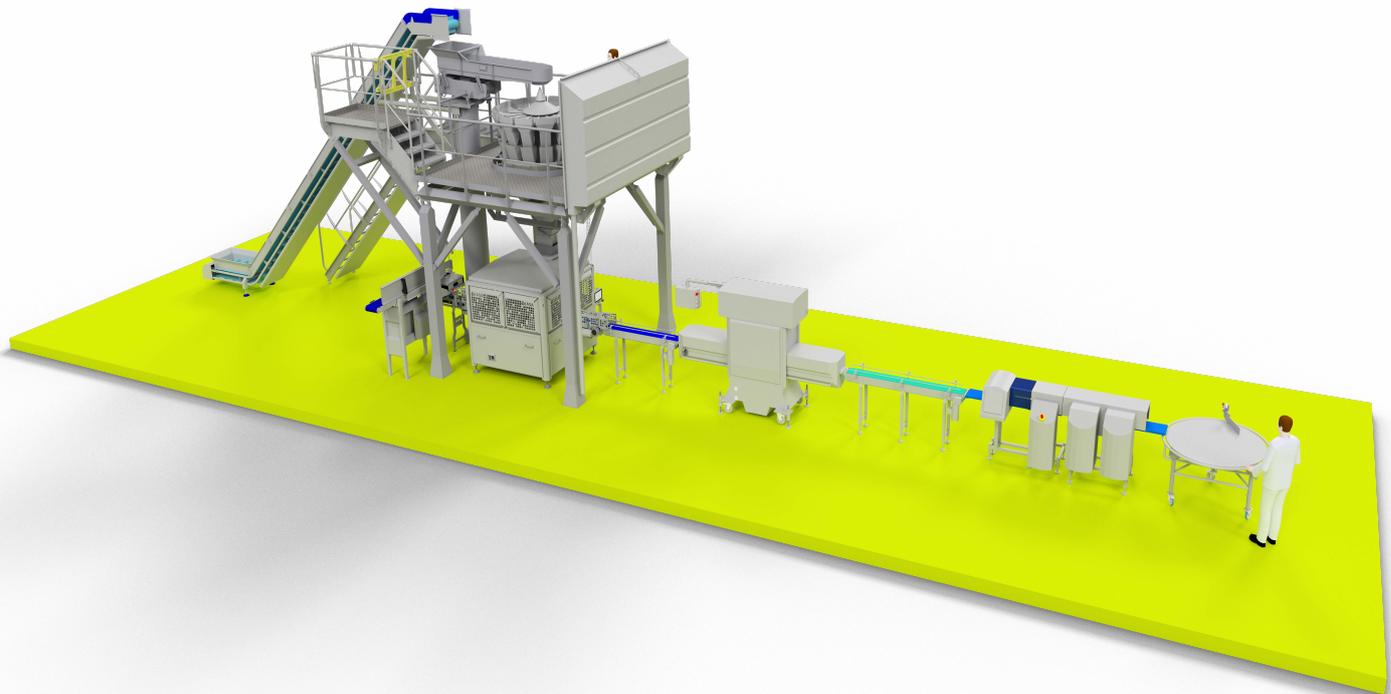
Metal detection equipment is used to detect the most minor pieces of metal; x-ray systems can detect metal, glass, broken products, plastic, and many other materials; and a check-weigher checks the weight of all products. A combination of these systems is often chosen, for example, metal detection and a check-weigher or an x-ray and a check-weigher.

Case packing and palletizing

At the end of the line is a case erector that folds the box, a case sealer that tapes the bottom of the box, and a robotic arm that picks up the package and puts it in that box. This process is fully automated. Once the packages are in the box, they are sealed, and a palletizer places the box on a pallet.

3.3 TRAY LINE

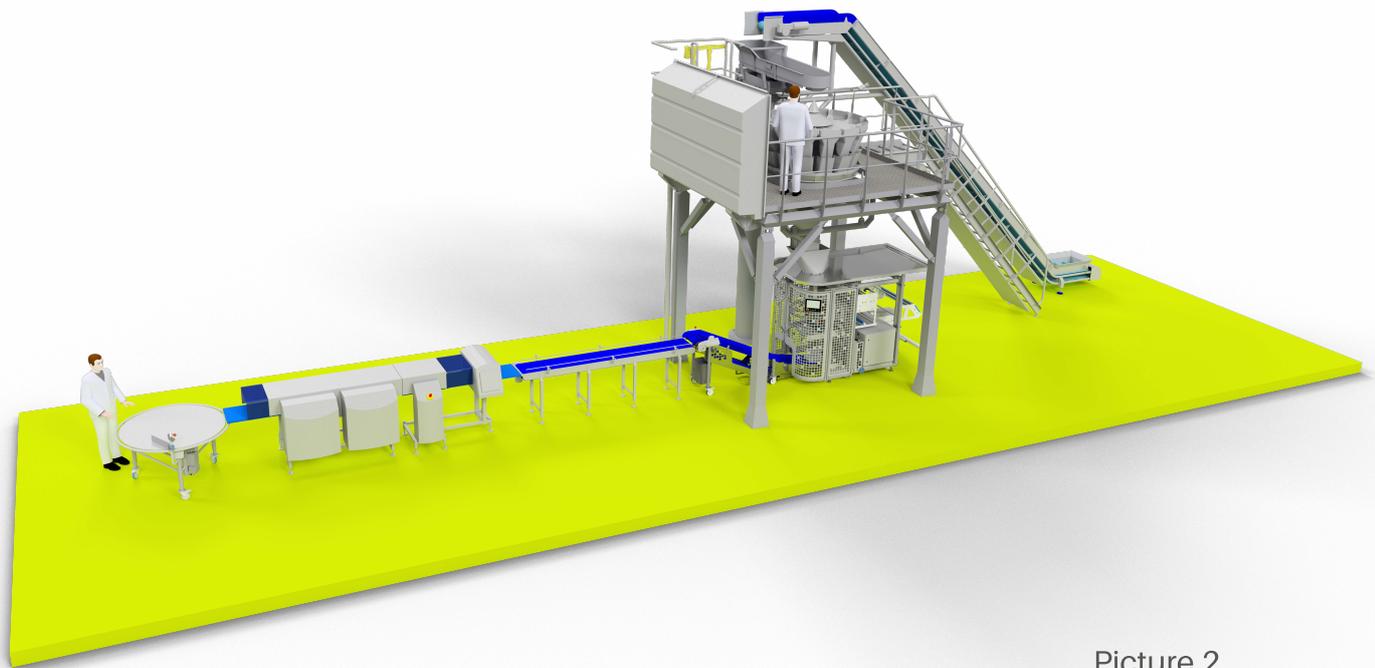
See picture 1 as an example of a complete tray line. This is a basic layout with dimensions of 19m (length) at 3,9m (width) at 4,7m (height). **Depending on the area where the line will be placed and the requirements pertaining to the line, it will be adapted to the available dimensions.**



Picture 1

3.4 BAG PACKING LINE

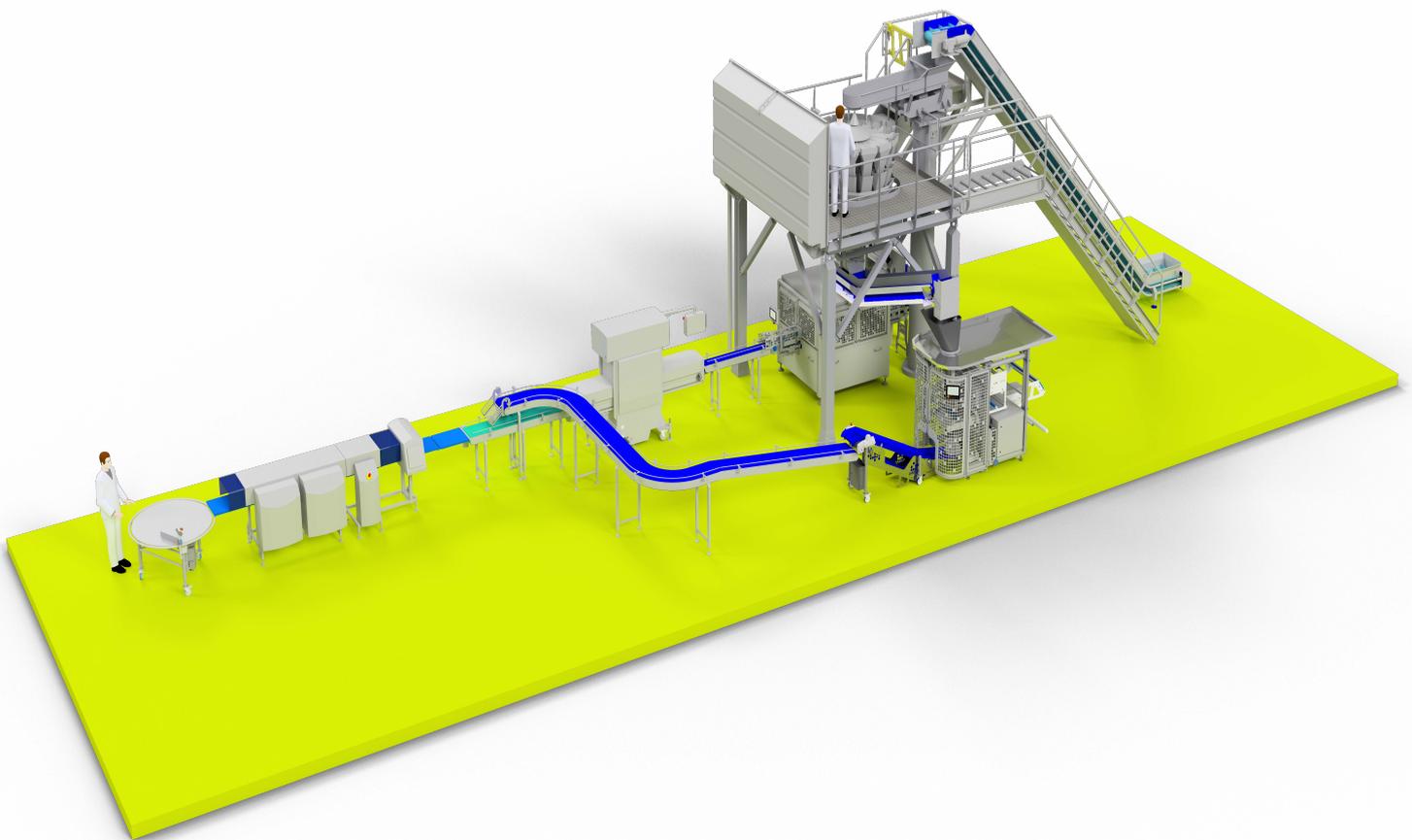
See picture 2 as an example of a bag packing line. This is a basic layout with dimensions of 10m (length) at 4,4m (width) at 5,9m (height). **Depending on the area where the line will be placed and its requirements, it will be tailored to the available dimensions.**



Picture 2

3.5 COMPLETE LINE FOR BAGS & TRAYS

See picture below as an example of a combined bag and tray line. This is a basic layout integrating both packaging types into one line, enabling maximum production flexibility. Depending on the area where the line will be installed and the specific requirements, it will be adapted to the available dimensions.



3.6 SAFETY & HYGIENE

In terms of hygiene and food safety, some strict laws and regulations impose demanding criteria on food packaging It is therefore crucial that the packaging systems are made of stainless steel and have a hygienic design that is quick and easy to clean. The safety of employees must also be guaranteed, for example, by an emergency stop for the entire line. This stops the whole line at the push of a button. The strict hygiene and safety guidelines that are adhered to do not have to compromise the versatility and speed of the packaging line.



4. A STEP-BY-STEP GUIDE TO SELECTING THE OPTIMAL PACKAGING LINE

To design a good packaging line, it helps to have answers to the following questions:

- What type of product
- What type of packaging is desired
- What is the total output from the greenhouse
- What is the desired weight per package
- What is the composition of the finished product (how much single product, how much mix product and in which ratio with, e.g., spring mix)
- How many packs/total weight of each SKU per day/week
- Additional desired options such as:
 - mixing
 - washing
 - drying
 - sorting
 - labeling/printing on packaging
- Manual final packaging from a turntable or fully automated, including case packing and palletizing
- Planning for future expansion
- The layout of the packaging area → dimensions to be observed



5. EPILOGUE



Greenhouses offer the solution for shorter transport distances, protection of crops from extreme weather conditions, and the possibility of providing fresh leafy greens all year round without pesticides.

JASA offers the packaging solution for leafy greens. **JASA distinguishes itself with its turnkey solutions and Dutch quality and service. The company is specialized in tray and bag packaging lines for leafy greens for over 40 years and offers guidance on the entire packaging process.** This involves listening to the customer's wishes and advising on the suitable machines, materials, and perspectives for the future.

JASA uses high-quality materials and components and can put together **a fully automated and versatile packaging line tailored to the customer's needs.** Also, the area where the packaging line will be installed is considered, making it possible to run a JASA packaging line even in an area with an obstacle or a low ceiling.

With its innovative packaging solutions, JASA is a frontrunner and market leader in the packaging industry. JASA offers sustainable, versatile, high speed, and high-quality packaging lines for leafy greens.

From harvesting to palletizing, JASA can lead and guide the entire process from stem to stern. To this end, JASA cooperates with various experts, for example, in the field of greenhouse construction, growing systems, washing and mixing, and case packing and palletizing.

SOURCES

[1] Statista. Per capita consumption of fresh vegetables in the United States in 2024, by vegetable type. Accessed on 24-05-2021, van <https://www.statista.com/statistics/257345/per-capita-consumption-of-fresh-vegetables-in-the-us-by-type/>

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JASA

PACKAGING SOLUTIONS

Information

+1 804 290 3683
sales@jasapackaging.com
www.jasapackaging.com

Office North-America

JASA Packaging Solutions Inc.
7472 Waterside Loop Rd - Ste 101
Denver NC 28037
United States

Headquarters

JASA Packaging Solutions
Butter 17
1713 GM Obdam
The Netherlands