

**Limgroup**<sup>®</sup>

## **White Asparagus Cultivation Manual**



**Limgroup**  
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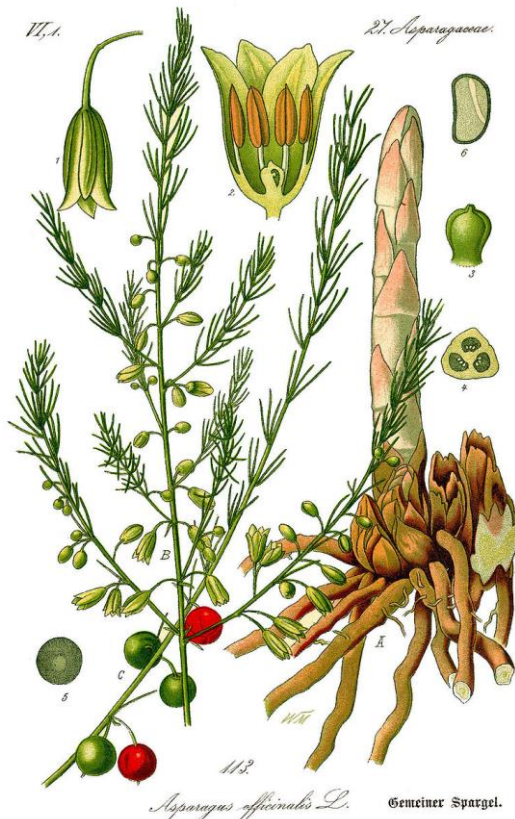
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Limgroup BV has composed this publication with great care. All the information contained in the publication is to be regarded merely as a general guideline; users are to use the information according to their own insight and knowledge of local conditions. Any data provided in this publication in the fields of research results, cultivation advice and/or descriptions of varieties are noncommittal and purely informative. We advise you to carry out a trial in case of doubt. Limgroup BV accepts no liability concerning the information contained in this brochure.

## 1. Asparagus

### 1.1 *Asparagus officinalis*

*Asparagus (Asparagus officinalis)* is grown as a perennial vegetable all over the world and can go on yielding for eight or more years. Cultivation by humans dates back 2500 years. Whereas our Greek ancestors cultivated the crop for medical use, it is nowadays mostly appreciated as a healthy and tasty vegetable.



#### *Asparagus officinalis*

The asparagus plant can be divided into three parts: the fern, the crown and the root system. The ferns comprise stems which carry needles rather than true leaves. The fern produces sugars by photosynthesis that are transferred to the crown. The crown is a collection of rhizomes (modified stems) and lateral roots. The roots absorb nutrients and store the produced sugars (carbohydrates). The root system can grow up to one meter (10 feet) in depth. The rhizome generates buds that initiate new spears. The spears, which are harvested, are actually immature ferns. The asparagus is a dioecious plant, which means that there are separate male and female plants. Both male and female plants produce white/yellow flowers. Female asparagus plants produce numerous bright red berries, whereas male plants produce ferns without berries.

The two main cultivated asparagus types in the world are white and green asparagus. Because of differences in cultivation methods and varieties, this manual focuses on white asparagus cultivation.



## 1.2 White asparagus

There is no genetic difference between plants producing green asparagus and white asparagus spears. Through the influence of temperature, water and nutrition the asparagus plant starts by producing spears and later ferns that enable the process of photosynthesis to take place. Photosynthesis depends on chlorophyll, the pigment that provides the green colour of the spears and fern. Apart from green coloration, asparagus spears may be tinged with purple, especially on the tips and bracts. The purple coloration is the result of anthocyanin production which is initiated by exposure to ultraviolet light (a natural component of daylight). The degree of purple coloration depends on the variety and environmental conditions.



*Harvesting white asparagus*

White asparagus is grown mostly on sandy soils.

When it comes to the quality of the white asparagus, it is important that the spears are straight and pure white in colour and have a closed tip.

A distinct difference in the cultivation of white asparagus as compared to green asparagus is that the plants grow in ridges. Because the spears are covered by the ridge and in most cases plastic foil, they are not exposed to sunlight and the spears preserve their white colour. After all, no photosynthesis has taken place and therefore no chlorophyll (green pigment) is produced. When harvesting white asparagus, it is necessary to dig in the soil. Heavier soils are therefore less suitable for the cultivation of white asparagus.

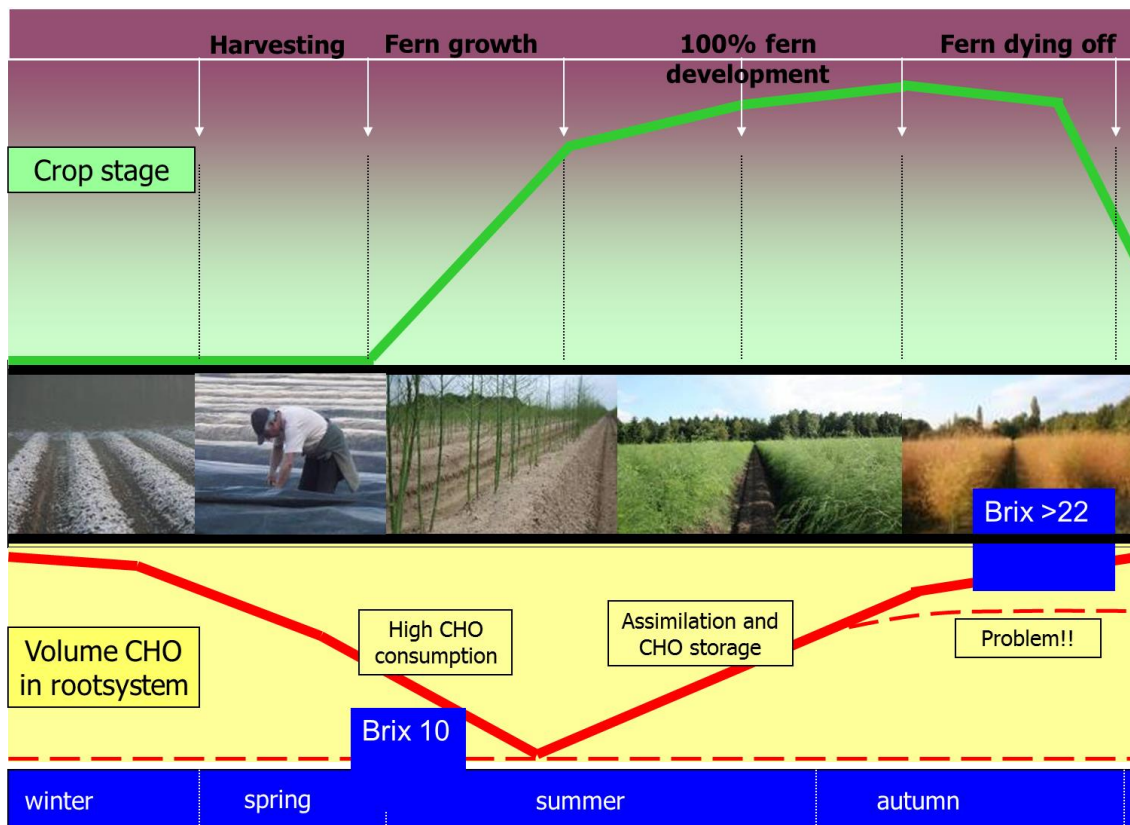
### 1.3 Crop stages and CHO levels

The following crop stages can be defined:

- Harvesting (spring/summer)
- Fern growth (summer)
- 100% fern development (summer/autumn)
- Fern dieback (autumn/winter)

Since asparagus is a perennial plant, profitable cultivation can continue for up to 10 years. The durability of the asparagus plant is strongly influenced by the plant's annual ability to restore the sugar levels in its root system. During the harvesting and fern growth stages, energy is extracted from the plant. This energy is stored as sugar in the roots of the plant. This means that, at the end of the fern growth stage, sugar levels in the root system are minimal. From the moment the plant reaches the 100% fern development stage, the sugar levels are restored through the process of assimilation (photosynthesis). The maximum sugar levels must have been reached before the plant reaches the fern dieback stage.

It is therefore very important not to 'over-harvest' the asparagus plant. If the crop is harvested for too long, the plant does not have enough time to recover and restore its sugar levels. In general, an asparagus plant needs at least 100 days of full fern growth in order to restore its sugars to a sufficient level. Too low sugar levels at the end of the fern development stage can result in lower yields the following season, a less durable plant, or even worse, the plant dying off completely.



*Crop stages in asparagus cultivation; fern development and CHO volumes in root system*

Sugar levels in the roots of the plant can be measured using a Brix meter or refractometer.

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## 2. Soil and site selection

Since asparagus is a perennial vegetable, special attention should be given to choosing the best planting site. Selecting a suitable site is a major focus and a necessary step for anyone wanting to achieve a profitable crop.

Sandy soils are best for white asparagus cultivation. A heavier soil can be used if the soil is covered with thermal plastic. However, very heavy clay soils are generally unsuitable due to their poor aeration and drainage.

Always avoid soils that are poorly drained or have a high water table. Waterlogging in winter increases the spread of soil-borne diseases, particularly Fusarium wilt (*Fusarium oxysporum* f. sp. *asparagi*) and Phytophthora crown and spear rot (*Phytophthora asparagi*). Waterlogging in itself provides anaerobic conditions unsuitable for asparagus roots and is likely to cause significant root death. This problem can be overcome on many sites with adequate field drainage.

Some sandy soils are prone to slumping and compaction after wet weather and also after the long harvesting season (up to 2 months) when the crop could have been walked through up to fifty times. The window for soil cultivation in an established crop is very narrow and on heavier soils care should be taken to make optimum use of this window, i.e. when soil moisture conditions are ideal for operations such as fern removal in the autumn or winter and soil ridging over the crowns in the autumn, winter or spring. Cultivation in dry conditions can result in slumping or capping of the soil surface if rainfall occurs soon afterwards. Soil smearing and compaction can occur if cultivation is carried out on wet soils.

Asparagus roots can reach a depth of 100 cm (3.3 feet) and the soil should allow full development of the storage roots. Keep crop rotation in mind and preferably choose fresh sites for a new planting.

Bringing the soil up to optimal condition starts a year in advance. The soil needs time to establish a new natural balance. Don't work the soil more intensively than is absolutely necessary. Growing a cover crop in the summer will suppress weeds and increase the organic matter. Keep in mind that the deeper the soil for rooting, the better the yield and the economic life of the plant. Asparagus develops its main root system in the first three years after planting. In this period, it's very important to give the plant what it needs. The root system is the 'battery' for the crop.

During the autumn or spring before planting, it's advisable to take a soil sample at different depths in the soil for a nutrient analysis. Use this analysis to ensure the soil has the right nutrient conditions.





*Well-developed root system of an asparagus plant*

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### 3. Fertilisation

The optimal pH for asparagus is 5.8 to 7; lime may need to be incorporated into the soil before planting.

Before planting, apply and plough in fertiliser to supply per hectare:

- 100 kg (220 lbs) nitrogen
- 80 kg (176 lbs) phosphor
- 100 kg (220 lbs) potassium

Annual fertilisation in a well-growing asparagus field per hectare:

- 140 kg (300 lbs) nitrogen
- 100 kg (220 lbs) potassium
- 80 kg (200 lbs) phosphor
- 140 kg (310 lbs) magnesium

Magnesium and phosphor are best applied in early spring before the harvest gets under way. The time to apply nitrogen and potassium is directly after the harvest has ended. Use slow-release nitrogen. Do not use organic manure shortly before harvest as it can affect the taste of the asparagus. Always apply organic manure before the winter and mix it into the soil.

Most of the energy the plant produces in the fern stage is stored in the root system. During this fern stage the plant produces carbohydrates through photosynthesis. So it's important to have a healthy and well developed fern. Fern growth in the first stage and harvesting will cost the plant energy. During the growth stage of the fern, the sap stream is going from root to fern. This is a so-called upwards sap stream. When the fern has reached its mature phase, the sap stream is changing from root to fern into from fern to root. The sap stream is then downwards. At this point the plant starts to store carbohydrates in the root system. The higher the level of carbohydrates, the more energy is stored. In general, the plant needs at least three stems and approximately fourteen weeks of mature fern growth. This is an indication only. The exact time depends on climate, weather, yield and plot conditions.



#### 4. Irrigation

Asparagus is a drought-tolerant plant. This does not mean that irrigation is not important. Asparagus can evaporate 8-10 l/m<sup>2</sup> on sunny days. The asparagus plant needs sufficient water for growing and producing spears. Nutrition is only available for take-up in plant roots if the moisture level in the soil is adequate. The right level of moisture in the soil is therefore very important in order to obtain the maximum yield and quality from the crop.



*Irrigation by dripper*

Irrigation is therefore an advantage. Keep the soil sufficiently moist. The correct water supply depends on various factors, such as the root/foilage ratio, the growth phase of the plants and the availability of water in the soil. Check the moisture level of the soil frequently. Tensiometers or refractometers can be useful for measuring the moisture level of the soil. Always check that the tensiometer is slightly moist when placed in the soil.

In practice, irrigation is carried out using rain reels, pivots and/or drip tubing. The choice of irrigation method depends on:

- crop acreage
- terrain conditions
- flexibility
- costs
- the need for add fertilisers.

Irrigation is especially important during the first two years of the plant's development in the field. Providing sufficient water allows the asparagus plant to develop its root system optimally.



*Irrigation by rain reel*

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## 5. Planting; crowns or transplants?

Asparagus can be planted either as crowns or as transplants (seedlings). Both crowns and transplants are usually produced by plant breeders. Crowns are in fact one-year-old plants grown from seed. Crowns are often graded in two categories of plant sizes:

- A plants (above 70 g/crown)
- B plants (40-70 g/crown)



*Asparagus crown production field*

Transplants are grown from seeds that are sowed in trays in glasshouses or tunnels. Transplants are normally between 8 and 12 weeks old when they are planted out in the commercial field. Transplants are normally graded as either usable or non-usable plants.





*Asparagus crown (approx. 1 year old)*



*Asparagus transplant (approx. 14 weeks old)*

The decision as to whether to use crowns or transplants depends on the availability of planting material, the soil structure and the cultivation method. Always make sure you use healthy plant material, since this is one of the key factors in getting cultivation off to a profitable start.

If you opt for crowns, use healthy crowns with firm buds and strong storage roots with no mouldy plant parts. If you opt for transplants, use healthy transplants that have a well-developed root system, white-coloured roots and a vigorous green fern.

### **5.1 Planting crowns**

Plant the crowns shortly after lifting, preferably in the spring while they are dormant. Weather conditions can delay planting. In this case, store the plants in dry conditions in cold storage at a temperature of between 2 and 5 °C.

Always immerse the crowns in water shortly before planting and – if available and allowed – add an agent that will prevent Fusarium infection. Do not force planting in an unsuitable soil. If the crowns are stored correctly, the damage will always be less than if development is retarded because the plants are planted in unsuitable soil.

Planting depths vary between 12 and 24 cm. Deeper planting results in later sprouting of buds and therefore delays the start of the harvest. The decision as to what planting depth to choose should be based on the variety, the soil conditions and the cultivation system.

Asparagus should be planted in the spring as soon as the field is in good condition. Soil condition is a more important factor in determining planting time than aspects such as weather conditions. Planting is usually done by machine. It's important that the crowns are covered with enough soil to prevent dehydration. Earth up the plants a little as the spears start to emerge. This will kill off weeds and support the spears.



*Planting asparagus crowns by machine*

Row spacing depends on the operating conditions, such as tractor access, but should be in the range of about 1.80 m. Within the row the planting distance is between 20 and 35 cm. The plantation density is determined by the desired specifications of the crop: higher plant densities leads to thinner spear diameters. A planting distance of 1.8 x 0.25 m – taking into account 10% headland – results in a requirement of 20,000 plants per hectare.

Plant densities vary strongly per variety and region, mostly depending on the level of mechanisation and regional practices. For white asparagus cultivation the most commonly used plant density is approximately 20,000-25,000 plants per hectare. Distances between the rows are normally 1.7-2.4 m (5.5-7.8 ft). The planting distance in the row can vary from 0.2 to 0.33 m (8-13 ins). There is a tendency towards planting more plants per hectare.

## **5.2 Planting transplants**

In some regions (southern Europe, Peru and certain regions in Germany), growers use transplants. The seed is sown in trays in glasshouses or tunnels and raised to transplant in about 8 to 12 weeks.

The soil mix in the trays should be porous – one part peat to one part coarse sand – to ensure good drainage. Seeds are planted 0.6 to 1.3 cm deep, one seed per space.

A greenhouse temperature range of between 18 °C (night) minimum 29 °C (day) maximum provides good germination and plant growth. Irrigation and fertilisation needs vary with the existing climatic conditions, the soil mix and the age of the transplant. Initial nutrient requirements can be met by incorporating a complete fertiliser containing micronutrients into the soil mix.





*Asparagus transplants in trays in glasshouse*

After approximately 8 to 12 weeks, the plants are big enough to be planted out in the commercial field. The transplants are planted in a furrow at the ultimate plant depth. Good weather and soil conditions are key in ensuring good plant growth. Weed control is also very important. Drip irrigation is required for a successful crop. With the right soil conditions, weed control and irrigation, a survival rate of between 92 and 98 percent can be expected in the field.

An advantage of using transplants is that the grower can schedule planting. A disadvantage is that weed control is harder than with crown planting, since the transplants are smaller and therefore more vulnerable to mechanical or chemical weed control.

## **6. Choice of variety**

In general, varieties can be subdivided into several groups in line with the physical characteristics of the asparagus. One of the major characteristics of a variety that can influence product yield and quality is the gender of the variety. In practice, there are 100% male or mixed flowering varieties. The advantage of a male variety is the higher total yield, which can be anything up to 20% more than a mixed flowering variety. Male varieties are in general more tolerant to diseases like Fusarium. All commercial Limgroup asparagus varieties are 100% male varieties.

Most varieties need a certain period of dormancy in winter. These varieties normally grow in north-eastern Europe, North America and northern China.

Other varieties have less need for dormancy in winter and are more vulnerable to frost. These varieties normally grow in southern Europe, South America and southern China.

Limgroup breeds varieties for both of these geographic regions.



## 6.1 Limgroup white asparagus varieties

Limgroup offers varieties for most climates and culture types. The main varieties per climatic region are shown below. All hybrids are 100% male and are not genetically modified.

Limgroup white asparagus varieties suitable for a cool climate:

- [Backlim](#)
- [Frühlim](#)
- [Gijnlim](#)
- [Grolim](#)
- [Herkolim](#)

Limgroup white asparagus varieties suitable for a warm climate:

- [Grolim](#)
- [Terralim](#)
- [Vitalim](#)
- [Maxlim](#)

You can view more specific information on each variety by clicking on the variety name. If you have any questions about varieties or choosing varieties, please contact us at:

<https://www.limgroup.eu/en/asparagus/advise/>.

## 7. Crop protection

### 7.1 Weed control

Weeds are one of the most common problems asparagus growers face worldwide. They compete with asparagus plants for light, moisture and nutrients, and interfere with harvesting, thus reducing yields. Asparagus is a poor competitor against weeds. The open structure of an asparagus crop creates optimal conditions for weeds to grow. In sites with high weed pressure, these weeds can cause problems. Weed control is therefore very important.

To keep on top of weed control it is important to start controlling weeds before planting.

All types of weeds infest asparagus, including annual and perennial grasses, and annual, biennial and perennial broadleaves. Perennial weeds should be destroyed as thoroughly as possible while preparing the soil, or many months before planting in the case of heavy perennial weed pressure.

Frequent weed control is necessary, either by hoeing, cultivating or using herbicides. Mechanical removal of weeds by hoeing or cultivation is only temporary and usually has to be repeated several times per year. Tilling should be kept very shallow to avoid damaging asparagus roots.

Herbicides provide more lasting control, but may also have to be reapplied several times per year, depending on the weed pressure and environmental conditions. Using chemicals is a less labour-intensive alternative than mechanical weed control. Every country has its own regulations governing the use of chemicals, which should always be used as a reference. Chemicals can also suppress the growth of the asparagus and should therefore be used with great care.

Determine your herbicide needs based on the weed species and whether they will be emerged and growing at the time of application.

Powered machinery can be used for cultivating the soil between the rows to remove small weeds.

### 7.2 Pests and diseases; insect and fungal pests

Asparagus can be threatened by several insect and fungal pests. The damage can be devastating and can affect the profitability of the crop. Field selection and good soil preparation are important measures in reducing fungal pressure.

Recognising the various insects and fungi is a very important step in the process of fighting them.

The most important insect and fungal pests in asparagus cultivation are listed below.

#### **Insect pests**

Asparagus aphid	<i>Brachycorynella asparagi</i>
Asparagus beetle	<i>Crioceris asparagi</i>
Asparagus fly	<i>Platyparea poeciloptera</i>
Asparagus miner fly	<i>Ophiomyia simplex</i>
Asparagus moth	<i>Parahypopta caestrum</i>
Bean seed fly	<i>Delia platura</i>
Citrus gall midge	<i>Prodiplosis longifila</i>
Lygus bug	<i>Lygus pratensis</i>
Scarabs	<i>Scarabaeida</i>
Slugs	<i>Deroceras r., Arion h.</i>
Spotted asparagus beetle	<i>Crioceris duodecimpunctata</i>
Spotted snake millipede	<i>Blaniulus guttulatus</i>

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Thrips	<i>Thrips tabaci</i>
Wire worms	<i>Agriotes spp.</i> (larvae)
<b>Fungal pests</b>	
Asparagus anthracnose	<i>Colletotrichum gloeosporioides</i>
Asparagus rust	<i>Puccinia asparagi</i>
Botrytis blight	<i>Botrytis cinerea</i>
Crown and root rot	<i>Fusarium spp.</i>
Fusarium	<i>Fusarium culmorum</i>
Purple spot	<i>Stemphylium botryosum</i>
Pythium root rot	<i>Pythium spp.</i>
Red rot	<i>Helicobasidium purpureum</i> (syn. <i>Rhizoctonia violacea</i> )
Root rot disease	<i>Phytophthora megasperma</i>
Stem blight	<i>Phomopsis asparagi</i>
White mould	<i>Sclerotinia sclerotiorum</i>

A practical description and photos of these pests can be found [here](#).



## 8. Harvesting and post-harvesting activities

### 8.1 Harvesting white asparagus

Traditionally, white asparagus is harvested by hand. Harvesting tools consist of an asparagus cutting knife and an asparagus bucket.

On average, a harvester can harvest approximately 12-16 kg per hour. Spear diameter and spear weight are of great influence on harvesting capacity and are becoming more important as wages rise.

In recent years, harvesting machines have been developed that make harvesting easier. The main machine is the SpargelSpinne. This machine lifts the plastic that covers the ridges so that the harvest workers can concentrate purely on harvesting.



*Asparagus harvesting support machine: SpargelSpinne*

The variety, age and growth stage of the plants impact significantly on the harvester's capacity, but the plant density can have the biggest influence. High plant densities provide higher yields per m<sup>2</sup>. Harvesting capacity can grow as the yield per m<sup>2</sup> increases. High plant densities can therefore reduce the cost of harvesting.

In 2010, the shortage of labour in some regions led to the development of a harvesting machine that harvests the complete contents of the ridge. There is no spear length selection with this method.

Plots harvest by machine need 7-14 days to produce new spears. The weather dictates the time intervals between harvests. Cold and wet weather can delay harvest intervals by up to three weeks.

The major advantage of the machine is its huge capacity. One machine can harvest between 150 and 200 hectares. The machine is powered by a tractor with about 80 hp. Two discs cut the spears in the ridge. A sieve chain separates the asparagus from the soil. About four people grade and pack the spears in containers on the machine.

The impact on the plant in the long term is not clear. Practical experience is still needed to judge this method. Initial experience reveals opportunities for big asparagus growers or contractors.

New developments in harvesting techniques include fully automatic harvesting machines. These machines operate entirely without manpower. They search for the spears on top of the ridge and harvest them using laser or optical cameras. Spears are collected in boxes carried on the machine. However, these machines are still at the development stage and are not yet being used commercially.



*Mechanical asparagus harvesting with a Kirpy harvester*

## 8.2 Sorting and grading

Requirements regarding spear quality, diameter and length vary between regions. A common grading classification for white asparagus is: > 28 mm, 24-28 mm, 20-24 mm, 16-20 mm and < 16 mm (1 mm = 0.4 in).

The most important quality aspects are:

- white coloration, including the head of the spear
- straight spears
- closed tip
- no hollow spears
- no rust on spears.

## 8.3 Storage

When the harvested product arrives at the farm, it has to be cooled down. More and more growers are using water shock coolers. These water shock coolers are in fact showers with extremely cold water. By showering the asparagus with cold water, you can quickly reduce the temperature of the product. The faster the product is cooled down to approximately 4 °C (39 °F), the better the storage capacity and shelf life of the product will be.

In this respect, it is crucial to minimise the interval between harvesting and the time the product arrives in the cold store. The shorter the interval between these times, the better and longer the storage period will be.

A more traditional way of cooling down asparagus is by immersing the product in water basins for several hours.

As with green asparagus, the maximum temperature is 4 °C (39 °F). Always store the asparagus in a dark and cool environment with a high humidity to prevent coloration and dehydration of the spears.

In optimal storage conditions asparagus will keep fresh for up to 14 days. To ensure good quality it's important to keep the storage chain, and in particular the cooling chain, closed.



*White asparagus packed for retail*



## 9. Annual cultivation measures

Since asparagus is a perennial vegetable, there are several cultivation measures that have to be performed annually. The most important measures are described below. When any of these cultivation measures are performed, it is important that the soil is not too wet.

### 9.1 Making the ridges

Before the harvest season, ridges have to be made. The ridges provide a growing medium for the white asparagus spears and prevent the spears from colouring purple or green.

The ridges are formed by a tractor and a specialised machine.



*Making ridges for white asparagus cultivation*

### 9.2 Laying the plastic foil

Plastic foil is laid over the ridges. The purpose of this plastic foil is to:

- control the temperature in the ridge;
- prevent sunlight from penetrating the ridge, in order to keep the spear heads white;
- prevent weeds from growing on the ridge.

The foil is laid on the ridge by a tractor and a specialised machine.

### 9.3 Removing the plastic foil

Once the harvesting period has ended, the foil is removed from the field so that the fern can grow and develop. The foil is removed with the same machine.

#### 9.4 Removing/destroying the fern

Once the fern has died back, it can be removed or destroyed. There are several opinions as to what the best time for fern removal is. Some growers argue that the fern should have died back completely, whereas other growers say that fern removal can be done while the fern is still green.



*Laying plastic foil over the ridges*

The most common method of fern removal is milling the fern and mixing it into the soil. This method incorporates the fern residues back into the soil as organic matter.

Another method of fern removal is burning down the foliage. Growers who favour this method argue that by burning down the foliage, all harmful insects and fungal spores are destroyed, implying that next season's cultivation will get off to a clean start.

For additional information, or if you have any questions or comments, feel free to contact us:

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