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BELGIAN ENDIVE (*Cichorium intybus*)

Also known as witloof, Belgian endive is a winter crop grown for the light colored, tightly folded, small heads called chicons. The chicons are produced by forcing new growth from the fall-harvested roots. While extra management is certainly required for growing Belgian endive, it can enable growers to offer a new crop for the ever-expanding winter produce market.

SITE SELECTION AND SOIL PREPARATION:

Belgian endive requires a well-drained soil in full sun. Soil with moderate fertility and a pH of 5.8–6.5 is recommended. The soil must be loose (heavy clay is not advisable) and deeply cultivated so that the roots are able to penetrate the soil to a depth of at least 12 inches. Mildly stony soil is acceptable because unlike most other root crops, forked roots are only inconvenient and do not necessarily affect the chicon quality.

Fresh manure should be avoided due to the amount of available nitrogen, which causes excessive leaf growth. Soil testing for adequate nutrient levels is recommended; levels of 50–100 pounds per acre of phosphorous and 150–200 pounds per acre of potassium are sufficient for optimum yields.

PLANTING:

Direct sow in mid- to late spring as Belgian endive requires a long season, 115 days. The ideal soil temperature for germination is 50°F/10°C. Planting too early can result in bolting, but plants can tolerate light frosts at the end of the season. If the roots are to be stored in a root cellar or other location dependent on ambient temperature, harvest should be timed so the storage area will be sufficiently cold. In this case, count backward from the ideal harvest period to arrive at the planting date.

Sow seeds $\frac{3}{4}$ –1 inch apart (about 30 seeds per foot), $\frac{1}{4}$ – $\frac{1}{2}$ inches deep, in a 2 inch wide band or in single rows 16–24 inches apart for 3 rows planted on a 5–6-foot wide bed. Planting in a band can help ensure a good stand. Ensure that the soil does not dry out during germination. After emergence, thin the seedlings to 2 inches apart.

Water requirements later in the season are flexible, but very sandy soil may need more frequent irrigation. Keep weeds under control with shallow cultivation on a regular basis.

HARVEST OF ROOTS:

Optimum root shoulder diameter for harvest is $1\frac{1}{4}$ – $2\frac{1}{4}$ inches, with a root length of 7 inches. Small amounts can be harvested with a digging fork. For larger mechanical harvests, use a root lifter or modified potato harvesting equipment. Be gentle, as bruises may encourage rot during storage.

“Seasoning” the roots after digging is recommended. Place the roots side by side or in shallow piles, with leaves attached, and allow them to sit in the field for at least 1 day. Protect from direct sun and frost with straw. If time is an issue, roots can be dug in the morning and then prepared for storage later in the afternoon of the same day. Once the roots have dried slightly, trim off the leaves, leaving at least 1 inches to avoid damaging the growing point of the future chicon. Do not wash roots.

STORAGE FOR OVERWINTERING:

Storage conditions no higher than 32°F/0°C with 96–98% humidity are recommended. Commercial growers strive for cooler temperatures, around 30°F/0°C. The longer the intended storage, the more critical it is to meet these specifications. Forcing is possible after only a week’s storage but better success occurs after the roots have been stored for 6–10 weeks. For storage of up to 1½ months, move the roots to a cool garage or barn and cover loosely with sacks or tarps to prevent them from drying out.

Small amounts can simply be refrigerated in a perforated plastic bag. For moderate amounts, a root cellar or walk-in cooler is ideal. Any plastic bag, slightly ventilated or woven plastic, will work. Monitor the roots regularly; sprinkle with water if roots are drying or increase ventilation if there is any slime or mold. Discard any roots with noticeable mold.

FORCING PERIOD	SOIL TEMP (°F/°C)	AIR TEMP (°F/°C)
SEPT–NOV	71–77/22–25	64–70/18–21
DEC–JAN	64–70/18–21	58–66/14–19
FEB–MAY	60–64/16–18	55–59/13–15

FORCING:**Conditions:**

With carefully controlled conditions, the chicons will be of a much higher quality. Chicons may grow slower, may be slightly open, or tinged green in less than ideal conditions. You will probably want to stagger starting times to ensure a continuous supply. For optimum results strive for complete darkness in the forcing area, maintain constant soil and air temperatures (see table above), and provide some air circulation with a relative humidity of 90%.

Basements, greenhouses, or specially built rooms in a barn or other building will be suitable forcing locations. A cool area where bottom heat can be supplied will provide the ideal warmer-soil-than-air temperature. Cover windows and doorways with black plastic to maintain humidity levels and exclude sunlight.

Any size container can be used but it should be light enough once filled and deep enough to prevent roots from falling over. Roots can be planted after filling containers with a moist soilless mix, or the mix can be placed loosely between roots that have been stacked in their containers.

Root Preparation:

Cut roots to a uniform length (7 inches is common), and simply insert roots upright into the medium. Roots may be placed as close to one another as needed; approximately ½–¾ of the root length needs to be in the medium — do not cover the crowns with media. Containers that are slightly shallow may also be used, however roots will need to be placed at a slight angle. The root crowns can extend above the sides of the containers but should all be roughly even in height. Once the roots have been situated in the containers, moisten the soilless mix again to help the roots settle. Soil moisture will need to be checked regularly and maintained damp but not saturated. The containers should then be placed in some sort of leak-proof tray and located over heat mats.

To maintain humidity level, moisten the soilless mix and add a fine mist in the grow room if needed. Remember to adjust your heating system to compensate for changes in the outdoor temperature. A dim light while watering or checking the crop will do no harm.

FORCING IN AN EBB-AND-FLOW SYSTEM:

Large-scale operations force Belgian endive roots in ebb-and-flow systems, where a nutrient solution floods the containers the roots are in and drains out. In many of these systems, the trays are stacked, which saves space and in some cases allows for solution recycling.

Using an ebb-and-flow system is most practical if building an entirely new structure or if a system is already in place for another crop. Roots should be prepped for forcing in the same way as traditional forcing. For the stacked tray method, warm water with an added nutrient solution is slowly pumped through the top trays; the drainage and pump speed are regulated to maintain about 2 inches of water in the trays. The water drains downward to the lowest layer where it is collected, aerated, reheated, and re-circulated. This may eventually increase the air temperature of the location the roots are being forced in, necessitating some cool air ventilation. Soluble fertilizer added to the nutrient solution, while not entirely needed, will increase the total weight of the chicons. The water temperature should begin low, 50°F/10°C, and may be raised through the first week to the specified temperature for that forcing period.

DISEASES AND PESTS:

With the recommended 4 year rotation, Belgian endive is for the most part trouble free. Leaf miners are possible insect pests. Damage by leaf miners can be identified by “tunnels” that appear on the leaves. *Sclerotinia* (white mold) a problematic fungus. Check with your local Cooperative Extension Service for control methods.

HARVEST OF CHICONS:

Chicons should be ready for harvest in 21–29 days. The heads should be firm and about 5 inches long. For optimum weight and quality, the core of a head cut lengthwise will be just under 40% of the length. Core length decreases somewhat in later forcing periods.

Harvest by using one hand to grasp the root and with the other hand, gently snap the heads from the root. Trim off any loose leaves with a sharp knife. Keep chicons clean, as washing can cause the chicons to brown. Protect the heads from light, even after harvest, to keep them from greening. In Europe, the heads are marketed covered with blue paper which helps exclude light and retain moisture.

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