



Forage chicory

Forage chicory (*Cichorium intybus* L.) is a perennial plant that is suited to well-drained or moderately drained soils with medium- to high-fertility levels and a pH of 5.5 or greater. Chicory produces leafy growth which is higher in nutritive and mineral content (if managed properly) than is produced by alfalfa or cool-season grasses. It has a relatively deep taproot which provides for tolerance to drought conditions. Chicory provides both spring and summer forage with average growth rates from April through October of 50 pounds per acre per day. During peak growth periods chicory produces 73 pounds per acre per day.

Chicory is a relatively new forage crop in the United States, but has been used in other countries for more than 300 years. Although it originated in Central Europe, much of the breeding for improved forage characteristics has been completed in New Zealand.

Forage chicory is a low-growing rosette plant with broad leaves in the winter, very much like dandelion. With warm temperatures in the spring it produces large numbers of leaves from the crown. In late spring, after the establishment year, a few flower stems begin to develop from the crown and will reach heights of 6 feet if ungrazed. The thick tap root of chicory can be exposed and damaged by overgrazing, excessive hoof traffic, and frost heaving.

ADAPTED VARIETIES AND ESTABLISHMENT
‘Puna’ is the only variety of chicory that is currently sold in the United States, and approved for sale by the Pennsylvania Department of Agriculture. This variety was developed under New Zealand grazing conditions, and has been very productive in Pennsylvania. Other chicory varieties are being developed and evaluated in New Zealand, but are not yet available in this country.



Seeding into a tilled seedbed—A moist, firm seedbed is required for forage chicory, chicory-grass, or chicory-legume mixtures. Spring seedings (April 15 through June 1) of chicory have been successful in Pennsylvania. Summer seedings have been successful in New Zealand but have not been tested in Pennsylvania. If chicory is seeded in the summer, seeding should be completed by early August. Cool temperatures and shortening day lengths in the fall impede chicory stand development. Therefore, summer seedings later than recommended dates may not establish stands that survive Pennsylvania winters.

Seed may be either drilled or broadcast. Drilling is preferred because it provides a more uniform depth of planting. Plant chicory seeds 0.25- to 0.5-inch deep. Cultipacking the seedbed before and after broadcast seeding ensures that the seeds have good seed-to-soil contact and are not planted too deep.

Seeding into an existing pasture—Broadcasting and no-till drilling are two methods that can be used to seed chicory into existing pastures. Broadcast chicory seed onto existing pastures during the late winter or early spring when the soil freezes at night but thaws during the day. The freezing creates ice crystals which melt during the day and leave small holes in which the seeds can fall. To improve the success of this method, also called frost seeding, be certain to broadcast the seed early in the day before the soil thaws and becomes “greasy.”

No-till seeding of chicory into existing pastures has been successful in Pennsylvania. However, proper management is necessary to improve potential establishment with this method. Suppression of the existing sod to reduce competition is the first step. Refer to the *Penn State Agronomy Guide* (available at county extension offices) for detailed information about sod suppression for no-till seeding. Seeding early in the spring (before slugs hatch, about May 15 in central Pennsylvania) or using a molluscicide bait will reduce the potential damage associated with slug feeding on chicory seedlings.

Seeding rates in mixtures—Chicory seeding rate varies with seedbed condition, seeding method, and seed quality. Generally, when seeding chicory alone, rates of 3 to 4 pounds per acre are sufficient. When seeding in mixtures, a legume is included because it has nitrogen fixing capability. Seeding rate recommendations for chicory with various cool-season forage species are given in Table 1. Germination of stored seed can decline rapidly, therefore seed should be used promptly and not stored from year to year.

No herbicides are currently registered for use with chicory either during or after establishment. Therefore, it is important to select fields with little weed pressure. If weeds do become a problem during establishment, mowing can help suppress them. Chicory regrows rapidly after mowing and can outgrow most weeds.

GRAZING MANAGEMENT

Correct grazing management is essential to maximize the life (5 to 7 years) of the chicory stand and maintain forage quality. Spring-seeded chicory can be grazed after 80 to 100 days, depending on climatic conditions. Researchers at the USDA Pasture Laboratory found that ‘Puna’ chicory can yield more than 3 tons per acre during the seeding year (Table 2). Chicory production is optimized under rotational grazing management. Depending on time of year, a

Table 1. Seeding rates for chicory alone and in mixtures.

Seeding mixture ^a	Seeding rates		
	Chicory (lbs/A)	Legume (lbs/A)	Grass (lbs/A)
Chicory alone	3–4	—	—
Chicory in a mixture with			
RC	3–4	6–8	—
WC	3–4	3–4	—
RC and OG	1–2	3–4	4–6
WC and OG	1–2	1–2	4–6
RC and TF	1–2	3–4	8–10
WC and TF	1–2	1–2	8–10
RC and PRG	1–2	3–4	4–8
WC and PRG	1–2	1–2	4–8
RC and PG	1–2	3–4	20–25
WC and PG	1–2	1–2	20–25

^aRC = red clover; WC = white clover; OG = Orchardgrass; TF = tall fescue (use only endophyte free varieties of tall fescue); PRG = perennial ryegrass; PG = prairie grass.

Table 2. Dry matter yields of ‘Puna’ chicory under six harvest management schedules during the seeding year. Chicory was seeded on April 30 in Centre County, Pennsylvania.

Harvest Schedule	July	Aug.	Sept.	Oct.	Season total
	(lbs/A)	(lbs/A)	(lbs/A)	(lbs/A)	(lbs/A)
1	1,092	—	—	—	1,092
2	1,092	1,420	—	—	2,512
3	1,092	1,420	2,017	—	4,529
4	1,092	—	3,364	—	4,456
5	1,092	—	3,364	1,766	6,222
6	1,092	—	—	4,321	5,413

rest period of 25 to 30 days between grazings is best for chicory persistence and performance. A stubble height of 1.5 to 2 inches should remain after grazing.

Keep stems from growing—After the seeding year, chicory will grow vigorously and attempt to produce stems in the late spring and early summer. Stubble heights greater than 1.5 inches or rest periods longer than 25 days can allow stems to bolt (rapid stem growth). Once chicory stems have bolted, the production potential of the plants is reduced for the remainder of the grazing season or until the stems are mowed. Management practices which do not allow

the chicory flower stems to exceed a 6-inch height in late May, before they are grazed, and grazing to a 1.5-inch stubble height will reduce the amount of stem bolting.

When animals are strip grazing chicory, a back fence should be used so that regrowth will not be grazed and the stand weakened.

Manage for quality, yield, and animal performance—Established forage chicory stands have quality potentials and yields comparable to many other Pennsylvania forage crops. Protein levels in chicory range from 10 to 32 percent, depending on plant maturity. The digestibility and the mineral content of chicory leaves are greater than those of alfalfa. The digestibility of chicory leaves is generally between 90 and 95 percent. Chicory flower stems are less digestible than the leaves. This is an additional reason to manage chicory pastures so that stems do not develop fully. Yields of 6 tons per acre have been obtained from pure chicory stands in Pennsylvania trials.

Animal performance on forage chicory has been exceptional. In West Virginia trials, forage chicory pastures produced lamb gains of 820 pounds per acre. Studies in New Zealand have reported animal gains of 0.6 pounds per day for lambs and 2 pounds per day for Friesian bulls. Chicory contains relatively high levels of minerals (potassium, calcium, magnesium, sulfur, zinc, and sodium) which are essential for proper animal nutrition.

FERTILITY

Fertility needs at seeding should be determined by soil test. Chicory will remain productive at soil pH levels of 4.5, however, it is recommended that soil pH

be above 5.5 at seeding to optimize plant establishment. Phosphorus and potassium levels at seeding should be in the moderate to optimum range. Apply nitrogen fertilizer at 35 pounds per acre at seeding to stimulate chicory establishment. In the absence of a soil test, assuming a medium-fertility level soil, plow down 0-45-135 pounds per acre and apply 50-20-20 pounds per acre at seeding. If chicory is seeded with a legume, reduce the nitrogen application at seeding.

Chicory requires a high level of fertility for maximum production. It is also very responsive to N fertilization. If chicory is grown without a legume, apply 100 to 150 pounds N per acre in split applications of 50 pounds per acre in early spring when the chicory becomes green and 50 pounds per acre in early summer and in early fall. Yield responses to N fertilizer rates up to 200 pounds N per acre have been reported. However, as N rate increases so does stem growth. Therefore, the yield increase from N fertilization must be weighed against the ability to keep chicory grazed so that stems do not bolt. If chicory is planted with alfalfa or another legume, restrict annual N applications to limit the effect N has on reducing nitrogen fixation of the legume.

SUMMARY

Forage chicory is a deep-rooted plant which grows best on fertile, well-drained soils. It will provide spring and summer growth which can supplement the grazing season during the traditional “summer slump” of the cool-season forage species. ‘Puna,’ the only variety of forage chicory currently sold in Pennsylvania, has performed well under Pennsylvania conditions. However, proper management is essential to obtain adequate yield, quality, and persistence.

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