Dandelion

Taraxacum officinale F. H. Wigg.

Images above: Upper Left: Dandelion seedling (Antonio DiTommaso, Cornell University). Upper Right: Dandelion rosette (Scott Morris, Cornell University). Bottom Left: Dandelion plant in flower (Antonio DiTommaso, Cornell University). Bottom Right: Dandelion mature seeds on seed head (Antonio DiTommaso, Cornell University).

Identification

Other common names: common dandelion, lions-tooth, blowball, cankerwort, faceclock, pee-a-bed, wet-a-bed, lion's-tooth, cankerwort, Irish daisy.

Family: aster family, Asteraceae

Habit: Rosette forming, taprooted perennial herb with leafless flowering stalks.

Description: Cotyledons are 0.2-0.4" (0.51-1.0 cm) long by 0.08-0.14" (0.20-0.36 cm) wide, yellow-green, hairless, untoothed, flat, and oval to upside down teardrop shaped. The first true leaves of the **seedling** are alternate, hairless, spatula to upside down teardrop shaped, and gray-green on their lower surface; edges are wavy, irregularly toothed, and lobed at the third leaf stage. Later emerging leaves of the young plants are widely toothed and deeply lobed, with lobe tips pointed towards the center of the rosette. Scattered flat hairs may be present on both sides of the leaf. **Mature plants** form a basal rosette of leaves. Leaves are stalkless, narrow and deeply divided toward the base, 2-15.5" (5.1-39.4 cm) long, deeply lobed. Lobes are triangular, often oppositely paired, and point toward the crown. Scattered hairs are occasionally present on the midvein and leaf underside. Large, fleshy taproots may branch and can reach depths up to 6.5 ft (198 cm). The entire plant exudes milky white sap when cut. Single **flowers** develop on 2-30" (5.1-76.2 cm) long, hollow, sparsely hairy, leafless, white-green to reddish tinged stalks. The bright yellow flowerhead is 1-2" (2.5-5.1 cm) in diameter, 0.5-1" (1.3-2.5 cm) tall, and set directly above two rows of long, green, skinny bracts. The outer bract row is curled back to touch the stem, and the inner row encases the immature flowerhead. The flowerhead consists of 100-300 yellow petals, each with 5 points at the tip. **Seeds** are gray-yellow to light brown, 0.25" (0.64 cm) long, cylindrical, and attached to a feathery pappus by a 0.4" (1.0 cm) long stalk. The seedhead is gray-white and spherical.

Similar species: Redseed dandelion [*Taraxacum laevigatum* (Willd.) DC.] is very similar to dandelion but in contrast to that species, the terminal lobe of the leaf is about the same size as the lateral lobes, and the seeds are red to purple brown. Chicory (*Cichorium intybus* L.) can be distinguished from dandelion by the prominent, coarse hairs on its older leaves and by its lobes pointing forward, backward, and perpendicular to the leaf axis. Common catsear (*Hypochaeris radicata* L.) has similar yellow flowers, but its stems are tall and branching with scattered leaves and multiple flowers. Annual and perennial sowthistle (*Sonchus* spp.) have waxy blue-green leaves with large auricles at the leaf base.

Management

To avoid problems with dandelion, avoid high K levels in the soil. Dandelion competes poorly with forage grasses and grains for K, so when K is in relatively short supply, the grasses win (Tilman et al. 1999). In contrast, since grasses and grains show a greater response to N and P than dandelion, high N and P levels will favor the grasses. Excessive liming also promotes dandelion.

In pastures, dandelion is more likely to be a problem under continuous stocking than under intensive rotational grazing. With rotational grazing, the leaves will grow upright in response to competition from the grasses which makes them more susceptible to grazing when the animals are present. In contrast, under continuous stocking, the leaves will be prostrate and hard for the animals to bite, and growth rates are likely to be higher due to reduced competition from the grasses. Dandelion can establish in alfalfa after it is mowed, and tends to increase during the alfalfa phase of a crop rotation (Meiss et al. 2010, Ominski et al. 1999). Alfalfa can promote dandelion emergence and establishment, especially in small gaps in the alfalfa stand (Martinkova et al. 2014). Mowing alfalfa in the flowering stage is more effective at suppressing dandelion than mowing in the vegetative or bud stage. Seeding forages in narrow row spacing reduces subsequent dandelion density and growth. Although dandelion makes nutritious forage, it slows the drying of hay by up to a full day (Stewart-Wade et al. 2002). Generally, removal of leaves or the uppermost root from established plants has little effect on survival in lawns or hay (Mann 1981).

Moldboard plowing is the most effective tillage regimen for controlling severe dandelion infestations: plowing puts the root crown deep in the soil from which re-sprouting is difficult, and inversion of the roots decreases the likelihood of sprouts arising from small roots. Conversely, dandelion density often increases with adoption of reduced tillage practices. Re-sprouting of roots following tillage is less in May than at other times, probably because root reserves are reduced by flowering at that time (Mann and Cavers 1979).

Frequent tine weeding is effective for removing new seedlings that arise following the spring burst of seed production. Flame weeding will kill small seedlings, but it is ineffective against larger plants because the tissues that produce new leaves are protected by slight burial in the soil and by a whorl of newly forming leaves.

Because of its prostrate growth form, dandelion emerging from seed is one of the most sensitive weed species to mulching with straw. Seedlings have a difficult time emerging through a loose mat of straw. Long leaves emerging from root sprouts have no trouble, however, in emerging through even a thick mat of loose straw. Matted straw from bales will prevent emergence of root sprouts, but in rainy weather, the straw will begin to rot and provide a favorable habitat for establishment of seedlings.

Dandelion often poses little problem for field crop production in humid regions, even though the bright yellow flowers make the field appear very weedy. It is short in height and a poor competitor for nutrients, so if the crop is more than a foot tall and not water stressed, dandelions may cause little yield loss. Moreover, the flowers provide nectar and pollen for beneficial insects that help control pests. In drought years and in dry regions, however, a dandelion infestation may decrease yield substantially.

Ecology

Origin and distribution: Dandelion probably originated in Europe (Holm et al. 1997) but spread through Eurasia and North America prior to human agriculture. It occurs throughout the U.S.A. and Canada, up to nearly 65° N, and is considered both native and introduced throughout North America (USDA Plants, Stewart-Wade 2002). European settlers introduced dandelion very early during the colonization of New England, perhaps deliberately for its medicinal properties (Stewart-Wade et al. 2002). The species now inhabits all regions of the world, including tropical and sub-antarctic regions (Holm et al. 1997).

Seed weight: 0.34 mg (seeds produced in summer) to 0.54 mg (seeds produced in spring) (Martinkova et al. 2011, Doisy et al. 2014, Milberg et al. 2000, Werle et al. 2014); 0.6 mg (Bostock 1978).

Dormancy and germination: Newly dispersed dandelion seeds are capable of immediate germination if they receive the right cues (Stewart-Wade et al. 2002). A few freshly dispersed seeds will germinate regardless of conditions, but light, fluctuating temperatures and nitrate all increase germination (Bostock 1978). Light is the most effective stimulus for germination (Luo and Cardina 2012), but 100% germination requires light plus one of the other factors. If seeds experience a period of cold and dark, as occurs when buried in the soil during winter, they subsequently require light for germination (Stewart-Wade et al. 2002). Seeds will germinate at temperatures from 41 to 95 °F (5 to 35 °C), but percentage germination and speed of germination are reduced at temperatures above 68 °F (20 °C) (Luo and Cardina 2012, Washitani 1984). Germination is highest at alternating day/night temperatures of 59/41 °F (15/5 °C) and 77/59 °F (25/15 °C), and reduced at 95/77 °F (35/25 °C) (Luo and Cardina 2012).

Seed longevity: Seeds can last 1-5 years in the soil, but in normal agricultural conditions, only a few survive to the next season (Stewart-Wade et al. 2002). The overwhelming majority of seedlings come from recently dispersed seeds (Hacault & Van Acker 2006). In one experiment, a majority of seeds were consumed by ground beetles within 2 to 3 weeks after shedding, but the 2-4% of viable seeds that remained were sufficient to maintain high soil populations (Honek et al. 2005). In another experiment recording the fate of dandelion seeds shed in spring, 29 to 48% of seeds became nonviable, 35 to 44% were consumed by ground beetles, 5 to 25% were consumed as seedlings by slugs, and only 2 to 13% survived as seedlings (Honek et al. 2009).

Season of emergence: Some seedling emergence occurs throughout the growing season (Chepil 1946), but the bulk of new seedlings appear in early to mid-summer, shortly after the burst of seed production in late spring (Hacault and Van Acker 2006, Stewart-Wade et al. 2002). Many established rosettes overwinter, even in cold climates, and shoot establishment from rootstocks occurs in early spring (Doll 2002, Hacault and Van Acker 2006).

Emergence depth: Emergence is not affected by depth between 0 and 0.8” (2 cm) but declines at progressively greater depths. No emergence occurs from seeds below 3” (8 cm). Emergence from small root fragments can occur from 2-4” (5-10 cm) of soil (Stewart-Wade et al. 2002).

Photosynthetic pathway: C3 (Stewart-Wade et al. 2002).

Sensitivity to frost: Dandelion is very frost hardy and at least some plants overwinter throughout its range (Hacault and Van Acker 2006). In warmer parts of the U.S.A., plants continue to grow throughout the winter.

Drought tolerance: Young plants are highly sensitive to drought, but well-established plants are very drought resistant (Stewart-Wade et al. 2002).

Mycorrhiza: Dandelion forms mycorrhizal associations (Dhillion and Friese 1994, Pendleton and Smith 1983, Stewart-Wade et al. 2002).

Response to fertility: In competition with grasses, increased N and P favored grasses relative to dandelion. Without competition, dandelion growth increases with P fertility (Hoveland et al. 1976) but does not respond to N. Dandelion has a higher requirement for K than many grasses, and thus competes poorly for this element when it is in moderate to short supply (Tilman et al. 1999). Dandelion tolerates soil with a pH as low as 4.0, but establishment and growth increases at a pH up to 8. In one study, a soil with pH of 7.1 produced 45% more fresh weight and had 67% more plants than a soil with pH of 6.2 (Holm et al. 1997). Below pH of 5.2, growth is poor (Buchanan et al. 1975).

Soil physical requirements: Dandelion occurs on a wide range of soils from wet, fine textured meadow soils to rocky ridge tops (Stewart-Wade et al. 2002). In vegetated areas, seedlings establish best on ridges, but on bare soil, seedlings establish best in hollows.

Response to shade: Dandelion is shade tolerant (Stewart-Wade et al. 2002) and will grow even under competitive crops like potato.

Sensitivity to disturbance: Dandelion has a great capacity for resprouting from damaged roots or following the removal of leaves (Mann 1981). It does not normally reproduce vegetatively, but root fragments as small as 0.05" diameter by 0.25" length can establish new plants (Stewart-Wade et al. 2002). The likelihood of establishment increases with the length and diameter of the fragment. Root fragments that are moved out of their original vertical position are less likely to resprout (Mann and Cavers 1979). Fragments from near the root crown are more likely to sprout than are fragments from near the root tip (Mann and Cavers 1979). Root fragments derived from plants at peak flowering in mid-spring have lower survival than those derived from plants in summer (Mann and Cavers 1979). Flowers that are cut from the stalk will set seed, but the seeds are not viable (Gill 1938).

Time from emergence to reproduction: Some plants that establish in the spring may flower in the fall, but most do not flower until the following spring (Stewart-Wade et al. 2002). As with most perennial herbs that do not spread by roots or rhizomes, flowering is more related to reaching a minimum size than to the age of the plant. Dandelions that have formed a strong taproot and 20 leaves (some of which may have subsequently died) are usually ready to flower (Stewart-Wade et al. 2002). Peak flowering begins in mid-spring and continues for 2 to 6 weeks (Doll 2006, Honek et al. 2005), but can continue throughout the year with a secondary peak in fall (Gray et al. 1973, Mann and Cavers 1979). A few seeds may become viable as early as 3 days after the flowers wither and close, but most are not viable until 6-8 days after flowering in the summer or about 10 days after flowering in the spring or fall (Martinkova et al. 2011).

Pollination: Dandelions in North America have three sets of chromosomes rather than a multiple of 2 like most species (Stewart-Wade et al. 2002). Consequently, they are incapable of sexual reproduction except by extremely rare genetic accidents. The embryos develop into seeds without fertilization. However, insect visitors may be needed to trigger seed set.

Note on evolution: Why does dandelion produce pollen if the seeds develop without fertilization? Common dandelion almost certainly arose by hybridization of two related species that were insect pollinated. The hybridization left a chromosome arrangement that makes sex essentially impossible, but due to a fluke of fate, the hybrid was able to develop seeds asexually. Since both parent species produced pollen, the resulting dandelion does too. Although pollen is not needed for seed production, its manufacture cannot be selected out of the population because without sex, evolution proceeds extremely slowly.

Reproduction: The flower bud forms near ground level in about 1 week. Once the bud is formed the shoot grows up in 48 hrs. The flowers typically open on 2-3 successive days (Gray et al. 1973). They are open only in morning during summer but through most of the day in spring and fall (Gray et al. 1973). They close or remain closed if the weather is cold or wet (Gray et al. 1973). The shoot lies horizontal while the seeds mature (Stewart-Wade et al. 2002). Presumably this is an adaptation to reduce seed losses to grazing but also protects the developing seed head from mowing. Roughly 2 days later, the stalk returns to an upright position and the seed head opens for dispersal. The length of the flower stem is longer in summer when the temperature is higher and daylength is longer (Gray et al. 1973). Under good conditions, a dandelion plant will produce 50-150 seed heads per year with an average of 250 seeds per head (Stewart-Wade et al. 2002).

Dispersal: Seeds are wind dispersed by means of umbrella-like fluff. Updrafts are most important for long distance dispersal and a model of dandelion seed transport determined that 99.5% of seeds would land within 11 yards (10 m), 0.05% would travel more than 108 yards (100 m), and 0.01% would travel greater than 1083 yards (1 km) (Tackenberg et al. 2003). However, dispersed dandelion seeds were one of the most likely of weeds tested to be intercepted by standing vegetation and many seeds may not become incorporated into the soil (Doisy et al. 2014). Seeds also disperse in the feces of cattle (Mt. Pleasant and Schlather 1994), horses and birds, in soil on shoes, tires and farm implements and via water in irrigation ditches (Stewart-Wade et al. 2002).

Common natural enemies: Sparrows and finches eat the seeds while they are on the stalk, and rodents and sparrows eat seeds after dispersal. Deer, ducks, geese and grouse eat the leaves. The cyprinid wasp, *Phanacis taraxaci*, forms galls on the leaves. The weevil, *Ceutorhynchus punctiger*, attacks buds, seeds and leaves, and shows some potential as a biological control agent. The aphid, *Aphis knowltoni*, feeds on the roots. Several fungi attack dandelion in North America, including species of powdery mildew (*Sphaerotheca*), and *Puccinia taraxaci* and *Synchytrium tarazaci*, both of which make tiny growths on the leaves. The latter caused partial stunting of the plants. *Phoma exigua* and *P. herbarum* may prove useful as biocontrol agents. (all referenced in Stewart-Wade et al. 2002)

Palatability: Leaves of dandelion are commonly marketed for use as a salad green and as a cooked green (Stewart-Wade et al. 2002). Leaves are least bitter in early spring. It is one of the most nutritious of all vegetables, containing high concentrations of minerals and vitamins, including a higher concentration of beta carotene than carrots (Stewart-Wade et al. 2002). The flowers can be used to make wine. Dandelion foliage has good forage quality (Bergen et al. 1990, Marten et al. 1987), and palatability was greater than that of a tall fescue/legume forage for the entire growing season (Bunton et al. 2020). However, palatability to grazing lambs was lower than alfalfa (Marten et al. 1987). Chickens relish both the roots and leaves.

Notes: Incorporation of dandelion tissues into soil inhibits growth of tomato crown and root rot (*Fusarium oxysporum* f.sp. *radicis-lycoperici*) (Kasenberg and Traquair 1988).

References:

- Bergen, P., J. R. Moyer, and G. C. Kozub. 1990. Dandelion (*Taraxacum officinale*) use by cattle grazing on irrigated pasture. Weed Technology 4:258-263.
- Bostock, S. J. 1978. Seed germination strategies of five perennial weeds. Oecologia (Berlin) 36:113-126.
- Buchanan, G. A., C. S. Hoveland, and M. C. Harris. 1975. Response of weeds to soil pH. Weed Science 23:473-477.
- Bunton, G., Z. Trower, C. Roberts, and K. W. Bradley. 2020. Seasonal changes in forage nutritive value of common weeds encountered in Missouri pastures. Weed Technology 34:164-171.
- Chepil, W. S. 1946. Germination of weed seeds. I. Longevity, periodicity of germination, and vitality of seeds in cultivated soil. Scientific Agriculture 26:307-346.
- Dhillion, S. S., and C. F. Friese. 1994. The occurrence of mycorrhizas in prairies: Applications to ecological restoration. Thirteenth North American Prairie Conference 13:103-114.
- Doisy, D., N. Colbach, J. Roger-Estrade, and S. Médiène. 2014. Weed seed rain interception by grass cover depends on seed traits. Weed Research 54:593-602.
- Doll, J. 2002. Knowing when to look for what: Weed emergence and flowering sequences in Wisconsin. http://128.104.239.6/uw_weeds/extension/articles/weedemerge.htm
- Gill, N. T. 1938. The viability of weed seeds at various stages of maturity. Annals of Applied Biology 25:447-455.
- Gray, E., E. M. McGehee, and D. F. Carlisle. 1973. Seasonal variation in flowering of common dandelion. Weed Science 21:230-232.
- Hacault, K. M., and R. M. Van Acker. 2006. Emergence timing and control of dandelion (*Taraxacum officinale*) in spring wheat. Weed Science 54:172-181.

- Holm, L, J. Doll, E. Holm, J. Pancho and J. Herberger. 1997. World Weeds: Natural Histories and Distribution. John Wiley & Sons: New York.
- Honek, A., Z. Martinkova, and P. Saska. 2005. Post-dispersal predation of *Taraxacum officinale* (dandelion) seed. Journal of Ecology 93:345-352.
- Honek, A., Z. Martinkova, P. Saska, and S. Koprdova. 2009. Role of post-dispersal seed and seedling predation in establishment of dandelion (*Taraxacum* agg.) plants. Agriculture, Ecosystems and Environment 134:126-135.
- Hoveland, C. S., G. A. Buchanan, and M. C. Harris. 1976. Response of weeds to soil phosphorus and potassium. Weed Science 24:194-201.
- Kasenberg, T. R. and J. A. Traquair. 1988. Effects of phenolics on growth of *Fusarium oxysporum* f.sp. *radicis-lycopersici* in vitro. Canadian Journal of Botany 66: 1174-1177.
- Luo, J., and J. Cardina. 2012. Germination patterns and implications for invasiveness in three *Taraxacum* (Asteraceae) species. Weed Research 52:112-121.
- Mann, H. 1981. Common dandelion (*Taraxacum officinale*) control with 2,4-D and mechanical treatments. Weed Science 29:704-708.
- Mann, H., and P. B. Cavers. 1979. The regenerative capacity of root cuttings of *Taraxacum officinale* under natural conditions. Canadian Journal of Botany 57:1783-1791.
- Marten, G. C., C. C. Sheaffer, and D. L. Wyse. 1987. Forage nutritive value and palatability of perennial weeds. Agronomy Journal 79:980-986.
- Martinkova, Z., A. Honek, and J. Lukas. 2011. Viability of *Taraxacum officinale* seeds after anthesis. Weed Research 51:508-515.
- Martinkova, Z., A. Honek, and S. Pekár. 2014. The role of nurse plants in facilitating the germination of dandelion (*Taraxacum officinale*) seeds. Weed Science 62(3):474-482.
- Meiss, H., S. Médiène, R. Waldhardt, J. Caneill, V. Bretagnolle, X. Reboud, and N. Munier-Jolain. 2010. Perennial lucerne affects weed community trajectories in grain crop rotations. Weed Research 50:331-340.
- Milberg, P., L. Andersson, and K. Thompson. 2000. Large-seeded species are less dependent on light for germination than small-seeded ones. Seed Science Research 10:99-104.
- Mt. Pleasant, J., and K. J. Schlather. 1994. Incidence of weed seed in cow (*Bos* sp.) manure and its importance as a weed source for cropland. Weed Technology 8:304-310.
- Ominski, P. D., M. H. Entz, N. Kenkel. 1999. Weed suppression by *Medicago sativa* in subsequent cereal crops: a comparative survey. Weed Science 47:282-290.
- Pendleton, R. L., and B. N. Smith. 1983. Vesicular-arbuscular mycorrhizae of weedy and colonizer plant species at disturbed sites in Utah. Oecologia 59:296-301.
- Stewart-Wade, S. M., S. Neumann, L. L. Collins, and G. J. Boland. 2002. The biology of Canadian weeds. 117. *Taraxacum officinale* G. H. Weber ex Wiggers. Canadian Journal of Plant Science 82:825-853.
- Tackenberg, O., P. Poschlod, and S. Kahmen. 2003. Dandelion seed dispersal: The horizontal wind speed does not matter for long-distance dispersal - it is updraft! Plant Biology 5:451-454.
- Tilman, E. A., D. Tilman, M. J. Crawley, and E. A. Johnston. 1999. Biological weed control via nutrient competition: potassium limitation of dandelions. Ecological Applications 9:103-111.
- USDA Plants Database. Natural Resources Conservation Service. http://plants.usda.gov.
- Washitani, I. 1984. Germination responses of a seed population of *Taraxacum officinale* Weber to constant temperatures including the supra-optimal range. Plant, Cell and Environment 7:655-659.
- Werle, R., M.L. Bernards, T. J. Arkebauer, and J. L. Lindquist. 2014. Environmental triggers of winter annual weed emergence in the Midwestern United States. Weed Science 62:83-96