BARLEY
Hordeum vulgare L.

Plant Symbol = HOVU

Barley crop (USDA-NRCS photo)

Alternate Names

Common Alternate Names: common barley, grain barley, cereal barley

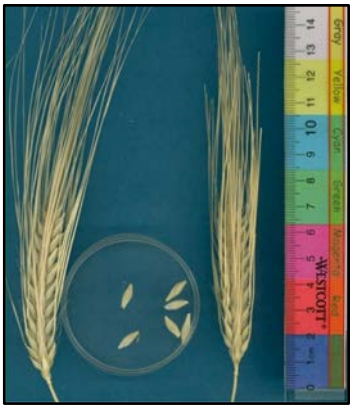
Scientific Alternate Names: *Hordeum aegiceras* Nees ex Royle, *Hordeum distichon* L., *Hordeum hexastichon* L., *Hordeum hexastichum* L., *Hordeum irregulare* Aberg & Wiebe, *Hordeum sativum* Pers., *Hordeum vulgare* L. ssp. *hexastichon* (L.) Bonnier & Layens, *Hordeum vulgare* L. var. *trifurcatum* (Schltdl.) Alef.

Description

General: Barley is an annual, cool season bunchgrass that grows 2–4 ft tall (Ball et al., 1996). Stems are hollow and jointed. Leaf surfaces and leaf margins are smooth, tapered, and arise on the stem above ground level (Brown, 1979). Nodes and internodes of stems are hairless (Radford et al., 1968). Seeds are borne on a spike inflorescence ¾ to 4 inches (2–10 cm) long with flower clusters in groups of three long bristles (called awns). Awns can be absent in some varieties, but when present can reach 6 inches in length (Radford et al., 1968).

Prior to flowering, barley can be confused with other small grains. Barley is distinguished from wheat, rye, and oats by examining the leaf collar when it is pulled away from the stem. The leaf collar on a barley plant will have two overlapping appendages that clasp the stem, called auricles (Ball et al., 1996)

There are two different groups of barley, the six-rowed and two-rowed types. These groups refer to the differences in the arrangement of the seedheads in the spike. When viewing a head of six-rowed barley from above, there are six rows of kernels, three on each side of the rachis (seedhead stem). In two-rowed barley, only the middle spikelet develops a kernel, and the other two spikelets are sterile. When viewed from above, the two-rowed type appears to have only two kernels (Carena et al., 2009).



Example of a six-rowed barley variety. (Photo by H. Bockelman, USDA-NRCS)

Traditionally, barley has a husk or hull around the grain that limits digestibility. Hull-less varieties have hulls that can easily be removed from the grain when it is combined and threshed, and contain more digestible energy (Griffey et al., 2009).

Distribution: Barley is not native to the United States and only exists in cultivated areas. It sometimes volunteers in fields and disturbed areas, but is not persistent (Hitchcock and Chase, 1971). It can be found in grainfields and along roads from Connecticut to New Jersey, South Dakota, Montana, Colorado, Utah, New Mexico, and California. For current distribution, please consult the Plant Profile page for this species on the PLANTS Web site.

Habitat: Barley is an ancient cereal crop that does not exist in the wild. It has been grown all around the world, and its precise origin is unknown (Harlan, 1979). Barley may have evolved from *Hordeum spontaneum*, a weedy plant commonly found throughout the fertile crescent region of the Near East. However, there is evidence to suggest that *Hordeum agriocrithon*, discovered in 1938 in Tibet, may be a closer ancestor to modern cultivated barley (Harlan, 1974). Both of these regions have long histories of farming barley crops.

Adaptation

Barley grows well with supplemental irrigation in cool, dry areas. It can be grown in a hot climate, but is more susceptible to diseases and pathogens in a hot, humid climate (Weibe, 1979). Barley crops are not typically grown in the humid regions of the southeastern United States (Schaffer, 1993). It is more winter-hardy than oats, but is more prone to winterkill than wheat

or rye (Weibe, 1979). Barley is sensitive to winter conditions and will die if the temperature drops below 17°F (Hannaway et al., 2004).

Barley cannot tolerate poorly drained soil, grows well when pH values are between 6.0– 8.5 (Midwest Cover Crops Council, 2012), and has been used to reclaim saline soils (Hannaway et al., 2004). It generally grows better than any other small grain in highly alkaline soils (Reid et al., 1979). Best soils for growing barley are well-drained loams and clay loams (Reid et al., 1979). Growing barley on sandy soils causes uneven plant growth and development (Hannaway et al., 2004).

Uses

Cereal grain production: Barley is a cool-season annual grass that produces grain for human and animal consumption. Because there are both summer and winter varieties, barley can be grown at a wide variety of locations. It ranks fourth in terms of world grain production behind maize (*Zea maize* L.), wheat (*Triticum aestivum* L.), and rice (*Oryza sativa* L.) (Carena, 2009). In the United States, barley grain is used primarily as a high-protein additive to livestock feed for cattle, sheep, pigs, and poultry. An estimated 25% of barley grain production in the United States is used to make malted beverages such as beer (Davidson et al., 2012). This crop is one of the only cereal crops that can withstand high elevations and short growing seasons, and is an important food staple for humans in the Andes mountains of Peru and the high plateaus of Tibet (Carena, 2009).

Forage: Barley, like other small grain crops, can be grazed by livestock before seedheads are produced. Barley can be planted sooner than wheat, and provides early season grazing. It is a valuable annual forage during drought, as it uses water more efficiently than other small grains (Schaffer, 1993). Silage yields are generally 2.5 ton/acre of dry matter with 9% crude protein and 27% crude fiber (Ball et al., 1998).

Cover crop: Barley is also used as a cover crop, a crop grown specifically to maintain cropland soil quality, fertility, and productivity (Magdoff and Van Es, 2009). Cover crops are not harvested and are terminated on the surface or incorporated into soil before they mature. Cover crop species limit soil erosion by providing cover to the soil when a commercial crop is not growing.

In the United States, barley can be grown farther north than other cereal grains and can produce more biomass than other small grain crops in a shorter amount of time (Clark, 2010). Barley is often seeded in mixtures with legumes to boost soil nitrogen levels. It can be planted as a winter annual in warmer climates or as a spring annual in cooler climates, but is most popular in the Midwest Corn Belt, Northern Plains, Inland Northwest, Northwest Maritime, California Central Valley, and Southwest bioregions (Clark, 2010). Seed is usually inexpensive and easy to acquire. Barley as a cover crop provides solutions to the specific resource concerns listed below.

Weed control: Barley is a fast-growing annual grass that competes with weeds by shading and absorbing nutrients and water from the soil. Barley also discourages weed germination by producing allelopathic chemicals (chemicals that are toxic to other plants). An Ohio study found that using barley as a cover crop suppressed yellow foxtail (*Setaria glauca*) emergence by 81% (Creamer et al., 1996a).

Soil condition, erosion: Barley cover crops protect soil from erosion, especially when grown as a winter annual in Plant Hardiness Zone 8 and warmer (California, western Oregon, and Washington) (Clark, 2010). Roots develop in the fall and can reach a vertical depth of 6.5 feet. Barley is planted between rows of berries in Oregon and between the rows of vineyards in California to hold the soil.

Excessive nitrate leaching: Grass cover crops have deep roots and are useful for their ability to capture nitrogen by the primary crop. Barley absorbs nitrogen and retains it in long-lasting biomass.

Inadequate soil organic matter/soil quality: Barley crops can produce up to 12,900 lb/acre of biomass (Clark, 2010). Leaving this biomass on the field to decompose increases the amount of organic matter in the soil. Increasing soil organic matter can increase soil aggregate stability, adequate soil drainage, and adequate soil pore space for oxygen, water, and plant roots.

Pest Management: Growing barley as a cover crop in a soybean rotation may improve beneficial fungi associations in soybean roots. One study reported that these fungal benefits increased soybean yields when compared to an area grown without a cover crop (Shimazaki et al., 2008). Planting a barley crop prior to growing potatoes as part of a rotational crop system has also been recommended to reduce soil pathogens that cause rhizoctonia canker, black scurf, and common scab (Larkin, 2010).

Nurse/companion crop: Barley is commonly planted to protect vegetable crops such as carrots and onions that are vulnerable to wind damage. It maintains an upright habit after termination with a herbicide, which protects vegetables more effectively than oat nurse crops (Midwest Cover Crops Council, 2012). When seeded in a fall mixture, barley can provide protection to fragile red clover or sweet clover seedlings (Reid et al., 1979). It can serve as a companion crop for alfalfa plantings in the irrigated western states because it does not persist or compete with the alfalfa after the first growing season (Reid et al., 1979).

Air quality: Cotton producers in Arizona have planted barley as a winter cover crop to control blowing dust within PM-10 (particulate matter that is 10 micrometers or less) active management areas (Munda et al., 1998). Cotton fields on highly erodible land (HEL) are usually fallow when wind velocities are highest and precipitation is lowest. Barley cover crops can be seeded after cotton crop harvest to hold the soil and limit wind erosion. Munda et al. (1998) reported that a barley crop in southern Arizona achieved 90% groundcover on a silty clay textured soil and 65% groundcover on a sandy textured soil with minimal irrigation.

Ethnobotany

Barley has been grown since ancient times to provide dietary starch to human societies. It remains a dietary staple for societies where wheat or corn will not grow, such as the Himalayas and Tibet. Barley grown in these regions is usually the naked (hull-less) variety because it is easier to grind into flour for breads or porridge (Reid et al., 1979).

Barley was brought to America by two routes. Columbus carried seed on his ships from Haiti to New England and Spanish conquerors brought barley to the southwestern region in the 17th century (Wiebe, 1979). Colonists planted barley mainly for conversion to malted beverages. Barley is better suited than wheat and rye to malting procedures because the seed has an intact hull that protects the seed while it is germinating and being processed (Dickson, 1979). The seed kernel is also firmer than other cereals, and can be handled with less damage at high moisture contents typical in the malting process. Malting is the second largest use of barley, surpassed only by feed for livestock. Barley cultivars are designated as being either malting or feed qualities. Feed quality cultivars do not meet rigorous industry standards for malting.

Status

Weedy or Invasive:

This plant may become weedy or invasive in some regions or habitats and may displace desirable vegetation if not properly managed. Please consult with your local NRCS Field Office, Cooperative Extension Service office, state natural resource, or state agriculture department regarding its status and use.

Please consult the PLANTS Web site (http://plants.usda.gov/) and your state's Department of Natural Resources for this plant's status (e.g., threatened or endangered species, state noxious status, and wetland indicator values).

Planting Guidelines

Prepare a clean, weed-free seedbed prior to planting. Deep, fibrous roots will absorb residual nutrients from the soil, so fertilization is not typically needed when planted as a cover crop. However, if soil tests indicate nitrogen is needed, apply recommended amounts at time of planting (Reid et al., 1979). If barley is planted in an arid climate, a minimum of one irrigation event is needed for establishment (Munda et al., 1998).

Seeding dates: Barley can be grown at a wide variety of locations with very different planting dates. Regional seeding dates are summarized by Reid et al. (1979).

Southeastern states: Winter barley is seeded from September to November. It can be seeded along with annual ryegrass (*Lolium spp.*) to provide quality cool-season hay, silage, or grazing pasture. Winter barley for pasture can be planted as early as August 15.

Great Plains region: Spring barley can be planted March through May 1 in order to establish plants before warm summer temperatures. Winter varieties can also be planted in late January to February in the southern Great Plains.

Northeastern states/New England: Spring barley can be planted March to June.

Great Basin & Pacific Northwest: Spring barley is planted from March 15–April 30, and winter barley is planted from September 1–October 15. Spring barley can be sown in the fall, but avoid planting varieties that flower early. These varieties may be harmed by late spring frosts.

If growing barley for a grain crop only, consult local cooperative extension information for specific seeding dates and rates for your area.

Cover Crop: Plant 50–75 lb/acre pure live seed (PLS) with a conventional grain drill or no-till drill with double disk openers at a depth of ¾ –1 ½ inches. Use 50 lb/acre PLS if using a narrow row seed planter (Midwest Cover Crop Council, 2012). Plant 80–125 lb/acre PLS if broadcasting, and incorporate seeds with shallow tillage using a field cultivator with harrow attachment (Clark, 2010). Barley can also be inter-seeded by planting a higher rate of 60–90 lb/acre PLS for aerial/surface seeding, when the primary crop reaches physiological maturity.

There is an average of 13,600 seeds per pound (Midwest Cover Crop Council, 2012). Seed size varies among cultivars, and kernels from two-rowed varieties are usually larger than six-rowed varieties. Determine seeds per pound prior to calculating seeding rate.

Planting a barley cover crop with a legume species is often recommended to boost soil nitrogen levels. The barley crop serves as a nurse crop for legume establishment and provides structural support for climbing legumes such as vetch (Sattell et al., 1998). Barley cover crop seeding rates should be reduced when planting in a mixture; however, rates are variable and depend on which resource concerns are being addressed. For example, Creamer et al. (1996b) planted a cover crop mix of barley, hairy vetch (*Vicia villosa* Roth.), rye (*Secale cereale* L.), and crimson clover (*Trifolium incarnatum* L.) to suppress weeds in tomato production. Barley was seeded at a rate of 24 lb/acre and composed 7–10% of the seed mix by weight.

Management

Management differs according to crop use. In arid areas, irrigation should be applied at boot stage (when seedheads begin to form) and after grazing. The most important management consideration when planting barley as a cover crop is ensuring that it is terminated at the proper time. Allowing barley to reach full maturity or failing to terminate growth at the proper time may inhibit germination and growth of the primary crop. See the Control section for more information. Refer to the USDA Risk Management Agency for updated guidelines for cover crop termination dates for different areas in the United States.

If the primary use of the crop is for forage, grazing can be initiated when plants reach 11–15 inches tall (Hannaway et al., 2004). At crop maturity, seedheads develop elongated, spiky awns that can cause injury to the mouths and eyes of livestock. Graze the plants prior to seedhead maturity, or plant awnless/hooded varieties to minimize adverse effects on grazing animals. Barley can be cut for hay as soon as seedheads begin to develop (early boot stage) or for silage when seeds begin to ripen but are still soft and doughy (dough stage) (Ball et al., 1996). In Oregon, hay can be cut 2–3 times during the fall growing season (Hannaway et al., 2004). Barley grown for pasture, hay or silage requires higher fertilizer application than crops grown only for grain, since a greater amount of nutrients are removed in plant residue (Reid et al., 1979).

Pests and Potential Problems

Residue from mature plants has a very high carbon to nitrogen ratio (meaning that it will break down slowly in the soil). In the short term, little or no nitrogen will be released for use by the primary crop (Allison et al., 2000). This may actually increase nitrogen fertilization requirements in the first year. Seeding a legume species with a barley cover crop can minimize nitrogen deficiencies. Since barley crops produce large amounts of biomass, planting the primary crop can be difficult with traditional planting equipment. It is important to terminate growth at the appropriate stage to minimize thatched residue, which can prevent primary crop germination by shading out seedlings. See Control/Cover Crop Termination for more information.

Barley is susceptible to various diseases, especially in humid climates. The most serious of these is barley yellow dwarf virus (BYDV), which is transmitted by a variety of aphids. This virus is commonly transmitted by the bird cherry-oat aphid and greenbug (Moseman, 1979). In the southeastern United States, winter barley crops can be severely damaged by armyworms. Barley crops are also susceptible to damage from the Hessian fly and different species of grasshoppers. Many cultivars have improved resistance to pests and pathogens, so it is important to use the correct variety for local conditions.

Environmental Concerns

There are no known environmental concerns associated with barley.

Control/Cover Crop Termination

Since barley exudes allelochemicals that inhibit the germination of other plants, it is important to terminate plants at least 14 days before planting corn or other crops (Midwest Cover Crops Council, 2012). . Refer to the USDA Risk Management Agency for updated guidelines for cover crop termination dates for different areas in the United States. Some studies suggest that barley should be terminated more than one month prior to planting corn to allow standing residue to decompose. Salmeron et al. (2011) found that terminating a barley cover crop 18–26 days prior to planting caused yield reductions in the subsequent irrigated corn crop due to nitrogen deficiency in the soil. Allowing barley to seed out and reach full maturity may

immobilize (tie up) available nitrogen for the primary crop, so barley should be terminated when plants reach a height of 6–8 inches (Midwest Cover Crops Council, 2012). Methods of termination include applying an effective herbicide. Consult your local Agricultural Extension office for specific herbicide recommendations. Other effective termination methods include tilling (though tillage may negate the cover crop's soil building benefits), or mowing when seeds are developing but still soft and milky (milk or dough stage).

An alternative way to kill the crop while leaving residue to decompose on the surface involves the use of a roller crimper. A roller crimper is a custom piece of equipment designed to kill residue without intense tillage or chemicals (Sayre, 2003). A roller crimper attaches to a tractor and crimps the plants with corrugated blades and lays them flat on the surface. No-till planters can seed the primary crop directly into the leftover residue. Barley residue on top of the soil provides a mulch that limits weed germination and soil erosion, while conserving soil moisture for the primary crop. Clark and Panciera (2002) found that terminating a rye (*Secale cereale*) cover crop using the roller crimper was as effective as an herbicide treatment and did not affect subsequent corn yields planted into residue.

To minimize re-sprouting, barley cover crops should be terminated using the roller crimper when the cover crop has flowered but not set seed. At least 20% of the crop should be at the soft dough stage to achieve full termination with the roller crimper (Sayre, 2003).

Please contact your local agricultural extension specialist or county weed specialist to learn what works best in your area and how to use it safely. Always read label and safety instructions for each control method.

Seeds and Plant Production

Barley seed/grain production occurs in cool, dry areas of the United States. North Dakota is the nation's leading producer of barley seed. Barley is generally planted in North Dakota as a spring crop in April.

For grain crop establishment, plant higher rates of 120 lb/acre (Ottman, 2004). Seed size varies between cultivar and region of production, so it is important to determine seeds per pound before calculating seeding rate. Consult local cooperative extension recommendations for commercial barley crop seeding rates. In arid areas, adequate irrigation should be applied for establishment. General recommendations include application of 25–40 lb/acre of nitrogen at planting (Alley et al., 2009). It is important to calculate fertilizer rates based on soil tests because barley may exhibit lodging (collapse of tillers) when excess nitrogen is available. Alley et al. (2009) reported that lodging occurred in barley crops grown in Virginia fields when nitrogen application rates reached 100 lb/acre or greater.

Barley harvest should occur when seed moisture content is between12.5 and 18% (McIntyre, 2010). If moisture content is below 11%, the seed is too dry and the seed coat may peel away (Davison, 2012). Harvesting crops with higher moisture content requires drying in cool, well-ventilated conditions. Seed is harvested mechanically with a combine and thresher. Seed harvested for use in the malting industry must be harvested with care, as cracked or skinned seeds are not acceptable to industry standards (McIntyre, 2010). Grains with 10.5% moisture or less can be stored for up to 18 months at 50–68°F, while grains with 12.5% moisture and above can only be stored for less than 3 months at 68–86°F to meet quality-malting standards (McIntyre, 2010).

Cultivars, Improved, and Selected Materials (and area of origin)

There are two types of barley seed stock commonly available: malting and feed varieties. Malting varieties must meet rigorous standards for germination quality, kernel size and weight, kernel plumpness, and moisture content. Varieties that do not meet malting industry standards are referred to as feed varieties. Almost all malting varieties are spring two-rowed barleys (Davison, 2012).

Thousands of barley cultivars have been developed for specific uses. 'Seco' is a six-rowed cultivar developed in 1987 for its yield and vigor in dryland plantings in Arizona and California (Soil Conservation Service, 1989). Variety should be selected based on the local climate, resistance to local pests, and intended use. Consult with land grant university or local extension office for recommendations on adapted barley variety for use in your area.

Literature Cited

Alley, M.M., T.H. Pridgen, D.E. Brann, J.L Hammons, and R.L. Mulford. 2009. Nitrogen fertilization of winter barley: principles and recommendations. Virginia Cooperative Extension. Publication 424-801. http://pubs.ext.vt.edu/424/424-801/424-801.html (accessed 10 Sept. 2012).

Allison, M.F., M.J. Armstrong, K.W. Jaggard, and A.D. Todd. 1998. Integration of nitrate cover crops into sugarbeet (*Beta vulgaris*) rotations. J. Agri. Sci. 130: 53-60.

Ball, D.M., C.S. Hoveland, and G.D. Lacefield.1998. Southern forages. 2nd ed. Potash and Phosphate Inst. and Foundation for Agronomic Research, Norcross, GA.

Brown, L. 1979. Grasses: an identification guide. Houghton Mifflin Company, New York.
Carena, M.J. 2009. Handbook of plant breeding: cereals. 1st ed. Springer, New York.
Clark, A. 2010. Managing cover crops profitably. Third edition. SARE Outreach, College Park, MD.
Clark, S., and M. Panciera. 2002. Cover crop roll-down for weed suppression in no-till crop production. In: 2012 Fruit and vegetable crops research report, Berea College. http://www.ca.uky.edu/agc/pubs/pr/pr470C.HTM#vegetables (accessed 7 Aug. 2012).
Creamer, N.G., M.A. Bennett, B.R. Stinner, J. Cardina, and E.E. Regnier. 1996a. Mechanisms of weed suppression in cover crop-based production systems. HortScience 31:410-413.
Creamer, N.G., M.A. Bennett, B.R. Stinner, J. Cardina. 1996b. A comparison of four processing tomato production systems differing in cover crop and chemical inputs. J. Amer. Soc. Hort. Sci. 121 (3): 559-568.
Davison, J., B. Schultz, and A. Widaman. 2012. Malting barley in Nevada. Univ. of Nevada Cooperative Extension Fact Sheet. FS-01-47. Reno. http://www.unce.unr.edu/publications/files/ag/2001/fs0147.pdf (accessed 7 Aug. 2012).
Dickson, A.D. 1979. Barley for malting and food. In: Barley: origin, botany, culture, winter hardiness, genetics utilization, pests. USDA Agriculture Handbook 338. Washington, DC.
Griffey, C., W. Brooks, M. Kurantz, W. Thomason, F. Taylor, D. Obert.2009. Grain composition of Virginia winter barley and implications for use in feed, food, and biofuels production. J. Cereal Science 51:41-49.
Harlan, J.R. 1979. On the origin of barley. In: Barley: origin, botany, culture, winter hardiness, genetics utilization, pests. USDA Agriculture Handbook 338. Washington, DC.
Hitchcock, A.S., and A. Chase. 1971. Manual of the grasses of the United States. Dover Publ., New York.
Hannaway, D.B., C. Larson, and D. Myers. 2004. Barley fact sheet. Oregon State Univ. http://forages.oregonstate.edu/php/fact_sheet_print_grass.php?SpecID=55(accessed 28 Aug. 2012).
Larkin, R.P., T.S. Griffin, and C.W. Honeycutt. 2010. Rotation and cover crop effects on soilborne potato diseases, tuber yield, and soil microbial communities. Plant Dis. 94:1491-1502.
Magdoff, F., and H. Van Es. 2009. Building soils for better crops, sustainable soil management. Sustainable Agric. Publ., Waldorf, MD.
McIntyre, K., and D. Lester. 2010. Barley-planting, nutrition, and harvesting. Queensland Dep. of Agric., Fisheries, and Forestry. http://www.daff.qld.gov.au/26_3514.htm (accessed 24 Aug. 2012).
Midwest Cover Crops Council. 2012. Midwest cover crops field guide, ID-433. Purdue Univ., West Lafayette, IN.
Moseman, J.G. 1979. Insect pests of barley and their control. In: Barley: origin, botany, culture, winter hardiness, genetics utilization, pests. USDA Agriculture Handbook 338. Washington, DC.
Munda, B., T.C. Knowles, and A. Meen. 1998. Winter forage cover crop trials. In: 1998 Forage and grain agriculture report, AZ1059. Univ. of Arizona College of Agric., Tucson. http://ag.arizona.edu/pubs/crops/az1059/az105922.htm. (accessed 9 Sept. 2012).
Ottman, M. 2004. Seeding rates for small grains in Arizona. Univ. of Arizona Cooperative Extension. http://ag.arizona.edu/pubs/crops/az1334/ (accessed 24 Aug. 2012).
Radford, A.E., H.F. Ahles, and C.R. Bell. 1968. Manual of the vascular flora of the Carolinas. Univ. of North Carolina Press, Chapel Hill.
Reid, D.A., R.G. Shands, and C.A. Suneson. 1979. Culture of barley in the United States. In: Barley: origin, botany, culture, winter hardiness, genetics utilization, pests. USDA Agriculture Handbook 338. Washington, DC.
Salmeron, M., R. Isla, and J. Cavero. 2011. Effect of winter cover crop species and planting methods on maize yield and N availability under irrigated Mediterranean conditions. Field Crops Research 123:89-99.
Sattell, R., R. Dick, R. Karow, D. Kaufman, J. Luna, D. McGrath, and E. Peachy. 1998. Barley, oats, triticale, wheat. In: Cover crops in Oregon. EM 8704. Oregon State Univ., Corvallis. http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/14959/em8692.pdf (accessed 7 Aug. 2012).
Sayre, L. 2003. New tools for organic no-till. Rodale Institute. http://newfarm.rodaleinstitute.org/depts/NFfield_trials/1103/notillroller.shtml (accessed 7 Aug. 2012).
Schaffer, J.A., E. Palm, and R.E. Munson. 1993. Barley. Univ. of Missouri Extension: G4312. Colombia.
Shimazaki, Y., T. Uchida, and H. Kobayashi. 2008. Winter barley as a cover crop affects the arbuscular mycorrhizal colonization of no-tillage soybeans. Japanese J. of Crop Sci. 77:395-402.
Soil Conservation Service. 1989. 'Seco' barley release brochure. Program aid number 1428. USDA. http://www.plant-materials.nrcs.usda.gov/pubs/azpmcrbhovuseco.pdf (accessed 8 Aug. 2012).
Wiebe, G.A. 1979. Introduction of barley into the new world. In: Barley: origin, botany, culture, winter hardiness, genetics utilization, pests. USDA Agriculture Handbook 338. Washington, DC.

Citation

Jacobs, A.A. 2016. Plant guide for common barley (*Hordeum vulgare* L.). USDA-Natural Resources Conservation Service, Jamie L. Whitten Plant Materials Center. Coffeeville, Mississippi.

Published: November 2016

Edited: 24Oct2012 aym, 10Jan2012 cms, 01Nov2016 erg

For more information about this and other plants, please contact your local NRCS field office or Conservation District at http://www.nrcs.usda.gov/ and visit the PLANTS Web site at http://plants.usda.gov/ or the Plant Materials Program Web site:
http://plant-materials.nrcs.usda.gov.

PLANTS is not responsible for the content or availability of other Web sites.