BLACK OAT

Avena strigosa Schreb

Plant Symbol = AVST2

Figure 1: Black oat seed head (Photo by Burlingham Seeds)

Alternate Names

Common Names: black bristle-pointed oat, bristle oat, lopsided oat, sand oat, small oat

Scientific Names: Avena agraria-mutica Brot, *Avena agraria* Brot

Description

General: Black oat is an upright, winter annual member of the Poaceae family. Heights vary from 2 ½–5 feet tall depending on the growing conditions. Leaf blades are flat, rough and numerous. The panicle is open, loose and oval shaped. The primary panicle branches droop with pendulous spikelets. Spikelets usually have two fertile florets with multiple awns. The primary awn is straight, black and 0.7–1.4 inches long. Black oat sexually reproduces a hairy caryopsis. In Alabama, black oat seed ripens in mid-May through early June (USDA-ARS-NSDL, 2005; Clayton et al., 2014).

Distribution: Black oat has a Mediterranean origin and has been used in European countries since the Bronze Age for cereal or fodder (Diedrichsen, 2014; Kubiak, 2009). Its use in Europe declined dramatically with the introduction of the more productive common oat (*Avena sativa*). Currently, black oat is grown in Brazil, the temperate areas of Argentina and Uruguay, the temperate area of Chile, and the tropical high altitude areas in Bolivia, Ecuador and Peru as a winter season cover crop (FAO, 2004). It is also grown on marginal soils in the Outer Hebrides of Scotland and Australia (Scholten et al., 2009; Kubiak, 2009). Black oat is used in the southeastern United States, Hawaii, and Arizona for forage, pasture and as a cover crop. For current distribution, please consult the Plant Profile page for this species on the PLANTS website.

Adaptation

Black oat does best on sandy or loamy soils but can also grow in heavy clay and soils with low nutrient value. It is not highly shade tolerant but can tolerate drought (Plants for A Future, 2012). Black oat is not cold hardy and will winter kill at temperatures less than 19°F depending on growth stage (Ashford and Reeves, 2003). In the United States, the black oat cultivar ‘SoilSaver’ is adapted for use as a winter cover crop in USDA Plant Hardiness Zones 8b-10a (USDA-ARS-NSDL, 2005).

Uses

Cover Crop/Green manure: Black oat is used as a cool season, annual, rotational cover crop either alone or seeded into a cover crop mixture. It is not frost tolerant. Black oat produces dry matter amounts similar to other winter cereals such as rye and wheat of 4,000–7000 pounds per acre when planted alone (USDA-ARS-NSDL, 2010). However, in experiments in Alabama, black oat grew quicker than wheat and rye (Patterson et al., 1996). Additionally, researchers have found that black oat has a higher nitrogen concentration and lower C:N ratio than four other winter cereals commonly used as cover crops (Bauer and Reeves, 1999).

Weed Management: Similar to many other cover crop species, black oat leaf tissue has been found to have allelopathic effects that can inhibit small seeded weed species (Price et al., 2008). In greenhouse and field experiments conducted in Germany, black oat reduced the shoot dry matter of weeds and volunteer wheat by up to 98% (Brust and Gerhards, 2012). In a study conducted without herbicide in Alabama, black oat provided more effective weed control in conservation tillage cotton than rye in years it was not winter killed (Reeves et al., 2005).

Pest Management: Black oat has been shown to have a high resistance to barley yellow dwarf virus (Comeau, 1984), and most studies indicate that black oat is resistant to, or inhibits, some species of nematodes. In a greenhouse study of 52 plant species suitable for cover crops, a Brazilian black oat cultivar was shown to be resistant to root-knot nematode (Lima et al., 2009). In a study in Connecticut, fewer lesion nematodes were found in the roots of strawberry plants grown in a plot previously planted to 'Saia' black oat, than plots planted to sorghum-sudangrass (*Sorghum bicolor x S. Sudanese*) or common oats (*Avena sativa*) (LaMondia et al., 2002). Another black oat cultivar, 'Pratex', was selected for its ability to suppress or control nematodes (Diedrichsen, 2014). However, a study in Israel found one black oat cultivar, 'Saia', infested with root knot nematode (Oka et al., 2003).

Forage: Black oat is considered an excellent feed for cattle due to its high nutritional value and good digestibility (Restelatto et al., 2013). Nitrogen application has been found to have a large effect on the crude protein content of black oat forage. In a Brazilian study, the crude protein content of black oat ranged from 180–249 grams crude protein per kilogram of dry matter (Restelatto et al., 2013). Black oat has also been studied as forage for dairy cows in North Vietnam. In the study, the traditional diets of cows were compared to diets supplemented with black oat forage. Cows fed with the black oat diet had a higher milk persistency and milk yield than cows receiving the traditional diets (Salgado et al., 2013).

Phytoextraction: In Japan, black oat is being studied for its use in phytoextraction of cadmium on agricultural soils. These laboratory studies have found that black oat possesses greater potential for cadmium accumulation and tolerance than other common crops (Uraguchi et al., 2006).

Other uses: Oils extracted from black oat seed are used in cosmetics as skin and hair moisturizers (CosIng, 2014). Black oat grains can be used for cooking and can also be roasted and used as a coffee substitute (Plants for a Future, 2012).

Ethnobotany

Historically, black oat is believed to have been the primary oat crop grown in Europe, particularly on poor or marginal soils (Kuszewska and Korniak, 2009). As the more productive common oat became more frequently used, black oat came to be regarded as a tolerated weed of common oat crops. With improved seed cleaning techniques, European black oat populations have dropped with some local cultivars reaching extinction (Diedrichsen, 2014). Small populations of black oat survive in areas where common oats do not produce seed without significant inputs (Podyma et al., 2002; Scholten, 2009). Efforts to revive black oat cultivation in Europe are ongoing in order to maintain the gene bank of oat species (Diedrichsen, 2014; Podyma et al., 2002; Scholten, 2009).

Status

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 Department of Natural Resources for this plant's current status (e.g., threatened or endangered species, state noxious status, and wetland indicator values).

Planting Guidelines

Black oat can be established in conventional, reduced tillage, or no-till cropping systems with drill seeding or broadcasting. Recommended planting dates within a region are similar to common oat (USDA-ARS-NSDL, 2005). The recommended seeding depth for black oat is also similar to common oat, 1–1 ½ inches (McGregor, 2014).

If planting black oat for cover crop, pest management, and/or weed control, some general recommendations are to broadcast seed at 100 lbs. per acre or drill seed at 50–70 lbs. per acre (Malin, 2014; USDA-ARS-NSDL, 2010). Lower seeding rates are typically used if planting black oat for other purposes or with other species. For the best seeding rates, methods, and practices for your area contact your local NRCS office or Extension service.

Management

Fertilization: Fertilizer application frequency and amounts will vary with the goals of the planting. Soils should be tested prior to planting to determine fertilizer requirements. Black oat biomass will increase with the amount of nitrogen applied. Applications of 60–80 lbs. of nitrogen/acre are common in seed production fields (Malin, 2014).

Forage/grazing management: In Australia, an experiment varying the height and frequency of defoliation on the dry matter yield of black oat found that defoliation every six weeks at a cutting height of 2 inches resulted in the highest dry matter yield but the plants had less tillers (Lowe and Bowdler, 1988).

Cover crop termination: Black oat can be killed with herbicide, tillage, mowers, and/or a roller crimper. The most effective termination method is largely determined by the developmental stage of the black oat at the termination date. In a study conducted in Alabama, the most effective and economical method found to kill black oat at anthesis was the combination of a roller crimper and herbicide (Ashford and Reeves, 2003). When

termination occurs at the early milk stage or later, the use of herbicides may be eliminated. In greenhouse and field trials conducted in Canada, termination of black oats at flowering rather than at maturity lowered the percentage incidence of leaf spot in residues (Fernandez and Santos, 1992).

Pests and Potential Problems

Depending on the cultivar studied, black oat is reported to be moderately susceptible or moderately resistant to crown and stem rusts (FAO, 2004; USDA-ARS-NSDL, 2005). Seed yield reductions are seen in black oat with leaf rust, stem rust and leaf spot but do not affect forage production and soil coverage (USDA-ARS-NSDL, 2005). Grain can also be affected by fusarium head blight and ergot (FAO, 2004). Black oat seed producers in Oregon have reported treating stands for control of the cereal leaf beetle (McGregor, 2014). Please contact your local agricultural extension specialist for assistance in proper identification of diseases and/or insect pests in your fields.

Environmental Concerns

Black oat is considered a weed or a contaminant in common oat crops or production fields in many countries. When used as a green manure/cover crop in a corn seed production rotation in Hawaii, producers do not let the black oat produce seed to prevent a weed issue in the subsequent corn seed crop (Malin, 2014).

Please consult with your local NRCS Field Office, Cooperative Extension Service office, state natural resource, or state agriculture department regarding its status and use. Weed information is also available from the PLANTS Web site at http://plants.usda.gov/.

Control

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. Trade names and control measures appear in this document only to provide specific information. USDA NRCS does not guarantee or warranty the products and control methods named, and other products may be equally effective.

Seeds and Plant Production

When planting for seed production, a firm weed free seedbed is needed. Seeds should be planted 1–1 ½ inches deep depending on soil textures. The recommended seeding rate is approximately 20 pure live seeds (PLS) per square foot or 40 PLS lbs/acre. Expected seed yields range from 800 to 1400 lbs/acre (USDA-ARS-NSDL, 2005).

Fertilizer applications should be based upon soil tests. The nutrient requirements of black oat seed production are similar to that of common oat with applications of 60-80 lbs. of nitrogen per acre (McGregor, 2014). Chemical control of insects and diseases should follow recommendations for common oat (USDA-ARS-NSDL, 2005).

Black oat seed is harvested by direct combine if standing. If the crop is lodged, it is first swathed, allowed to dry, and then combined (McGregor, 2014). Seed is cleaned with a standard screen cleaner and an indent cylinder separator (McGregor, 2014).

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

The only cultivar of black oat currently available in the US is 'SoilSaver'. 'SoilSaver' is a joint release between Auburn University and the Institute of Agronomy of Paraná, Brazil (IAPAR). It was selected for increased cold tolerance by Auburn University and USDA-ARS researchers from a population of 'IAPAR-61-Ibiporã', a public variety released by IAPAR and the Parananese Commission for Evaluation of Forages. Pratex black oat is a release developed in northern Germany. It was selected for its ability to suppress or control root lesion nematodes and stubby root knot nematodes. Other common cultivars of black oat include 'Saia', 'IAPAR-61-Ibiporã' and 'São Carlos'.

Cultivars should be selected based on the local climate, resistance to local pests, and intended use. Consult with your local land grant university, local extension or local USDA NRCS office for recommendations on adapted cultivars for use in your area**.**

Literature Cited

Antony, T. 2007. Evaluation of Black Oat (Avena Strigosa Schreb.) Germplasm. Master's Thesis. Auburn University, Auburn, AL. http://etd.auburn.edu/handle/10415/219 (verified Jan 2014).

Ashford, D. L. and D. W. Reeves. 2003. Use of a mechanical roller-crimper as an alternative kill method for cover crops. American Journal of Alternative Agriculture 18: 37–45.

Bauer, P. J. and D. W. Reeves. 1999. A Comparison of Winter Cereal Species and Planting Dates as Residue Cover for Cotton Grown with Conservation Tillage. Crop Science 39: 1824–1830.

Brust, J. and R. Gerhards. 2012. Lopsided oat (Avena strigosa) as a new summer annual cover crop for weed suppression in Central Europe. In: 25th German Conference on Weed Biology and Weed Control, Braunschweig, Germany. 13-15 March. The Institute for Geoecology of the TU Braunschweig and the Weed Science Working Group of the Deutsche Phytomedizinische Gesellschaft and The Julius Kühn Institute. p. 257–264. http://pub.jki.bund.de/index.php/JKA/article/view/1740 (verified Jan 2014).

Clayton, W. D., M. Vorontsova, K. T. Harman and H. Williamson. 2014. Avena strigosa. In: Grass Base-

The Online World Grass Flora. Kew Royal Botanic Gardens. http://www.kew.org/data/grasses-db/www/imp01116.htm (verified Jan 2014).

Comeau, A. 1984. Barley Yellow Dwarf Virus Resistance in the Genus Avena. Euphytica 33: 49–55.

Diedrichsen, A. 2014. Characterization of Bristle Oat (Avena strigosa Schreb. s.l.), a Nordic-Canadian-German Cooperation. Available at http://www.nordgen.org/index.php/en/content/view/full/1686 (verified Jan 2014). NordGen Plants, Alnarp, Sweden.

European Commission Database on cosmetic substances and ingredients (CosIng). 2009. Avena Strigosa Seed Extract. Available at http://ec.europa.eu/consumers/cosmetics/cosing/index.cfm?fuseaction=search.simple (verified April 2014). European Commission Health and Consumers. Brussels, Belgium.

Dunn, E. E. 1981. Cropping the Machair. Sand Dune Machair 3: 6–7.

Fernandez, M.R. and H.P. dos Santos. 1992. Contribution of Avena spp., used in crop rotation systems under conservation tillage, to the inoculum levels of some cereal pathogens. Canadian Journal of Plant Pathology 14: 277–277.

Food and Agriculture Organization (FAO). 2004. Fodder Oats: a world overview. Plant Production and Protection Series No. 33. Available at http://www.fao.org/docrep/008/y5765e/y5765e00.htm#Contents (verified Jan 2014). Food and Agriculture Organization of the United Nations, Rome, Italy.

Kubiak, K. 2009. Genetic diversity of Avena strigosa Schreb. ecotypes on the basis of isoenzyme markers. Biodiversity: Research and Conservation 15: 23–28.

Kuszewska, K and T. Korniak. 2009. Bristle Oat (Avena strigosa Schreb.)- a weed or a useful plant?. Herba Polonica 55: 341–347. Available at http://www.herbapolonica.pl/magazines-files/3706730-Pages%20from%20Herba_3-46.pdf (verified April 2014).

LaMondia, J. A., W. H. Elmer, T.L. Mervosh and R.S. Cowles. 2002. Integrated management of strawberry pests by rotation and intercropping. Crop Protection 21: 837–846.

Lima, E. A., J. K. Mattos, A. W. Moita, R. G. Carneiro and R.M.D.G. Carneiro. 2009. Host status of different crops for Meloidogyne ethiopica control. Tropical Plant Pathology 34: 152–157.

Lowe, K.F. and T.M. Bowdler. 1988. Effects of height and frequency of defoliation on the productivity of irrigated oats (Avena strigosa cv. Saia) and perennial ryegrass (Lolium perenne cv. Kangaroo Valley), grown alone or with barrel medic (Medicago truncatula cv. Jemalong). Australian Journal of Experimental Agriculture 28: 57–67.

Malin, B. 2014. Personal Communication/Black oat production and use in Hawaii and Arizona. Desert Sun Marketing. Phoenix, AZ.

McGregor, M. 2014. Personal Communication/Seed production of black oat. Burlingham Seeds. Rickreall, OR.

Oka, Y., G. Karssen and M. Mor. 2004. First Report of the Root-Knot Nematode Meloidogyne marylandi on Turfgrasses in Israel. Plant Disease 88: 309.

Patterson, M. J., D. W. Reeves and B. E. Gamble. 1996. Weed Management with Black Oat (Avena strigosa) in No-Till Cotton. In: Proceedings Beltwide Cotton Conferences, Nashville, TN. 9-12 January. National Cotton Council, Memphis,TN. 2: 1557–1558.

Plants for a Future. 2012. Avena strigosa. Available at http://www.pfaf.org/user/Plant.aspx?LatinName=Avena+strigosa (verified April 2014). Dawlish, England.

Podyma, W. M., Scholten and E. Bettencourt. 2005. Avena strigosa (Schreb.) in north-western Europe: a historical landrace without crop wild relatives? In The First International Conference on Crop Wild Relative Conservation and Use. 14-17 Sept. The European Crop Wild relative Diversity Assessment and Conservation Forum. Forum Case Studies. Available at http://www.pgrforum.org/Documents/Conference_posters/Avena_casestudy.pdf (verified April 2014).

Price, A. J., D.W. Reeves and M. G. Patterson. 2006. Evaluation of weed control provided by three winter cereals in conservation tillage soybean. Renewable Agriculture and Food Systems 21: 159–164.

Price, A.J., M.E. Stoll, J.S. Bergtold, F. J. Arriaga, K.S. Balkcom, T.S. Kornecki and R.L. Raper. 2008. Effect of cover crop extracts on cotton and radish radicle elongation. Communications in Biometry and Crop Science 3: 60–66.

Price, A. J., F. J. Arriaga, R. L. Raper, K. S. Balkcom, T. S. Komecki and D. W. Reeves. 2009. Comparison of Mechanical and Chemical Winter Cereal Cover Crop Termination Systems and Cotton Yield in Conservation Agriculture 13: 238–245.

Reeves, D. W., A. J. Price and M. G. Patterson. 2005. Evaluation of Three Winter Cereals for Weed Control in Conservation-Tillage Nontransgenic Cotton. Weed Technology 19: 731–736.

Restelatto, R., P.S. Pavinato, L. R. Sartor and S. J. Paixão. 2013. Production and nutritional value of sorghum and black oat forages under nitrogen fertilization. Grass and Forage Science doi: 10.1111/gfs.12076.

Salgado, P., V.Q. Thang, T. V. Thu, N. X. Trach, V. C. Cuong, P. Lecomte and Dd. Richard. 2013. Oats (Avena strigosa) as winter forage for dairy cows in Vietnam: an on-farm study. Topical Animal Health Production 45: 561–568.

Scholten, M., B. Spoor and N. Green. 2009. Machair corn: management and conservation of a historical machair component. The Glasgow Naturalist 25: 63–71.

Schomberg, H. H., R. G. McDaniel, E. Mallard, D.M. Endale, D. S. Fisher and M. L. Cabrera. 2006. Conservation Tillage and Cover Crop Influences on Cotton Production on a Southeastern U.S. Coastal Plain Soil. Agronomy Journal 98: 1247–1256.

Schomberg, H. H., D. M. Endale, A. Calegari, R. Peixoto, M. Miyazawa and M. L. Cabrera. 2006. Influence of cover crops on potential nitrogen availability to succeeding crops in a Southern Piedmont soil. Biology and Fertility of Soils 42: 299–307.

Uraguchi, S., I. Watanabe, A. Yoshitomi, M. Kiyono and K. Kuno. 2006. Characteristics of cadmium accumulation and tolerance in novel Cd-accumulating crops, Avena strigosa and Crotalaria juncea. Journal of Experimental Botany 57: 2955–2965.

USDA-ARS-NSDL. 2005. SoilSaver-A Black Oat Winter Cover Crop for the Lower Southeastern Coastal Plain. Conservation Systems Fact Sheet No. 01. Available at http://www.ars.usda.gov/SP2UserFiles/Place/64200500/csr/FactSheets/FS01.pdf (verified January 2014). USDA-ARS-NSDL, Auburn, AL.

USDA-ARS-NSDL. 2010. Black Oat. Conservation Systems Fact Sheet No. 04j. Available at http://www.ars.usda.gov/SP2UserFiles/Place/64200500/csr/FactSheets/FS04j.pdf (verified January 2014). USDA-ARS-NSDL, Auburn, AL.

Zibilske, L. M. and D. J. Makus. 2009. Black oat cover crop management effects on soil temperature and biological properties on a Mollisol in Texas, USA. Geoderma 149: 379–385.

Citation

Dial, H.L. 2014. Plant guide for black oat (*Avena strigosa* Schreb.) USDA-Natural Resources Conservation Service, Tucson Plant Materials Center, Tucson, AZ, 85705.

Published May 2014

Edited: 5May2014 erg, 9May2014 aym

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.