

## **Big Trefoil** **(*Lotus uliginosus*)**

by Jonathan Christie, January 2009

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Big Trefoil (*Lotus uliginosus*, also known as *L. pedunculatus*) is an excellent legume for poorer soils. It thrives in soils that are high in acidity, high in aluminum content, or are waterlogged. Big Trefoil is commonly used for hay, forage, conservation plantings, or wildlife habitat. Less commonly, it may also be used for honey production and land reclamation.

### **Growing conditions**

Big Trefoil is well adapted to grow in poor soils. *Lotus* can withstand (and thrive) on soils that:

- are waterlogged (constant moisture).
- have high aluminum (>3umols Al).
- have high acidity (4.5-5 pH)
- have high manganese (up to 0.76g/kg DM)
- possess little fertility ("fragipan-type" soils) -- See Kaiser & Heath (1990).

Here in the Willamette Valley of Oregon, much of our soil is heavy clay with high aluminum which creates a toxicity for many crop plants. This coupled with a high rain fall creates an acidic, high aluminum, and wet clay soil--a perfect location for growing this crop.

### **Planting & Seeding**

Big Trefoil may be seeded using traditional crop methods. Broadcasting or aerial overseeding are effective, especially in areas where conventional tillage would be difficult or impossible (such as in a forestland or area for wildlife).

Standard seeding is in the Fall or Spring. Seeding rates are usually 2-3 pounds per acre, but increasing this amount leads to a larger stand so it is not unusual for producers to plant up to 5 pounds per acre. Big Trefoil is often planted with companion grasses when it is used for pasture or forage. Rates are usually about 2-5 pounds of Trefoil for every 5-15 pounds of grass seed depending upon the species.

### **Nutritive Value in Forage**

Big Trefoil is similar to other legumes in nutritive value for forage:

- 29% crude protein on average, depending on maturity.
- Hay quality similar to alfalfa when cut in season.
- Non-bloating due to condensed tannins found naturally in *Lotus*.
- Easily palatable.
- Big Trefoil is tolerant of grazing due to the presence of rhizomes, but it can be overgrazed, especially in late fall.

Grazing of Big Trefoil has been shown to increase liveweight gains in sheep and cows as compared to grass grazing. Further, lambs were reported to have leaner meat when grazed on Big Trefoil as opposed to clover. See Purchas & Keogh (1984). Also see Barry *et al.* (1986).

### Anti-Helminthic Properties

Grazing on crops with condensed tannins (like Lotus) seem to reduce worm egg counts in growing lambs. Use of Lotus in pasture can be advantageous to parasite control and a boon to organic sheep production. See Niezen et al. (1993, 1998), Ramirez-Restrepo (2004), and Min & Hart (2003).

### Conservation & Wildlife Uses

As with forage use, Big Trefoil is suited for conservation and wildlife uses because:

- can survive in wetlands or riparian areas due to its ability to grow in waterlogged or heavy clay soils.
- is easily palatable by most wildlife due to non-bloating nature and leafy growth.
- grows prostrate and provides low cover for wildlife.
- can be broadcast over forested or recently logged areas.
- can out-compete other weeds and grasses to establishment.
- favorable honey production (see American Bee Journal (1959))

### Comparison between big trefoil & birdsfoot trefoil

Big trefoil (*Lotus uliginosus*) is closely related to birdsfoot trefoil (*Lotus corniculatus*), but it is less well known. Both are trefoils and share the same general plant morphology and growth patterns. Both are non-bloating legumes and can be used in similar ways.

The table below details the differences between these species:

	<b>Big Trefoil</b>	<b>Birdsfoot Trefoil</b>
Seeds	1,075,000 per pound (average); green	500,000 per pound; brown
Growth	Prostrate growth with rhizomes and stolons	May be prostrate, some stolons
Aluminum Tolerance	Very high (>3umols)	Lower (<7 umols)
Acidity Tolerance	4.5-5.5	>6.0
Manganese Tolerance	up to 0.76g/kg DM	<0.50g/kg DM
Soil Water Tolerance	Constant Moisture (Waterlogged)	Moist, but not constant
Soils	Fragipan (high clay, low pH)	Moderate Clay
Seeding Rates	2-4 pounds per acre (average)	4-6 pounds per acre (average)

The main difference between these two plants is the growing conditions. Big Trefoil can grow in standing water, high acid soils, or soils with a high aluminum content. Birdsfoot trefoil grows better in less extreme soils. Both do well in soils with low fertility. In terms of other common legumes (like alfalfa and clovers) the trefoils can routinely handle poorer soils.

## References and Annotated Bibliography

### Cited Sources:

Anonymous (1959) Pollination of Bird's Foot Trefoil. *Amer. Bee Jour.* 99:90-91. as cited in:  
[http://www.beeculture.com/content/pollination\\_handbook/trefoil.html](http://www.beeculture.com/content/pollination_handbook/trefoil.html)

Barry, T.N.; Allsop, T.F. and C. Redekopp. (1986) The role of condensed tannins in the nutritional value of *Lotus pedunculatus* for sheep. *British Journal of Nutrition* 56: 607-614.  
<http://journals.cambridge.org/production/action/cjoGetFulltext?fulltextid=859968>

Kaiser, C.J. and M.E. Heath. 1990. Big trefoil: A new legume for pastures on fragipan soils. p. 191-194. In: J. Janick and J.E. Simon (eds.), *Advances in new crops*. Timber Press, Portland, OR.  
<http://www.hort.purdue.edu/newcrop/proceedings1990/v1-191.html>

Minn, B.R. & S.P. Hart (2003) Tannins for suppression of internal parasites. *J. Anim. Sci.* 81(E. Suppl. 2):E102–E109.  
<http://www.asas.org/symposia/03esupp2/jas2418.pdf>

Niezen, J.H., Waghorn, T.S., Charleston, W.A.G. and Waghorn, G.C. (1993) Internal parasites and lamb production—a role for plant containing condensed tannins. *Proc. New Zealand Soc. Anim. Prod.* 53: 235–238.

Niezen *et al.* (1998) Production, faecal egg counts, and worm burdens of ewe lambs which grazed six contrasting forages. *Veterinary Parasitology* 80:15-27.

Purchas, R.W. & R.G. Keogh (1984) Fatness of lambs grazed on 'Grasslands Maku' Lotus and 'Grasslands Huia' white clover. *Proceedings of the New Zealand Society of Animal Production* 44: 219-222.  
<http://nzsap.org.nz/proc/1984/ab84054.html>

Ramirez-Restrepo, C.A.; Barry, T.N.; Lopez-Villalobos, N.; Kemp, P.D. and McNabb, W.C. (2004) Use of *Lotus corniculatus* containing condensed tannins to increase lamb and wool production under commercial dryland farming conditions without the use of anthelmintics. *Animal feed science and technology* 117:85-105.

### General Resources on Lotus:

#### Web Resources--General:

Oregon Big Trefoil Fact Sheet

[http://forages.oregonstate.edu/fi/topics/fact\\_sheet\\_print\\_legume.cfm?specid=239&use=Soil](http://forages.oregonstate.edu/fi/topics/fact_sheet_print_legume.cfm?specid=239&use=Soil)

Tropical Forages Newsletter regarding Big Trefoil

[http://www.tropicalforages.info/key/Forages/Media/Html/Lotus\\_uliginosus.htm](http://www.tropicalforages.info/key/Forages/Media/Html/Lotus_uliginosus.htm)

Australian Fact Sheet on Big Trefoil

<http://www.fao.org/ag/AGP/agpc/doc/gbase/DATA/PF000345.HTM>

The Lotus Newsletter

<http://www.inia.org.uy/sitios/lnl/>

### **Web Resources--Specific:**

Use of Big Trefoil in Oregon & Washington coastal pastures.

<http://extension.oregonstate.edu/catalog/pdf/em/em8645.pdf>

Use of Big Trefoil in tropical (Hawaii) soil systems. Trefoil is about 1/3 of the way down.

<http://www.ctahr.hawaii.edu/soilsurvey/Hawaii/Htm/usemanagesoil.htm>

### **Books:**

*Trefoil: The Science and Technology of Lotus*. CSSA Special Publications #28. ASA-CSSA.

--A comprehensive survey of the genus. Includes a good description of Lotus in reclamation.

Frame, Chalton, Laidlaw. 1998 "Birdsfoot Trefoil & Greater Lotus" in *Temperate and Forage Legumes*. CAB Press. ISBN: 0-85199-214-5.

--best all-around reference on Lotus I've found.

Hafenrichter, Schwendiman, Harris, MacLauchlan, & Miller, 1979. *Grasses & Legumes for Soil Conservation in the Pacific Northwest and Great Basin States*. Agricultural Handbook #339. SCS-USDA.

--A good general handbook comparing many legumes. Contains many of the rarer plants.

Henson, 1962. *The Trefoils: Adaptation & Culture*. Agriculture Handbook no. 223. USDA.

--Older article, but full of good information. Difficult to find, though.

Howell, 1948. *A Legume for Acid Soils: Lotus uliginosus (L. major)*. Agricultural Experiment Station Bulletin #456, Oregon State University.

--Almost impossible to find now but worth reading.

Rhykerd, Johnson, & Hankins. 1981. "Big trefoil production and potential in Southern Indiana." Agronomy Guide AY-232. Purdue University Cooperative Extension Service.

--A discussion on big trefoil in Indiana and the foundation of the Kaiser cultivar.

### **Articles of Interest:**

Edmeades, Blamey, Asher, & Edwards, 1991. "Effects of pH and Aluminum on the growth of temperate pasture species I & II." In *Australian Agriculture Research* 42:559-569 & 42:893-900.

-and-

Wheeler & Dodd, 1995. "The effect of aluminum on the growth of a range of temperate legume species and cultivars: A summary of results." In *Plant Soil Interactions at Low pH (R.A. Date et al. eds.)* pp. 433-437.

--These two articles present data showing aluminum tolerance of Lotus.

Shiferaw, Shelton, & So, 1992. "Tolerance of some subtropical pasture legumes to waterlogging." In *Tropical Grasslands* 26:3,187-195.

--Documents how big trefoil survives well in waterlogged conditions.

West, Dean, & Perceval, 1991. "The productivity of Maku Lotus as a forest understorey." In *Proceedings of the New Zealand Grassland Association* 53:169-173.

--Discusses how big trefoil is used to seed forest understoreys for habitat and to prevent erosion.