

Autecology of Wild Licorice on the Northern Mixed Grass Prairie

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The autecology of Wild Licorice, *Glycyrrhiza lepidota*, is one of the prairie plant species included in a long ecological study conducted at the NDSU Dickinson Research Extension Center during 67 growing seasons from 1946 to 2012 that quantitatively describes the changes in growth and development during the annual growing season life history and the changes in abundance through time as affected by management treatments for the intended purpose of the development and establishment of scientific standards for proper management of native rangelands of the Northern Plains. The introduction to this study can be found in report DREC 16-1093 (Manske 2016).

Wild licorice, *Glycyrrhiza lepidota* Pursh, is a member of the legume (bean) family, Fabaceae, and is a native, perennial subshrub. Aerial growth has annual erect herbaceous stems 1-3 feet (31-91 cm) tall arising from deep, extensive woody rhizome systems. Older stems deposit lignin in cell walls resulting in stiff fibrous structure but does not form true wood. Stems die back to ground level in fall. The root system has deep extensive fleshy roots and has a deep woody rhizome system with many branches extending several feet; the rhizome systems have a tremendous capacity to produce sprouts that can form large clonal colonies. Regeneration is by vegetative and sexual reproduction. Vegetative growth is sprouts from the extensive deep woody rhizome system. Sexual reproduction is from racemes with numerous perfect bisexual flowers with both male and female organs that emerge during July-August. Fruit is a legume pod with 3-5 seeds; the pod is covered with burlike hooked prickles that help distribution by animals. Large quantities of seeds are produced with low germination rates. Fire top kills aerial stems and activates sprout growth from the deep woody rhizome system. This summary information on growth development and regeneration of wild licorice was based on the works of Stevens 1963, Great Plains Flora Association 1986, Esser 1994a, Stubbendieck et al. 2003, Johnson and Larson 2007, and Wynia ND.

Procedures

The 1955-1962 Study

Wild licorice plant growth in height was determined by measuring ungrazed stems from ground level to top of leaf or to the tip of the inflorescence of an average of 10 plants of each species at approximately 7 to 10 day intervals during the growing seasons of 1955 to 1962 from early May until early September. Dates of first flower (anthesis) were recorded as observed. These growth in height and flower data were reported in Goetz 1963.

The 1969-1971 Study

The range of flowering time of Wild licorice was determined by recording daily observations of plants at anthesis on several prairie habitat type collection locations distributed throughout 4,569 square miles of southwestern North Dakota. The daily observed flowering plant data collected during the growing seasons of 1969 to 1971 from April to August were reported as flower sample periods with 7 to 8 day duration in Zaczkowski 1972.

Results

Wild licorice resumed growth in spring and developed several erect herbaceous stems that can form branches on the upper portions. The annual stems and stem bases grew from nodes on an extensive creeping perennial woody rhizome system. Field plot grown 14 month old rhizomes had a mean length of 45.2 cm (17.8 in), with 1 or 2 branches, and contained vegetative nodes about every 4.2 cm (1.6 in) (Boe and Wynia 1985). The flower period occurred from late June through late July during the 1969-1971 study (table 1) (Zaczkowski 1972). A mean mature stem height of 29.7 cm (11.7 in) with an annual variance in height from 22.0 cm (8.7 in) to 35.0 cm (13.8 in) was reached during August on the fall grazed pastures of the 1955-1962 study (table 2) (Goetz 1963). As the stems matured, lignin was deposited in the cell walls. This lignification of the cell walls makes the stems woody and rigid, resulting in uneatable stalks. Each stem had a tough taproot with numerous branched lateral roots. Weaver

(1954) excavated a taproot system that descended 12

feet (3.7 m) into the Kansas prairie soil. The lateral roots are fleshy (Montana Plant Life ND) and can be eaten after being slow roasted in campfire embers, pounded with sticks, and the tough woody string removed from the center of the root. These roots contain up to 6% glycyrrhizin, which is much sweeter than sugar (Wynia ND). The tough taproot and woody rhizomes are not eaten but used as medicine and processed differently. These roots are harvested in autumn from 3 year old or older plants, split into 4 lengthwise sections, dried in the sun, crushed, and then boiled to evaporate off the liquid, leaving a thick black paste or solid (Manitoba Agriculture ND). Medicinal use of North American Wild licorice requires extensive knowledge of all the positive and negative effects from potent herbal remedies. The stems die at the end of each growing season but usually persist until the next spring, often still supporting a few undispersed seed pods covered with hooked prickles.

The seed pods of wild licorice contain from 2 to 6 seeds each that generally have relatively low germination rates (Esser 1994), however, germination was found to be highly varied among years from natural seed collections in western North Dakota (Whitman 1979). Boe and Wynia (1985) and Boe et al. (1988) found that the bruchid beetle larvae, *Acanthoscelides aureolus*, caused seed predation at each of the 37 locations with wild licorice populations that were tested from North Dakota and South Dakota. The amount of seed damage varied among years and locations from 7% to 71% with a mean 41% of seed viability destroyed by the insect. Fortunately, wild licorice has a tremendous capacity for vegetative reproduction of sprouts from the nodes on the perennial woody rhizomes.

Discussion

Wild licorice, *Glycyrrhiza lepidota*, is usually classified as a perennial, leguminous forb, however, lignin forms in the cell walls of the annual stems, these stems die at the end of each growing season, with new annual stems developing the next spring, growing from woody perennial rhizomes, which is the description of a subshrub.

Wild licorice can grow in a wide variety of habitats; primarily in open, unshaded areas in prairies, grasslands, lowland meadows, thin shrublands, and open woodlands. Wild licorice can endure numerous soil textures of sandy, sandy loam, loam, clayey loam, and clay soils that are moist to moderately dry with good drainage. Wild licorice is very tolerant to sodium, moderately tolerant to salinity and calcium carbonate, tolerant to short term

flooding, tolerant of pH ranges between 4.8 and 7.2, and tolerant of partial shade but prefers full sunlight (Esser 1994, Wynia ND, Encyclopedia of Life ND, Anonymous 2016).

Normal stem height of wild licorice in the Northern Plains ranges from 12 in to 36 in (30.5 cm to 91.4 cm) (Stevens 1963). The mean mature stem height from the 1955-1962 study was 11.7 in (29.7 cm), 97.5% of the short normal height and 32.5% of the tall normal height. The reduced stem heights of wild licorice on the 1955-1962 study was caused by low quantities of available soil inorganic nitrogen well below the threshold levels of 100 lbs/ac that resulted from the traditional management practices detrimental effects on the biogeochemical processes of the prairie plant community.

Wild licorice is a legume and can develop symbiotic associations with glycyrrhiza rhizobium (Wynia ND). However, legumes growing in arid and semi-arid environments use greater quantities of soil inorganic nitrogen than the reduced amounts of nitrogen fixed by the rhizobia because the low supply of soil water prohibits adequate rhizobia activity. Poor management practices and low rhizobia activity cause inorganic nitrogen deficiencies for all plants in those prairie ecosystems.

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Table 1. Flower period of *Glycyrrhizia lepidota*, Wild Licorice.

	Apr	May	Jun	Jul	Aug	Sep
Flower Period 1969-1971			X	XX	XX	

Flower Period Data from Zaczkowski 1972.

Table 2. Autecology of *Glycyrrhizia lepidota*, Wild Licorice with growing season changes in mature height.

Data Period	Minimum Annual Mature Height cm	Maximum Annual Mature Height cm	Mean Mature Height cm	Percent of Mature Height Attained					
				Apr %	May %	Jun %	Jul %	Aug %	Sep %
1955-1962	22.0	35.0	29.7			71.7	91.3	100.0	

Data from Goetz 1963.

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