Weed Biology & Management Series for Christmas Tree Production

Biology and Management of Field Horsetail in Christmas Tree Production

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The Horsetail (Equisetaceae) family includes 30 species, all within the ancient genus Equisetum. During the Carboniferous period, over 230 million years ago, the Horsetail family was the dominant plant group globally, with some plants growing to enormous sizes. Today, two main forms of horsetails exist. One is the hollow, jointed, and leafless scouring rush, while the other features slender, green, jointed branches around hollow stems, often found in large numbers and resembling a horse's tail. Equisetum arvense, commonly referred to as "horsetails," is known by various names such as snakeweed, skeletonweed, field horsetail, horse pipes, jointed monkey grass, or snake grass. Horsetail is one of the most difficult to control weed species in landscape settings, nursery production areas, field grown ornamentals, and Christmas tree seedling beds. In this article, we discuss the biology and management strategies of field horsetail.

Environmental conditions:

Horsetail thrives in various environments, generally favoring more acidic and wet soil conditions with full sunlight. It can establish and grow well in drier places, making it common to find horsetail in landscape beds, nursery crops, Christmas tree seedling beds, agricultural fields, wooded areas, and along gravelly roadsides (Figure 1) and easements. However, it cannot grow well in shaded areas and will eventually die out without adequate sunlight. Cultural and mechanical control methods have not proven very successful against field horsetail [3].

Biology of Field Horsetail:

Rhizome: Field horsetail forms an extensive underground rhizome system, capable of reaching depths of over four feet. The patches of *Equisetum* expand radially as the rhizomes grow outward from the center. Without soil disturbances that move rhizome pieces, the lateral spread of horsetail is relatively

Figure 1 – *Field horsetail growing on gravels under full sun condition. Photo credits: Debalina Saha, MSU Horticulture.*

slow. Canadian researchers have observed an expansion rate of approximately 20 inches per growing season.

Stems: Two types of stems are found in field horsetail which includes fertile (reproductive) and sterile (vegetative) stems. Both types are thin, hollow, jointed, vertically ridged, and round.

A. **Fertile Stems:** These are whitish to light brown, unbranched, and somewhat succulent with large, easily separated joints (nodes). They have a terminal spore-producing head that looks like a pinecone and is 1 to 4 inches long. These stems can grow between 4 to 10 inches tall, sometimes up to 12 inches.

B. **Sterile Stems:** These are green, rough, and wiry, standing upright or sagging at the base. They can grow between 4 to 20 inches tall, sometimes reaching up to 25 inches. The middle and upper joints have whorls of green, needle-like, leafless branches that are 4 to 6 inches long, which may be horizontal or point upward (Figure 2). These stems and branches are covered with rough silica deposits. The distance between joints is shorter in sterile stems compared to fertile stems. The stems are usually green and photosynthetic.

Leaves: The leaves of field horsetail are reduced and scale-like, forming a tube-like, toothed sheath around each joint of both fertile and sterile stems, with 8 to 12 leaves per sheath. The upper edge of these sheaths is black. Sheaths are more noticeable on fertile stems, while on sterile stems, they are situated above the branch whorls. Equisetum leaves are usually non-photosynthetic [1].

Reproductive Cycle: In the plant world, *Equisetum* is a primitive plant most closely related to ferns. Like ferns, they do not produce seeds but reproduce sexually through the formation of spores. However, spores play a relatively minor role in the spread of *Equisetum* [1].

They reproduce through two main methods. First, they produce spores in cone-like structures at the tips of specialized stems called fertile stems, which are brown and appear early in the spring. These spores need wet environments to grow, which is why horsetails are often found near ditches and ponds.

Second, field horsetails spread through an extensive underground root system called rhizomes. These rhizomes can grow deep into the soil and produce many new green stems, known as sterile stems, which are responsible for photosynthesis. This allows horsetails to spread into drier areas, often resulting in large colonies of upright, branchless stems. Be cautious when tilling the soil, as this can break up the rhizomes and help horsetails spread even more [2].

Identifying Characters: Field horsetail has several distinctive characteristics.

One of the most notable is its hollow stems. These stems are jointed, can be easily separated into sections, and have siliceous ridges that give them a rough texture. The stem serves as the primary photosynthetic organ. While many horsetails are characterized by branchless stems, branched stems are also fairly common. Although field horsetail appears leafless, it does have leaves, which are reduced to small scales [2].

Additionally, field horsetails produce cone-like structures at the tips of their stems, which are responsible for spore production. These cones are another distinctive feature. The plants also exhibit a unique reproductive strategy, alternating between a spore-producing phase and a gametophyte phase. Field horsetails have a deep and extensive root system with rhizomes that allow them to spread and form dense colonies, often giving the appearance of a miniature forest. Their preference for moist environments and ability to thrive in a variety of soil conditions further distinguish them from other plants.

Figure 2 – *Green, rough, wiry sterile vegetative stems of field horsetail. Photo credits: Debalina Saha, MSU Horticulture.*

Similar species: Field horsetail (*Equisetum arvense*) has similarity with some species like Birdseye Pearlwort (*Sagina procumbens*) and scouring rush (*Equisetum hyemale*) [4]. But field horsetail can be distinguished from Birdseye Pearlwort and scouring rush through specific features. Birdseye Pearlwort has small, narrow leaves and prostrate, spreading stems with tiny white flowers, while scouring rush has robust, erect stems with black-tipped sheaths. Field horsetail's unique scale-like leaves form a tube-like sheath with a black upper edge around each joint, setting it apart from these species.

Management of field horsetail

Non-chemical control: Controlling field horsetail is challenging; preventing its establishment is preferable. When possible, avoid tillage in affected areas to prevent the spread of rhizomes and clean equipment after use. Enhancing drainage in water-logged areas can also help. Managing irrigation system and avoiding overwatering is recommended. Mechanical or physical control for a smaller area of horsetail can include removal of stems every 2 weeks during the growing season. This technique can deplete the energy reserves of the rhizomes. Repeated mowing or tilling could be successful if timed to target regrowth before it has had the chance to replenish energy reserves in the roots, or before it reaches 8-10 inches. This strategy might require multiple years of effort. Cultural control methods include use of heavy-duty landscape fabric to block stem growth, but rhizomes can often grow out to the edge of the fabric or find their way through any holes in the fabric. Mulches have not been found to be very effective. Nitrogen-focused fertility plan can help in shading out field horsetail as they do not readily respond to nitrogen whereas the ornamentals can out compete them.

Chemical control: Chemical control options are limited. Field horsetail's perennial nature and deep-rooted system make it resistant to many herbicides, particularly contact types, due to minimal leaf area for absorption and a siliceous stem structure that hampers herbicide efficacy. Although herbicides like glyphosate are commonly used, their effectiveness is variable and often requires multiple applications over years. Other chemicals like Casoron® (dichlobenil) and MCPA, have shown some efficacy, although usage restrictions apply in certain regions. The Casoron label includes Christmas trees but no other ornamental plants. Peter Sikkema from the University of Guelph in Ontario reported over 80% control, and up to 95% control, when using a combination of glyphosate and flumetsulam, which is found in the product Python® [2]. Neither flumetsulam nor MCPA is labeled for use in Christmas tree production. Application of glyphosate needs to be done very carefully so that it does not get in contact with the Christmas tree as it can cause severe injuries. Always read the label of herbicides carefully before application.

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