



Fighting with your toughest weeds in Christmas Tree Production? Here is the solution!

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Weeds are Problem

Over 250,000 plant species, among them only 1% (2500) are considered as weedy plant species, and 0.1% (250) are the most problematic weeds.

Special characters:

- Weeds have rapid seedling growth and the ability to reproduce when young e.g. Redroot Pigweed can flower and reproduce when it is less than eight inches tall.
- Weeds have quick maturation period or take only a short time in the vegetative phase e.g. Canada thistle can produce mature seeds in two weeks after flowering.
- Weeds may have dual mode of reproduction. Most weeds are angiosperms & reproduce by seeds and vegetatively too.
- Weeds have environmental plasticity. Many weeds are capable of tolerating and growing under a wide range of climatic and edaphic conditions.





Weeds are Problem

- Weeds are often self-compatible, but self-pollination is not obligatory.
- If a weed is cross pollinated, this is accomplished by non- specified flower visitors or by wind.
- Weeds resist detrimental environmental factors. Weed seeds resist decay for long periods in soil/medium and remain dormant for longer duration.
- Weed seeds exhibit several kinds of dormancy and escape the rigors of environment and germinate when conditions are more favorable for their survival.
- Some annual weeds produce more than one seed flush per year and seed is produced as long as growing conditions permit.





Weeds are Problem

- Each weed plant can produce a large number of seeds per plant, and seed is produced over a wide range of environmental conditions.
- Many weeds have specially adapted long and short-range seed dispersal mechanisms.
- Roots and other vegetative parts of perennial weeds are vigorous with large food reserves, enabling them to withstand environmental stress.
- Weeds have great competitive ability for nutrients, light and water and can compete by special means (e.g. Rosette formation, climbing growth and allelopathy)





Problematic Tough Weeds



Problematic Weeds

Horsenettle (*Solanum carolinense*)





Horsenettle

Characters:

- Perennial spreading roots
- Prickly stems and leaves
- New plants arise from seeds & spreading underground roots





Characters:

- Flowers- white or purple, 5 petals, yellow center
- Fruits- Yellow, wrinkles at maturity (resembles tomatoes)





Horsenettle

Toxicity:

- **Fruits and foliage poisonous to livestock**
- **Toxin increases over the growing season**
- **Drying does not reduce effect**
- **Poisoning of sheep, deer, and cattle have been reported**
- **Mature fruits are toxic to humans**



Horsenettle Control

Preemergence Herbicides to Control Horsenettle (*Solanum carolinense*)

Trade Name	Common Name	Notes
Sureguard	Flumioxazin	Good control of new plants emerging from seeds



Horsenettle Control

Postemergence Herbicides to Control Horsenettle (*Solanum carolinense*)

Trade Name	Common Name	Notes
Roundup	glyphosate	Directed sprays to larger plants can give fair control
Garlon 3A	triclopyr	Directed sprays to larger plants can give fair control
Defy Amine 4 + Roundup	2,4-D amine (not ester) + glyphosate	Apply before bud break when Horsenettle has sprouted



Problematic Weeds

Yellow Nutsedge (*Cyperus esculentus*)





Yellow Nutsedge

Characters:

- Shoots triangular, borne individually from a tuber or basal bulb
- Leaves three-ranked, V-shaped in cross-section
- Leaves yellow-green color





Yellow Nutsedge

Distinguishing Character:

- In purple nutsedge, the leaf blade abruptly tapers to a tip and there is a prominent mid vein
- Yellow nutsedge leaves have long attenuated tips



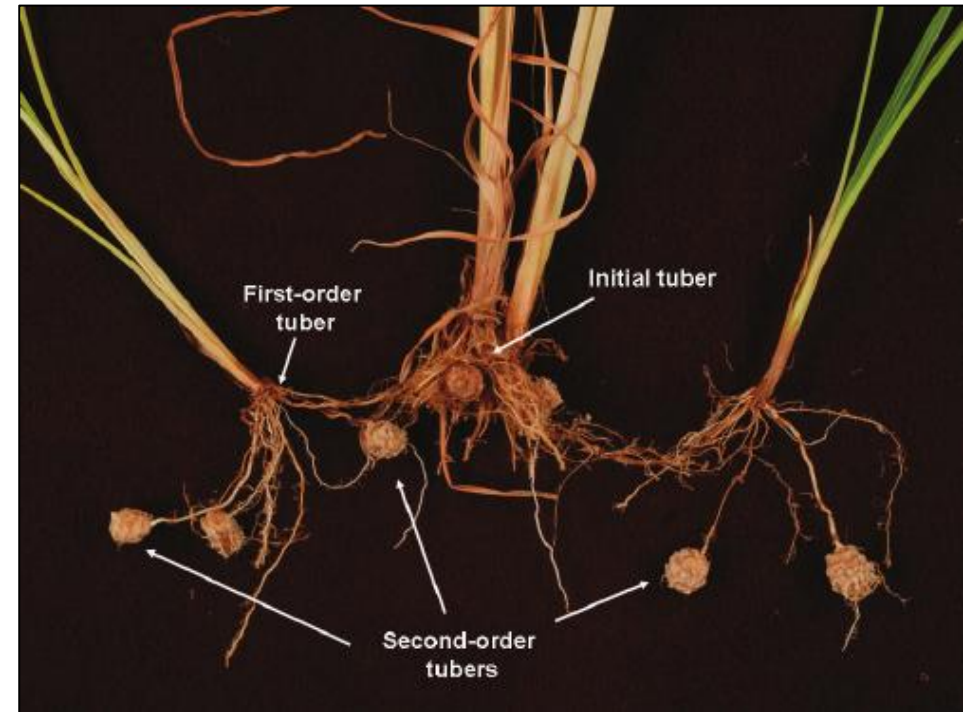
Purple Nutsedge Yellow
Nutsedge



Yellow Nutsedge

Characters:

- Produce deep fibrous roots, rhizomes, and distinct tubers
- Tubers are produced on rhizomes, or underground stems
- Buds on tubers sprout and grow to form new plants





Yellow Nutsedge Control

Preemergence Herbicides to Control Yellow Nutsedge(*Cyperus esculentus*) in Established Christmas Trees

Trade Name	Common Name	Response	Application Timings & Limitations
Mission 25WG	flazasulfuron	Good control	Apply in spring before budbreak or in late fall. This as both pre & post activity. Do not apply within 1 year of seeding trees. May be applied over the top in spring or after new growth has hardened in fall.
Pennant Magnum 7.62EC	s-metolachlor	Fair control	Apply in spring before weeds emerge



Yellow Nutsedge Control

Preemergence Herbicides to Control Yellow Nutsedge(*Cyperus esculentus*) in Established Christmas Trees

Trade Name	Common Name	Response	Application Timings & Limitations
Tower 6EC	dimethenamid-P	Good control	Apply after soil has settled around transplants. Do not apply during budbreak. Max of 2 applications and 64 fl oz/a/yr



Yellow Nutsedge Control

Postemergence Herbicides to Control Yellow Nutsedge(*Cyperus esculentus*) in Established Christmas Trees

Trade Name	Common Name	Response	Application Timings & Limitations
Roundup Ultra 4L	glyphosate	Fair control	Apply after new growth has hardened in the fall. Avoid contact with new tree growth. Do not apply over the top of Christmas trees. Apply as directed spray to the weeds using a hand boom or wiper application.



Problematic Weeds

Field Bindweed (*Convolvulus arvensis*)

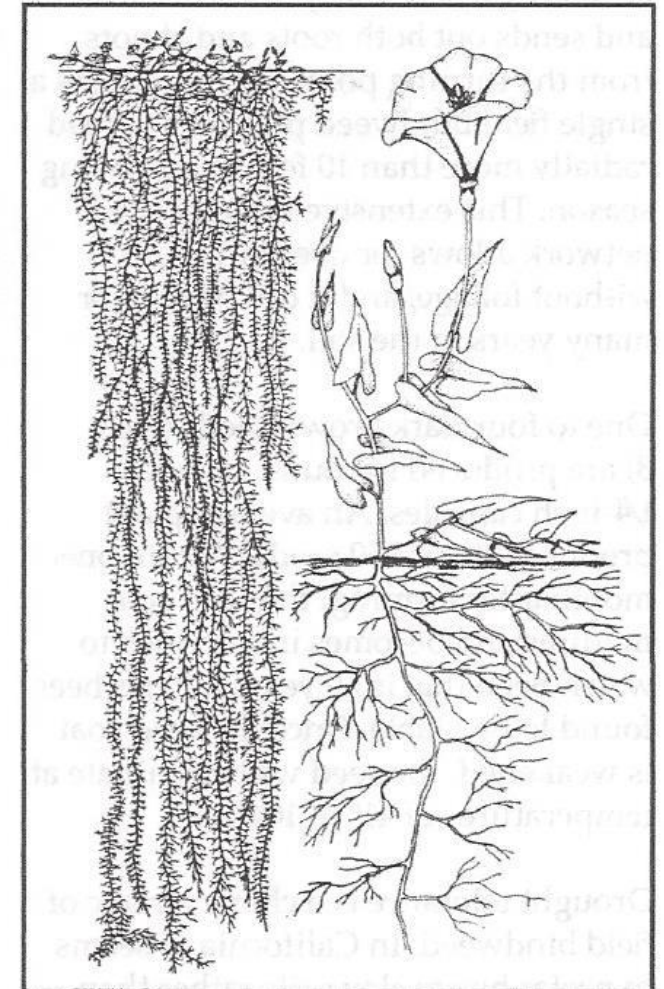




Field Bindweed

Characters

- Spreads by seed and a deep, extensive root system
- Seeds can persist in soil for up to 60 yrs; Roots can grow up to 30 feet deep
- Grows prostrate along ground until it comes in contact with other plants or structures
- Grows up and over anything in its path



Deep extensive root system



Field Bindweed

Characters:

Leaves arranged oppositely; arrow shaped

Young stem when broken, exude a milky sap

Flowers trumpet shaped, pink to white in color, 5 fused petals





Field Bindweed Control

Preemergence Herbicides to Control Field Bindweed (*Convolvulus arvensis*) in Established Christmas Trees

Trade Name	Common Name	Response	Application Timings & Limitations
Gallery 75 DF	isoxaben	Fair control	Apply in spring before annual weeds germinate. Apply to trees established in the field after soil is settled around the plants. May be applied over the top or as directed spray.
Princep 4L	simazine	Fair control	Apply to dormant trees more than 2 yrs old.
Sureguard 51WDG	flumioxazin	Fair control	Apply in spring before budbreak, or later in the season after new growth has hardened. Apply on top before budbreak. Can cause light needle burn.



Postemergence Herbicides to Control Field Bindweed (*Convolvulus arvensis*) in Established Christmas Trees

Trade Name	Common Name	Response	Application Timings & Limitations
Defy amine 4; Turret 5.5 L	2,4-D	Good control	Apply before budbreak in spring or in late summer after new growth has hardened. Avoid spraying tree foliage. Do not apply to diseased or stressed seedlings.
Garlon 3A	triclopyr	Good control	Apply in late summer or early fall after conifer terminal growth has hardened and weeds and woody plants are still growing.
Stinger 3L	clopyralid	Fair control	Apply when susceptible weeds are at 3-5 leaf stage. May be applied over the top of trees at any stage.



Marestail/ Horseweed

- **Family:** Asteraceae (Composite family)
Life cycle: Winter (primarily) and summer annual
- Produces a basal rosette of hairy, irregularly toothed leaves 2-3 inches long.
- Stem reaches heights of 6 ft,
- terminal portion is a large panicle of inconspicuous flowers producing numerous wind-dispersed seed.
- Pubescent stem covered with alternately arranged, hairy leaves 3- 4 inches long





Marestail

Chemical Control

Preemergence herbicides:

- Aatrex, Gallery, Sureguard, Velpar (Provide good to excellent control)

Postemergence herbicides:

- Garlon, Stinger (Provides good control)



Field Horsetail

- Family: Equisetaceae
- Genus: *Equisetum*
- Species: *arvense*
- Common name: Horsetails, field horsetails, snakeweed, horse pipes, etc.
- 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.





Habitat

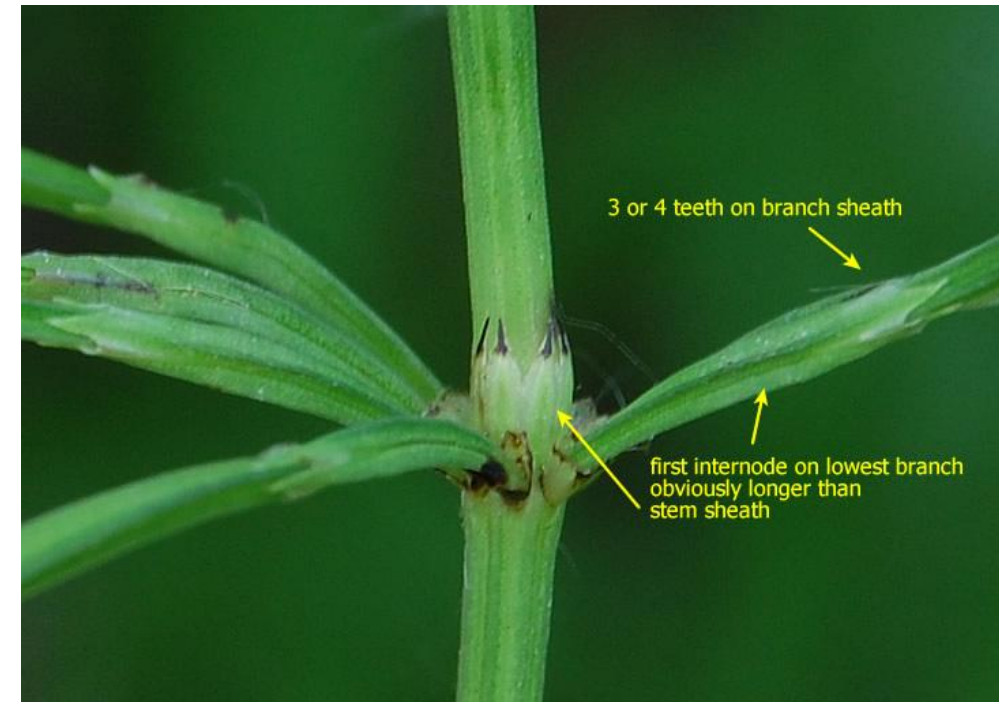
- Poorly drained areas like roadsides, wetlands, poorly drained landscape beddings, field, and drainage ditches.
- Preference for wet environments is linked to the need for moisture during the establishment of spores.
- However, these plants can also spread into well-drained areas through vegetative reproduction





Identifying Characters

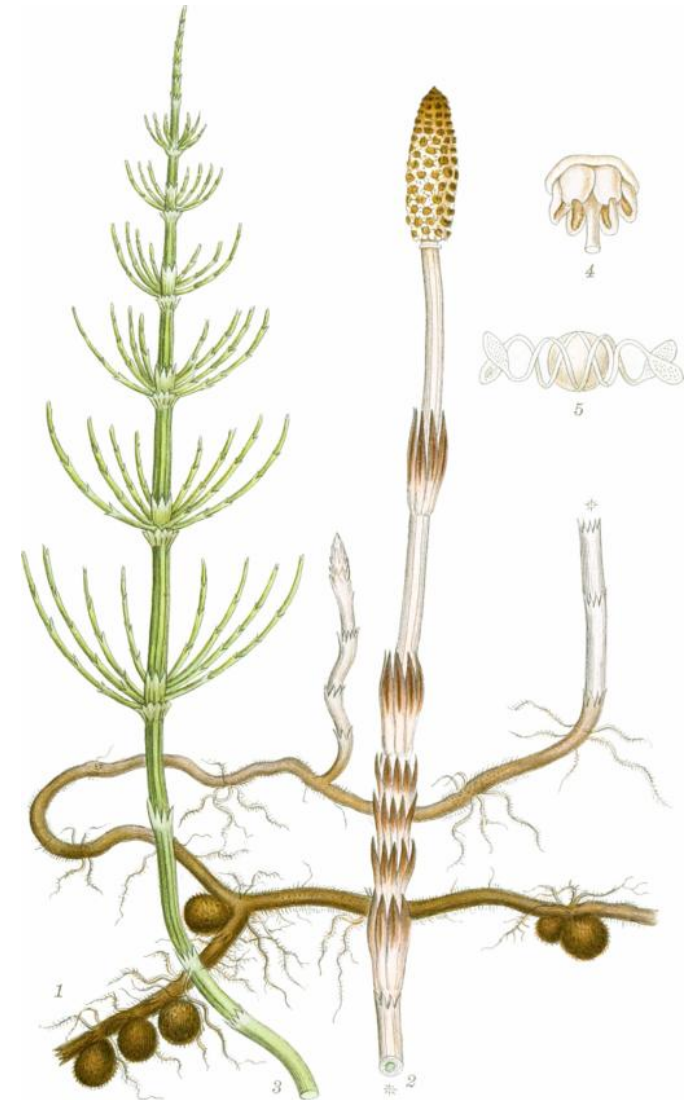
- Hollow and jointed stems; can be easily separated into sections
- Siliceous ridges that give them a rough texture.
- The stem serves as the primary photosynthetic organ.
- Although field horsetail appears leafless, it does have leaves, which are reduced to small scales
- Produce cone-like structures at the tips of their stems, responsible for spore production.





Identifying Characters

- Has alternating spore-producing phase and a gametophyte phase.
- Have a deep and extensive root system with rhizomes giving the appearance of a miniature forest.
- Preference for moist environments and ability to thrive in a variety of soil conditions.





Field Horsetail Control

- **Cultural:** Improving soil drainage and raising pH with lime can reduce favorable conditions for horsetail.
- **Chemical:**
 - Selective: Halosulfuron-methyl (Sedgemaster) or MCPA are effective in grass/pastures.
 - Non-Selective: Glyphosate, Diquat, or Diclobenil (Casoron) can be used, though they may only suppress growth rather than kill the roots.
- **Timing:** Apply to young, actively growing, and smaller plants, which may require multiple, consistent applications over 1–2 years.



MSU Research on Field Horsetail Control

Product	Rate(s)	Application Type	Interval of Applications
Finalsan (Ammoniated soap of fatty acids)	16.7 gal/100 gal 10 gal/100 gal	Foliar	0 and 14 days
Homeplate (Caprylic acid + Capric acid)	6 gal/100 gal 9 gal/100 gal	Foliar	0 and 14 days
Sedgehammer (Halosulfuron-methyl)	10 fl oz/acre 20 fl oz/acre	Foliar	0 and 42 days
SP1190 (not disclosed by SePRO)	16 fl oz/acre 32 fl oz/acre	Foliar	0 and 28 days
SP7105 (Pethoxamid)	24 fl oz/acre 48 fl oz/acre	Foliar	0 and 28 days
Marengo (indaziflam as Standard)	7.5 fl oz/acre 15 fl oz/acre	Foliar	0 and 28 days
Control	Untreated		

- SP1190 and SP7105 are two new herbicide products by SePRO chemical company.
- SP7105 (Pethoxamid) product has been launched in summer 2024 but needs to expand its label.
- Whereas SP1190 has an expected product launch in 2027
- Information source: IR4 Environmental Horticulture Workshop 2025.





MSU Research on Field Horsetail Control

Summary

- **Finalsan performed best** out of all the herbicides evaluated as it provided about 88.8% Equisetum control on 2 WAIT and about complete control on 16 WAIT.
- No significant differences were observed between the rates.
- In case of **SP7105**, **least** percentage of Equisetum control was observed, which is about 26% during 2 WAIT.
- Standard herbicide, Marengo at the rate of 7.5 fl oz/acre, provided 42% control during 2 WAIT.
- Homeplate also performed good as it provided 78% control at 2 WAIT at the rate of 9 gal per 100 gal.
- **Conclusion:** *Finalsan provided the best control of equisetum among all the treatments and the SP7105 showed the minimum control.*





Non-chemical Weed Control in Christmas Tree Production



Prevention

- Use of clean agricultural equipment
- Sowing of weed free transplants/ seedlings
- Removal of weeds along canal and irrigation channel
- Scouting of weeds in and around the farm





Mechanical Practices

- **Mowing:**

- Means removing the top growth of weeds growing in lawn/roadside and exhausting them to death.
- Repeated mowing prevents seed production and also starve the underground parts.
- It may require 1-3 years to control tall and perennial weeds by repeated and frequent cutting.
- Best time is when the underground root reserves are at the lowest level.
- Mowing removes apical dominance and repeated cutting hastens food depletion and death of the plant.
- Effective in tall growing plants. It favors short growing weeds plants by removing competition.





Mechanical Practices

Pros-

- **Avoid developing herbicide-resistant weeds**
- **Environment-friendly**

Cons-

- **Can spread perennial weeds such as field bindweed or Canada thistle**
- **Potential root or tree damage**
- **May not be effective very much**



Mulching

- physical barrier,
- restricting penetration of sunlight,
- release allelochemicals
- Prevent weed seed germination and emergence

Benefits of Organic Mulching:

- Reduction of weeds
- Improved soil moisture
- Maintenance of optimal soil temperature
- Increased soil nutrition
- Reduction of pesticide contamination
- Improved plant establishment
- Enhance root establishment & transplant survival





Mulching

- Problems related to mulching
 - Acidification
 - Diseases
 - Pest problems
 - Require re-applications





Flame Weeding (not encouraged)

- Should be applied with caution.
- Flaming in late afternoon or when sunlight is bright and air temperatures high provides the most effective results.
- Avoid open flame weeding in summer may ignite the entire field.
- Alternatives: infrared heaters and steam weeders that use propane to generate heat.
- The heat is applied indirectly to the weeds.





Cover Crops and Vegetated Strips

- Cover crops can directly compete with weed species and can suppress weed emergence
- Vegetated strips may include permanent grass strips which may take 3 to 4 years to establish and can be planted between tree rows before or after Christmas trees are planted
- Grass strip can significantly reduce the number of perennial and annual
- Can also provide a stable soil surface in the winter for harvest





Cover Crops and Vegetated Strips

Advantages of Cover crop

- Suppress weed emergence
- Slow soil erosion
- Improves soil physical properties
- Improves soil nutrients





Cover Crops and Vegetated Strips

Disadvantages of cover crop:

Consume water

Can reduce crop growth

Can compete with crops

Additional costs related to planting and killing

May increase pest populations and diseases



Cover Crops and Vegetated Strips

In Christmas tree plantations cover crops can:

- Improve tree growth and quality,
- Improve soil fertility
- Can be an alternative to commercial nitrogen fertilizers
- Stimulate soil microbial activity

Planting in the interspaces by:

- Legume cover crop (e.g. alfalfa)
- White clover
- Grasses (e.g. perennial ryegrass)
- Hard fescue grasses are common

Can increase the plant residue in the soil (improve soil microbial activity)



Cover Crops and Vegetated Strips

- Research has shown that:
- Soil fertility, tree survival and growth could be improved by incorporating leguminous and non-leguminous cover crops into Fraser fir production system.
- Cover cropping with banding can be an efficient strategy for maintaining productivity in Fraser fir plantation.





Biological Control

- Use of living organism's viz., insects, disease organisms, herbivorous fish, snails or even competitive plants for the control of weeds is called biological control.
- In biological control method, it is not possible to eradicate weeds but weed population can be reduced.
- This method is not useful to control all types of weeds.
- Introduced weeds are best targets for biological control.



Biological Control



True biological control agents are host-specific and only attack a single species



Contrast with generalist herbivores (or pathogens) that consume (or infect) a number of species and are not host specific



Selection of biological control agents is extremely important as there are instances of damage to non-target plants



Qualities of bio-agent:

- The bio-agent must feed or affect only one host and not other useful plants
- It must be free of predators or parasites.
- It must readily adapt to environment conditions.
- The bio-agent must be capable of seeking out itself to the host.
- It must be able to kill the weed or at least prevent its reproduction in some direct or indirect way.
- It must possess reproductive capacity sufficient to overtake the increase of its host species, without too much delay.





Biological Control

- Flea beetle and cinnabar moth for tansy ragwort (*Senecio jacobaea*)
- Klamath beetle for St. Johnswort (*Hypericum perforatum*)
- Two species of puncturevine weevils and a noctuid moth that attack bindweed



Chrysolina quadrigemina on
St. Johnswort



Biological Control

Merits:

- Least harm to the environment
- No residual effect
- Relatively cheaper and comparatively long lasting effect
- Will not affect non-targeted plants and safer in usage

Demerits:

- Multiplication is costlier
- Control is very slow
- Success of control is very limited
- Very few host specific bio-agents are available at present



Thanks

Questions?

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