

1

**INVASIVE PLANT CERTIFICATION PROGRAM**

How it works:

- A1 Principles and Fundamentals of Weed Science**
- A2 State Regulations Pertaining to Invasive Plant Management**
- A3 The Invasive Plant Issue and Invasive Plant Identification**
- B Developing an Invasive Plant Management Program**

2

**INVASIVE PLANT CERTIFICATION PROGRAM**

How it works:

For a certificate A1, A2 and A3 can be taken in any order but must be completed before taking B.

Attendees are encouraged to take all four sessions in one year to get the most out of the information. All sessions may also be taken individually.

Take-home assignment after each section.

3

**What is a weed?**

- a plant growing where it is not desired
- a plant out of place
- higher plants which are a nuisance

**Emerson 1912 - "A plant whose virtues have not yet been discovered"**

4

## The Best Definition

The Weed Science Society of America (WSSA) defines a weed as a plant that causes economic losses or ecological damage, creates health problems for humans or animals, or is undesirable where it is growing.

5

## Weed Life Cycles

- annual -
  - summer annual or winter annual
- biennial
- perennial -
  - simple or solitary
  - creeping or spreading

The most important thing you can learn about a particular weed because not all strategies are effective on all life cycles.

6

## Weed Life Cycles

Annual - complete life cycle in one year  
seed to seed in one year  
reproduce by seed

- Summer annual
- Winter annual

7

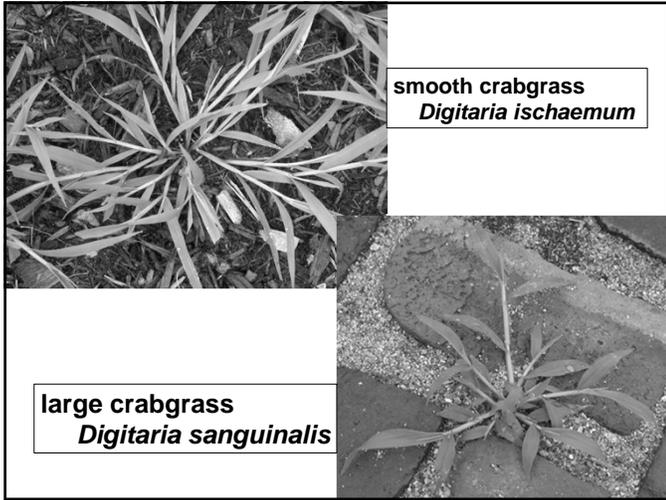
## Summer Annual

spring to fall:

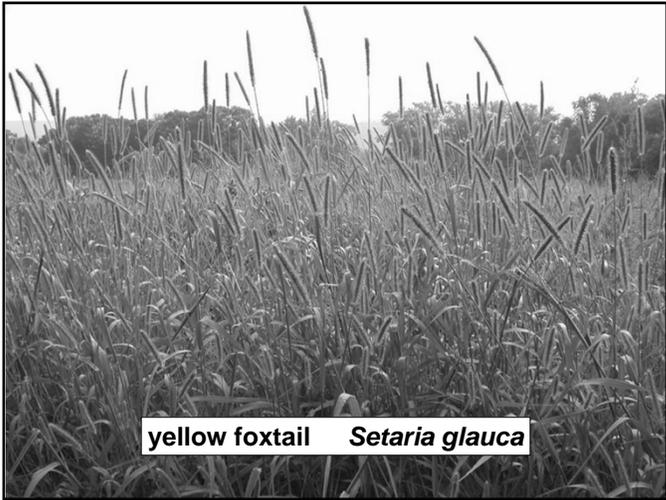
- germinate in spring,
- grow vegetatively through season
- flower & produce seed late summer and fall
- senesce with onset of cool weather

ex: large and smooth crabgrass, yellow foxtail, giant foxtail, goosegrass, lambquarters, pigweed, carpetweed, ragweed, velvetleaf

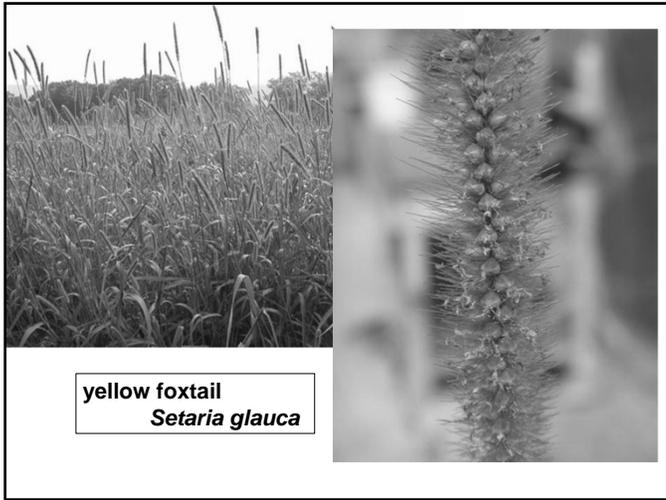
8



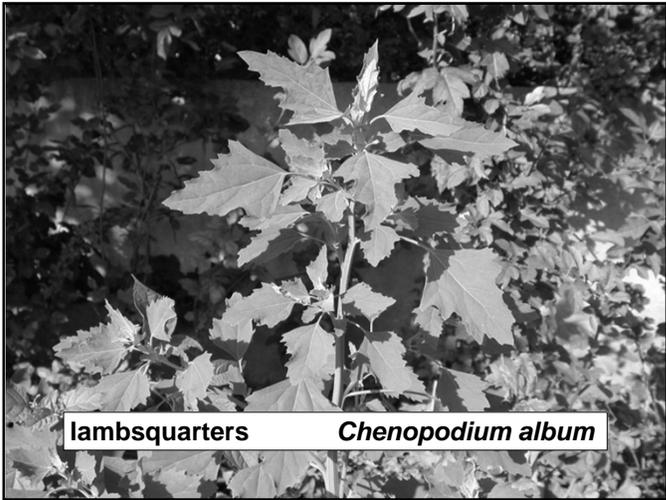
9



10



11



12



carpetweed *Mollugo verticillata*

13



common ragweed *Ambrosia artemisiifolia*

14



Japanese stiltgrass  
*Microstegium vimineum*

15



Japanese stiltgrass  
*Microstegium vimineum*

16



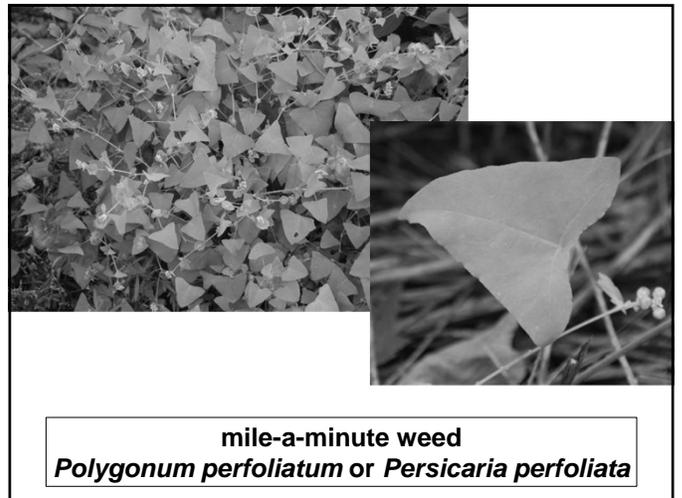
17



18



19



20



**mile-a-minute weed**  
*Polygonum perfoliatum* or *Persicaria perfoliata*

21



**mile-a-minute weed**  
*Polygonum perfoliatum* or *Persicaria perfoliata*

22

**Dormant Phase of Summer Annuals:**  
 as a seed from late summer/early fall  
 through winter to germination in  
 spring/early summer of the next year  
 or in future years

23

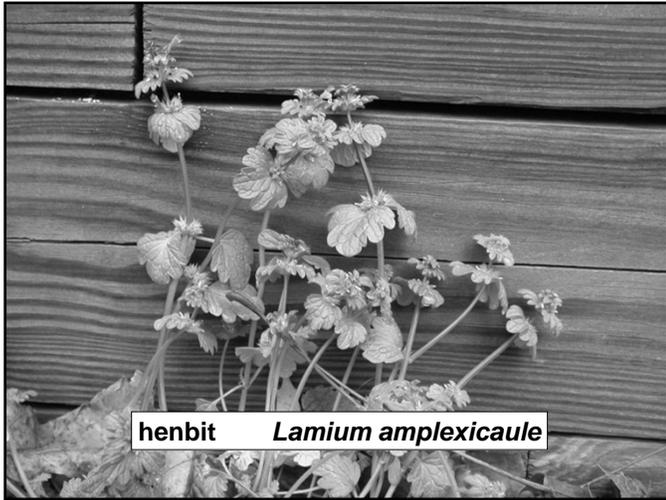
### **Winter Annual**

**fall to spring:**

- germinate in fall & grow vegetatively
- dormant with cold weather
- spring continue vegetatively
- flower & produce seed
- die with hot weather

ex. henbit, red deadnettle, groundsel,  
 common chickweed, horseweed, annual  
 bluegrass, bittercress, mouse-ear cress

24



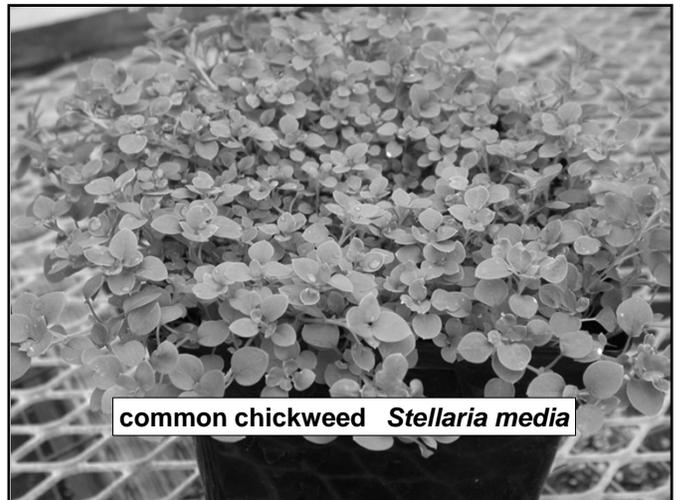
25



26



27

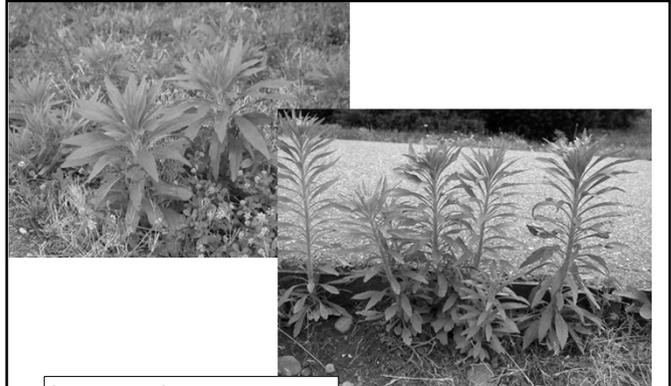


28



horseweed *Conyza canadensis*

29



horseweed  
*Conyza canadensis*

30



horseweed  
*Conyza canadensis*

31



annual bluegrass  
*Poa annua*

32



annual bluegrass *Poa annua*

33

**Dormant Phase of Winter Annuals:**

1. as a seed from late spring/early summer through summer to germination late summer/early fall later that same year or in future years
2. vegetatively dormant in the winter between germination and spring growth

34

**Biennial**

- complete life cycle in two years
- seed to seed in two years
- reproduce by seed

35

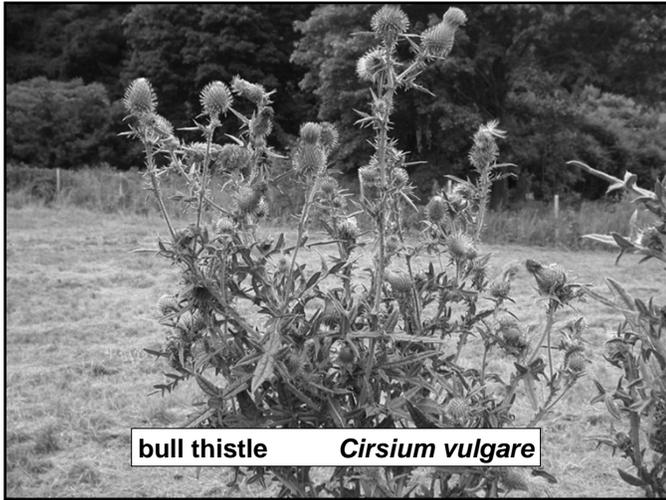
1st year - germinate, grows vegetatively and forms rosette



2nd year - grow vegetatively, then forms seed stalk (bolting stage), produce seed and die

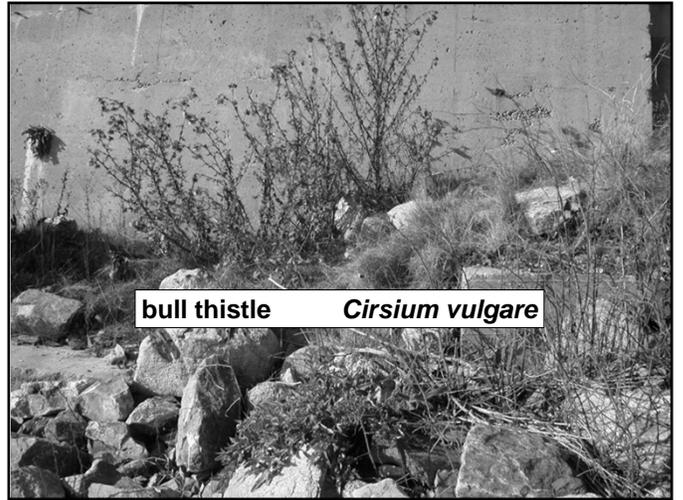
Ex: bull thistle, wild carrot, common mullein, burdock, garlic mustard

36



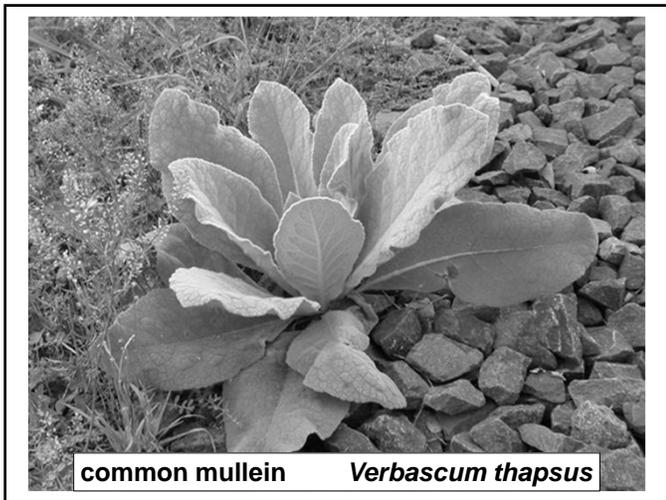
bull thistle *Cirsium vulgare*

37



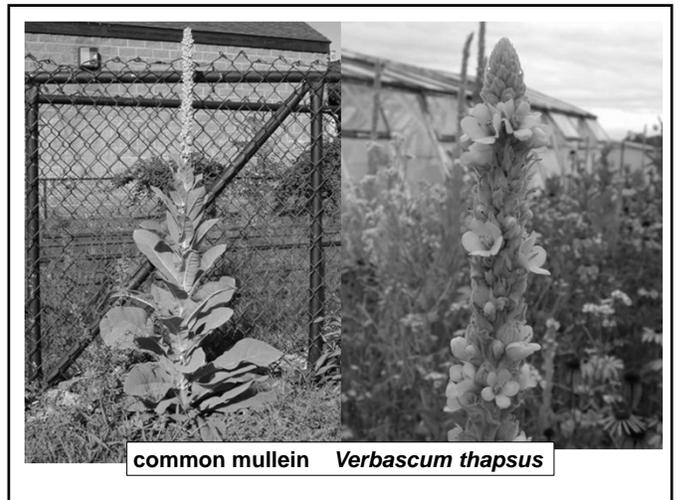
bull thistle *Cirsium vulgare*

38



common mullein *Verbascum thapsus*

39



common mullein *Verbascum thapsus*

40



41



42



43



44

**Dormant Phase of Biennials:**

1. as a seed from the end of second year of growth to next spring or future springs
2. vegetatively dormant in the winter between first and second year of growth

45

**Perennial - live 3 or more years**

- simple or solitary
- creeping or spreading

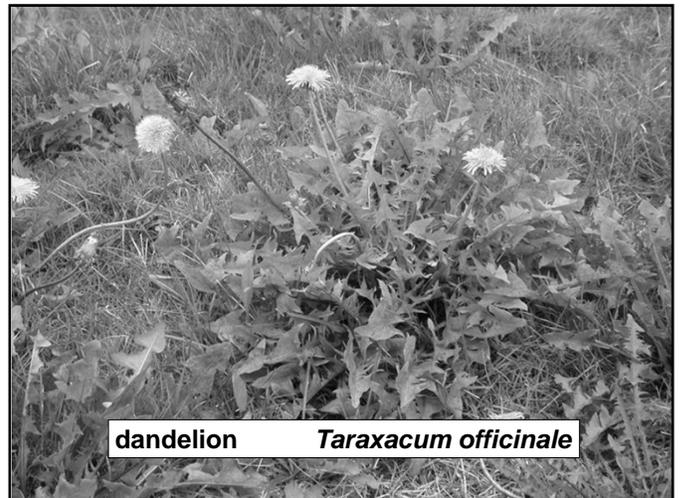
46

**Simple or solitary**

- reproduce by seed
- no natural vegetative propagation (taproot splitting??)
- new growth replaces last years dead top growth

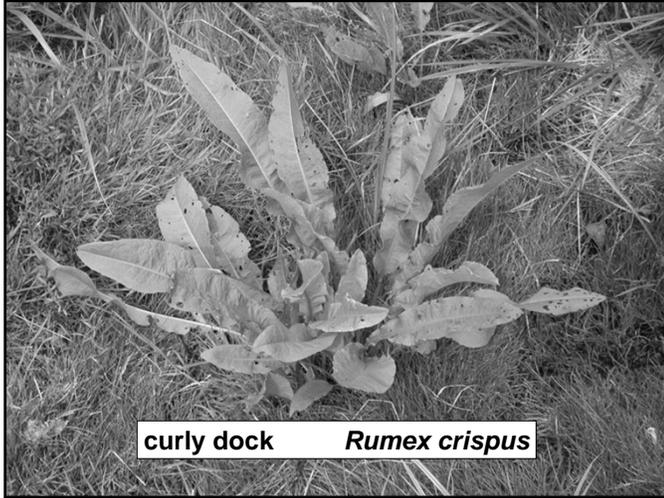
ex. dandelion, fall dandelion, narrowleaf plantain, broadleaf plantain, curly dock, broadleaf dock, pokeweed

47



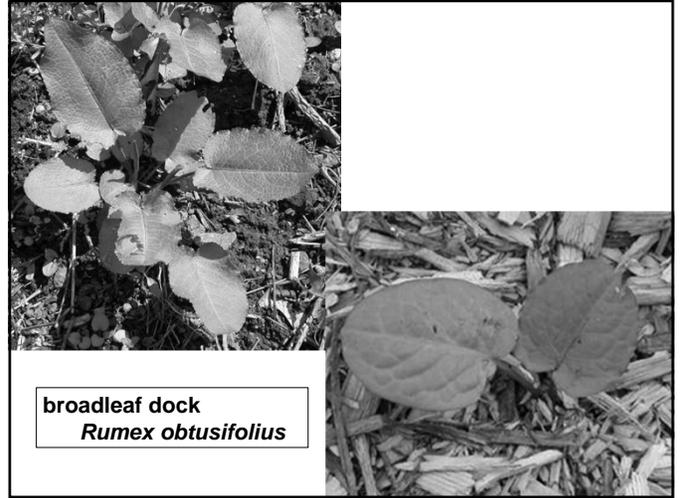
dandelion *Taraxacum officinale*

48



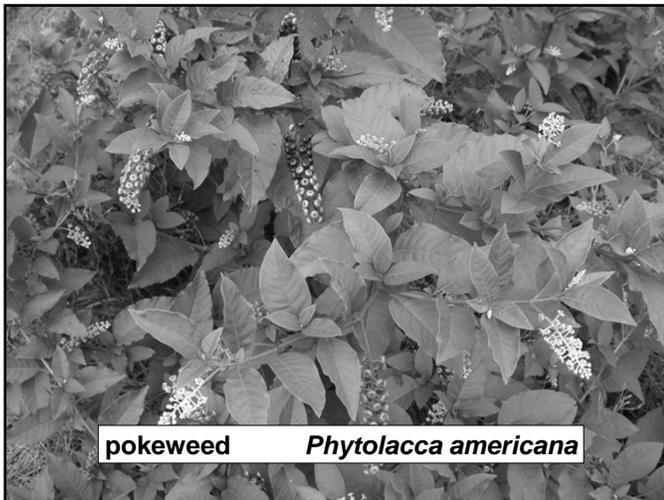
curly dock *Rumex crispus*

49



broadleaf dock  
*Rumex obtusifolius*

50



pokeweed *Phytolacca americana*

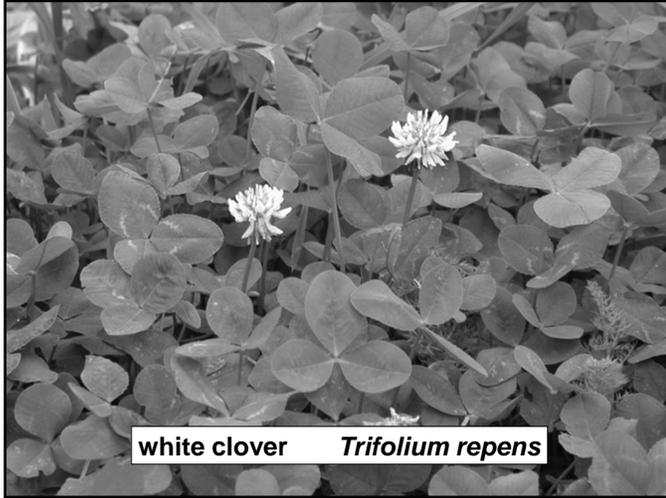
51

**Creeping or spreading**

reproduce by seed and asexual means

- rhizomes (below ground stems) - quackgrass, mugwort, yellow woodsorrel, Japanese knotweed
- stolons (above ground stems) - wild strawberry, creeping bentgrass, creeping woodsorrel
- creeping roots - Canada thistle, common milkweed, horsetruffle

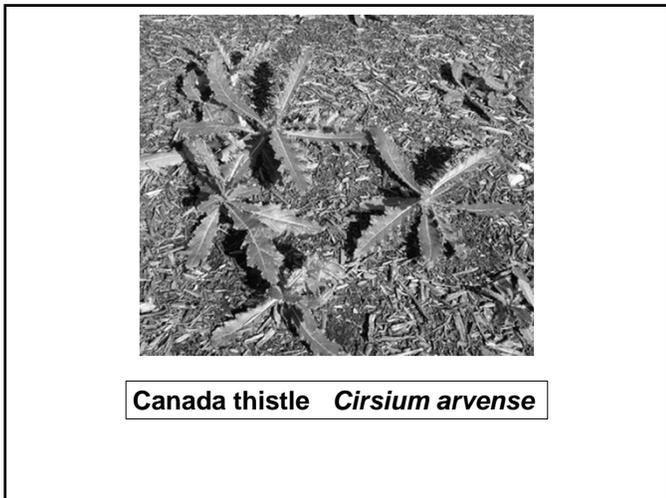
52



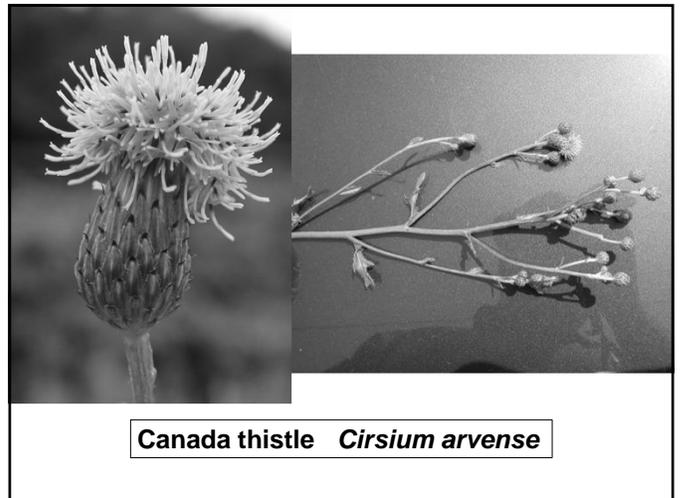
53



54



55

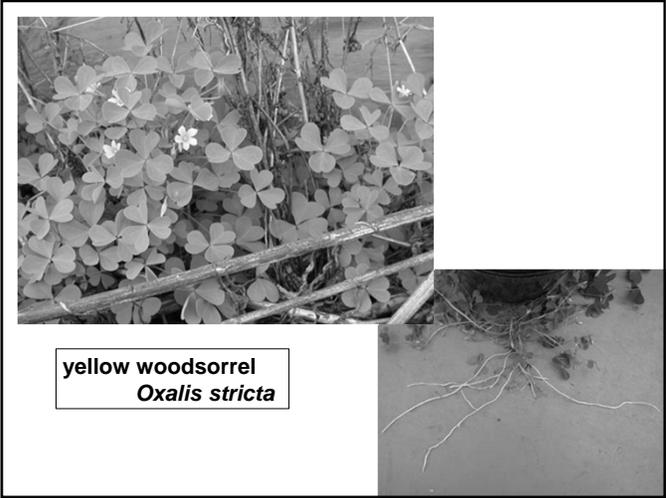


56



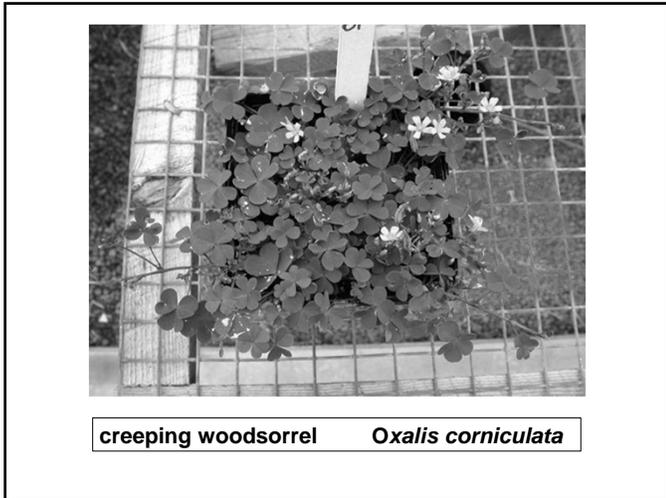
mugwort  
*Artemisia vulgaris*

57



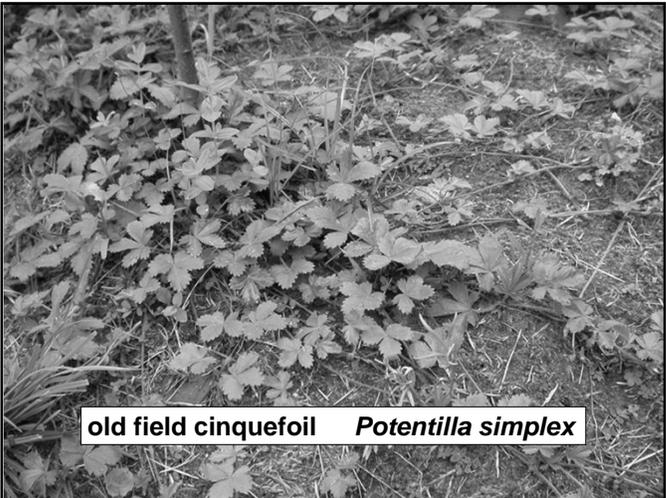
yellow woodsorrel  
*Oxalis stricta*

58



creeping woodsorrel    *Oxalis corniculata*

59

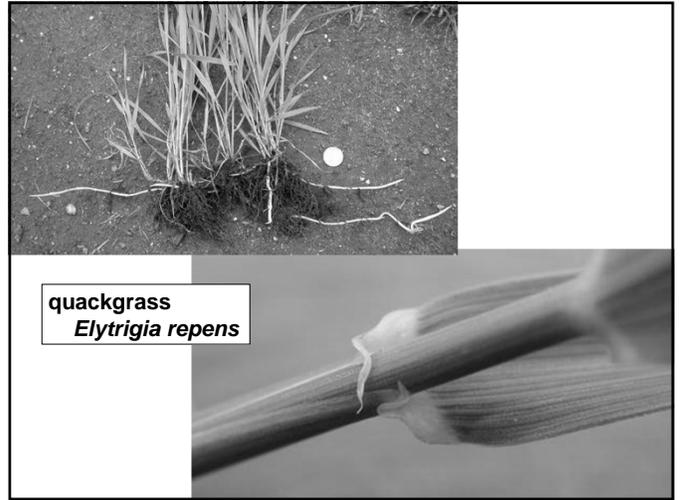


old field cinquefoil    *Potentilla simplex*

60



61



62



63

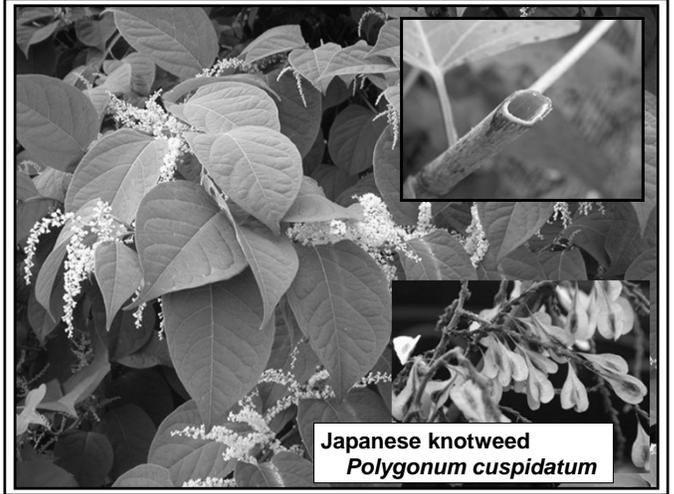


64



**black swallowwort**  
*Cynanchum louiseae*

65



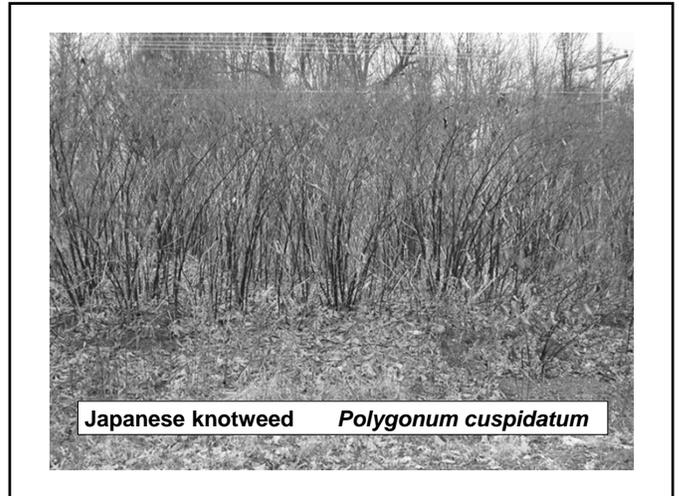
**Japanese knotweed**  
*Polygonum cuspidatum*

66



**Japanese knotweed**  
*Polygonum cuspidatum*

67



**Japanese knotweed** *Polygonum cuspidatum*

68

**Dormant Phase of Perennials:**

1. as a seed after production to germination (anytime of season)
2. vegetatively dormant in the winter

69

**Weed dissemination**

Associated w/ man's exploration and colonization

"We carry weeds with us"

70

movements of reproductive parts  
from place to place

- sexual = seeds
- asexual = stolons, rhizomes, roots

71

**Means of dissemination**

natural

1. wind
2. water
3. animal
4. force dehiscence

artificial - associated with man activity

72

**Natural**

**1. wind**

small, light seed moved by wind  
heavier use special appendages



Dandelion seed with its parachute is easily carried by the wind.

< parachute - dandelion  
tuft of hair - milkweed >  
wings - maple, ash



tumbling action  
tumble pigweed,  
genus *Panicum*

73

**2. water**

transports most types of seeds

reach water by erosion or wind  
seed being dropped or blown in

air filled bladders - docks  
corky plant material - jimsonweed



Seed pod



Seed

Curly dock seed pod is scurged with bladder-like floats.

74

**3. animal**

barbs, hooks or bristles  
sticky seed  
sharp projection - puncturevine  
carried in fecal matter  
decrease in well rotted manure



75

**4. force dehiscence**  
- exploding seedpod

jewelweed or touch-me-not  
yellow woodsorrel (*Oxalis*)  
bittercress - *Cardamine* spp.

76

**Artificial - associated with man's activity**

farm machinery  
mower equipment  
feed grain  
straw  
hay  
compost  
manure  
plant material (container/ B+B)  
top soil

77

**Dormancy of weed seeds**

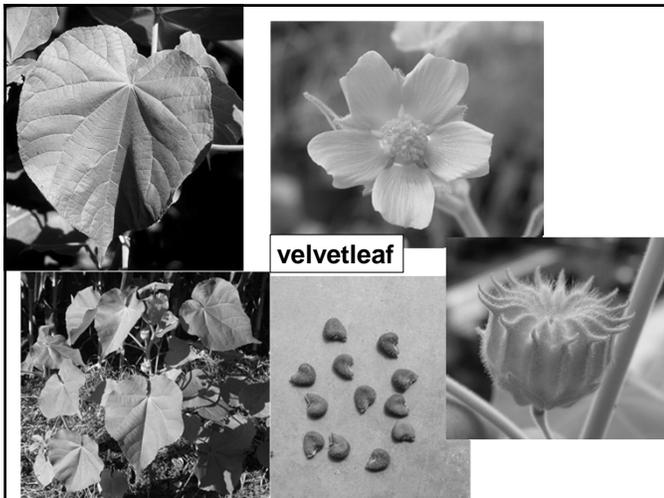
state of suspended development

spread of weeds over time

crop seed --- no dormancy

*"A year of weed equals seven of seed"*

78



79

**WEED SEED BANK**

definition - all viable seeds (and spores) present on or in the soil constitute the soil weed seed bank

**The INS and OUTS of the WEED SEED BANK**

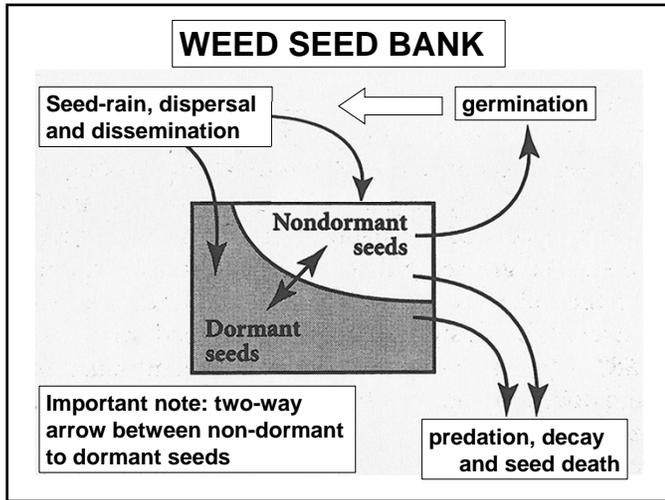
**Deposits (additions)** - seed rain, dispersal, dissemination

**Dormant and non-dormant seeds**

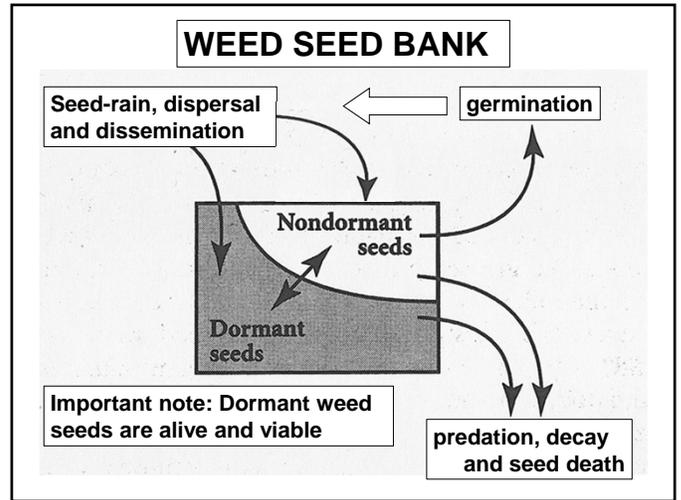
Important note: two-way arrow between non-dormant to dormant seeds

**Withdrawals (removals)** - germination, seed death, predation, decay

80



81



82

**Levels of Weed Management**

- prevention
- control
- eradication

83

**Prevention**

stopping new weeds:

1. invading an area
2. limit weed build-up

(prevent introduction, establishment and/or spread)

84

## Control

suppression  
decreases pop. to non-interfering levels

### DO NOT:

1. reduce yield or quality
2. interfere w/ harvest
3. effect aesthetics (turf, ornamentals)
4. playability and athlete safety

85

## Eradication

complete elimination of the weed species

must remove:

1. live plants
2. reproductive structures  
(seed and veg. propagules)

difficult because of:

acreage  
dormancy  
expensive

86

effective:

1. small scale
2. newly intro. species such  
as an invasive plant
3. high value hort. or orna. crops

could involve soil fumigation

87

## Biological

action of parasites, predators or pathogens  
in maintaining another organism's  
population at a lower average density than  
would naturally occur

- phytophagous insects
- pathogenic fungi
- fish
- snails
- bacteria
- pigs and goats

88



89

## Herbicides

phytotoxic chemical used to control, suppress or kill plants, or to severely interrupt normal growth processes

ability to selectively kill weed, not crop

90

### Herbicides vary in terms of:

- absorbed by roots, emerging shoot or aerials
- active or inactive on soil
- persistent vs non-persistent
- grass vs broadleaf weed
- crops and weeds
- chemical structure
- mode of action
- appl. timing - preemergence or postemergence

91

### Selective vs Non-selective

- non-selective kills all vegetation  
Roundup PRO
- selective kill weeds but not crop  
2,4-D, dicamba, fenoxaprop

### Contact vs Systemic aka. Translocated

- *contact* - kill the portions of the plant contacted by spray
- *systemic* - move within the plant to roots and underground parts

Systemic in the world of weed science is known as Translocated

92

**Which is more effective at controlling  
deep-rooted perennial weeds?**

**CONTACT or  
SYSTEMIC/TRANSLOCATED**

93

**SYSTEMIC/TRANSLOCATED!!!!**

94

### **Timings of Herbicide Application**

- **PREEMERGENCE**
- **POSTEMERGENCE**

95

### **Timings of Herbicide Application**

#### **Preemergence (PRE)**

- **applied to the soil before emergence  
of the specified weed or crop.**
- **ability to control weeds before or  
soon after they emerge.**
  
- **applied to weed-free soil**
- **weed seedlings contact thin  
layer of herbicide as they emerge**

96

### Postemergence (POST):

- applied after emergence of the specified weed or crop.
- ability to control established weeds.
  - Roundup PRO
  - RoundUp Custom for Aquatic and Terrestrial Weeds
  - Rodeo
  - Garlon 3A & Garlon 4
  - Acclaim Extra

97

### **Herbicide Nomenclature**

#### trade or proprietary name:

Roundup Pro - turf & ornamentals  
Roundup Weather Max - agronomic  
Rodeo or Aquamaster - aquatic

#### common name or active ingredient: glyphosate

chemical name: isopropylamine salt of - (phosphomethol) glycine

98

### **Herbicide Selectivity**

the favorable interaction of the plant, herbicide and the environment, i.e. ability of a given herbicide to kill certain plant species (WEED) without significant injury to others (CROP)

- plant factors: age of plant, stage & condition of growth, genetic makeup
- herbicide factors: rate, molecular configuration, formulation, placement

99

### **Plant factors**

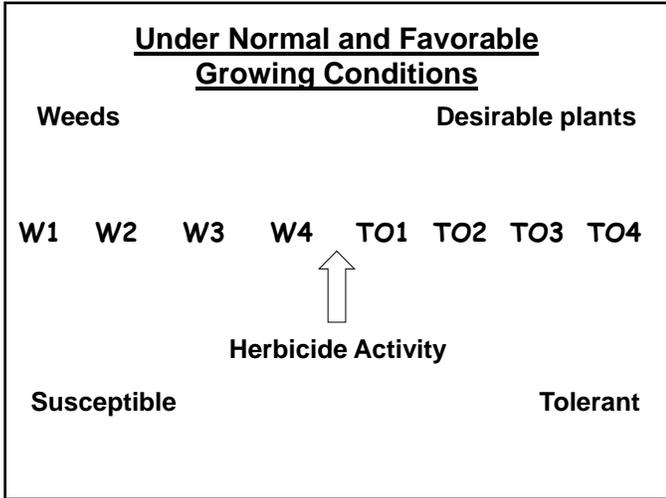
1. age of plant, stage + condition of growth  
younger plants usually more susceptible

faster growing plants are more susceptible

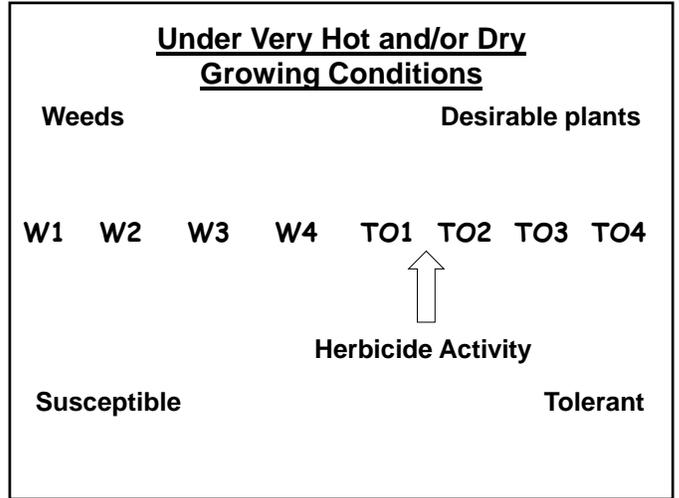
susceptible or tolerant, desirable plant under low temp. or drought

tolerance of susceptible, weed may be tolerant under drought and high temp.

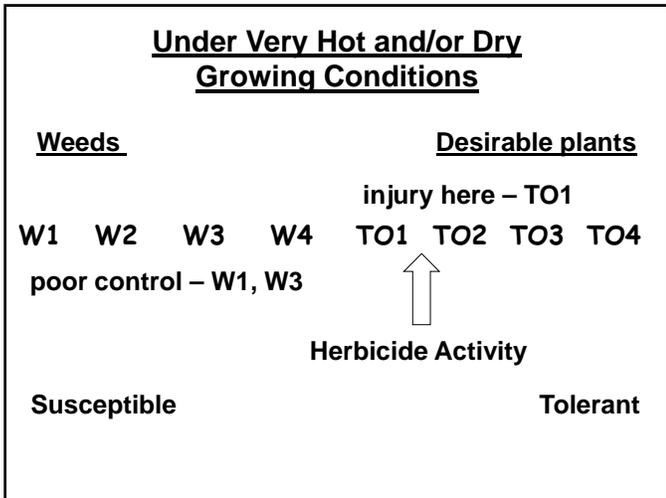
100



101



102



103

- 2. species
  - grasses or broadleaves
  - annuals or perennials
- 3. genetic makeup of species
  - bio-types
  - cultivar
  - transgenic, herbicide resistance

104

## **Herbicide factors**

### **1. rate**

- rate increase results in less selectivity
- excessive rates - toxic to most plants

### **2. molecular configuration**

- small modifications effect selectivity

105

### **3. formulation**

- dry vs liquid application
- granular vs spray

### **4. placement**

- on the soil surface
- directed spray
- boom and/or nozzle shields
- wick or wipers

106

## **Factors that affect spray drift**

movement of herbicide from intended target area

### **1. wind velocity**

- change daily
- early morning and evening - lowest
- hooded sprayer
- higher - increase

107

### **2. nozzle type**

- droplet size function of orifice size and design
- smaller - increase

### **3. spray pressure**

- higher - increase

### **4. height of boom**

- higher - increase

108

## Importance of calibration

insures target rate is achieved

problems with incorrect rate

- crop injury
- reduced efficacy

109

## Herbicides

- tank-mix
- combination products

110

## HERBICIDE COMBINATION RESULTS ADDITIVE

Herbicide	Weed A	Weed B	Weed C	Weed D	Weed E
H1	90	0	100	75	0
H2	0	95	100	0	80
H1 + H2	90	95	100	75	80

111

## HERBICIDE COMBINATION RESULTS SYNERGISM

Herbicide	Weed A	Weed B	Weed C	Weed D	Weed E
H1	40	75	40	95	0
H2	40	10	20	0	0
H1 + H2	100	95	75	100	0

112

## HERBICIDE COMBINATION RESULTS ANTAGONISM

Herbicide	Weed A	Weed B	Weed C	Weed D	Weed E
H1	100	90	40	100	60
H2	0	0	20	0	100
H1 + H2	75	90	40	65	85

113

## Do I need to rotate the herbicides that I use?

Why is pesticide rotation done?

Does this pertain to herbicides?  
- poor control may  
cause population shifts

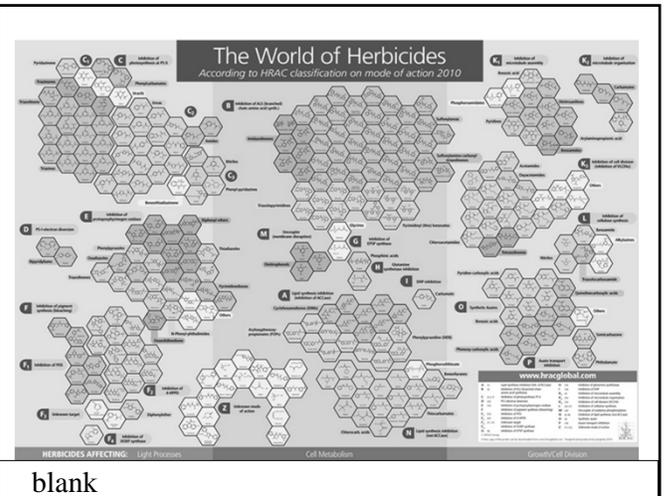
114

## What does rotate mean?

Herbicide???

Modes-of-action???

115



blank

116

Are the terms “herbicide rate” and “herbicide concentration” interchangeable?  
 Are they the same???

“herbicide rate” = amount of active ingredient (herbicide) that is applied to a given area.  
 units: lbs ai/A, oz/1000 sq. ft., pints/A

“herbicide concentration” = concentration of herbicide in a given volume of water, it is a solution concentration  
 units: 1%, 2%, 5%, 25% (spray-to-wet)

**SAME??**

117

**Which can be replicated?**

*herbicide rate*

or

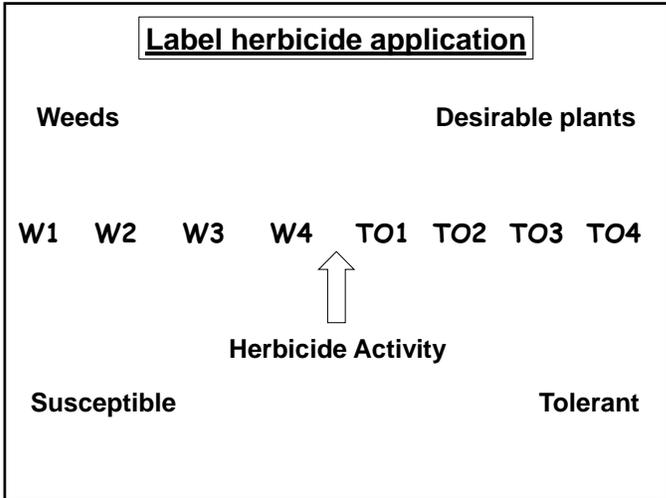
*herbicide concentration*

118

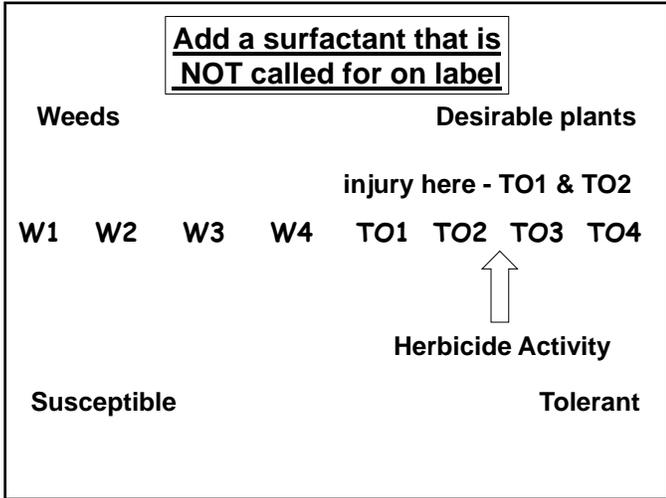
**Should we be adding spray adjuvants to our herbicide spray treatments??**

- old formulations
- story of glyphosate
- new products came along

119



120



121



**Thank You for Your Attention!!  
Have a Great 2021 Season!!**

**rprostak@umass.edu   413-577-1738**

122

**A1 Take-home Assignment for  
IPCP Certificate**

- To obtaining the Invasive Plant Management certificate of completion, you will need to complete the TAKE-HOME ASSIGNMENT and return it by the due date: February 15, 2021 at 5 pm. Take-home assignment will be emailed to you.

123

**Pesticide Credits**

If you provided your Pesticide License # when you registered and responded to all the poll questions, we will email you your pesticide Certificate of Attendance.

124

## Association Credits

- **Massachusetts Certified Arborists** - 2 Education Credits  
Fill out Confirmation Form at <https://massarbor.org/OnlineCEUs>
- **Massachusetts Certified Landscape Professionals** - 2 Education Credits  
Fill out Confirmation Form at <https://mlp-mclp.org/OnlineCEUs>
- **Massachusetts Nursery & Landscape Association** - 1 Credit  
E-mail [eweeks@umext.umass.edu](mailto:eweeks@umext.umass.edu) your **name** and **address** and request for MCH credit.
- **International Society of Arboriculture** - 4.5 CEUs  
E-mail [eweeks@umext.umass.edu](mailto:eweeks@umext.umass.edu) your **name** and **ISA Certification #** and **this code: NE-20-022**.