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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"

2

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.

3

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.

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Weed Life Cycles

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

- Summer annual
- Winter annual

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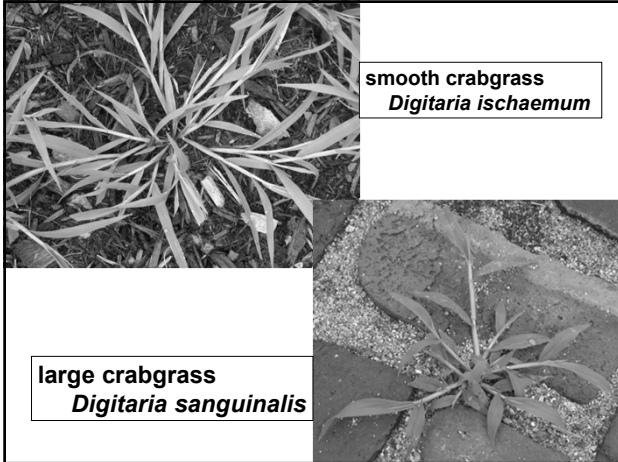
Summer Annual

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

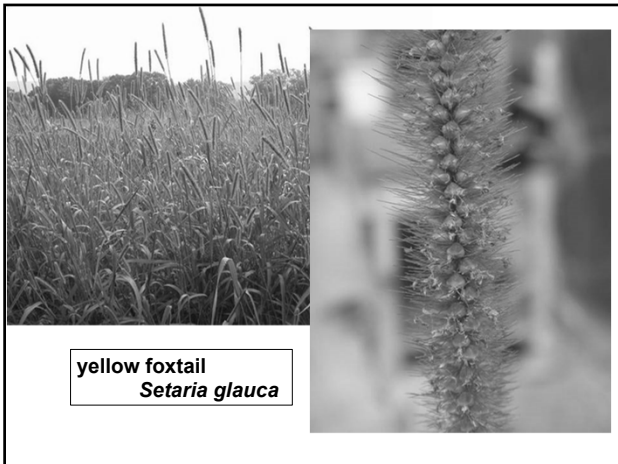
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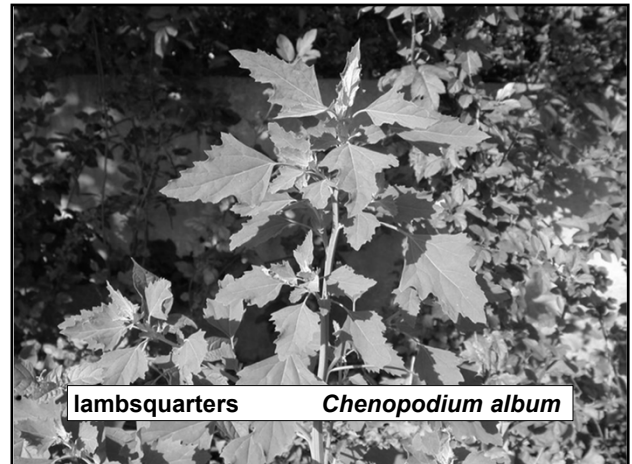
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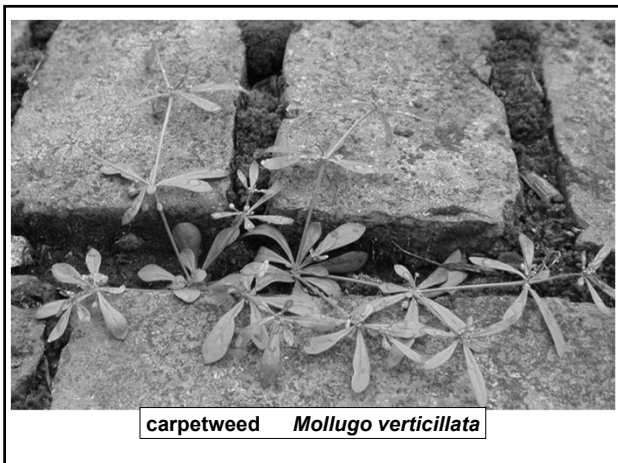
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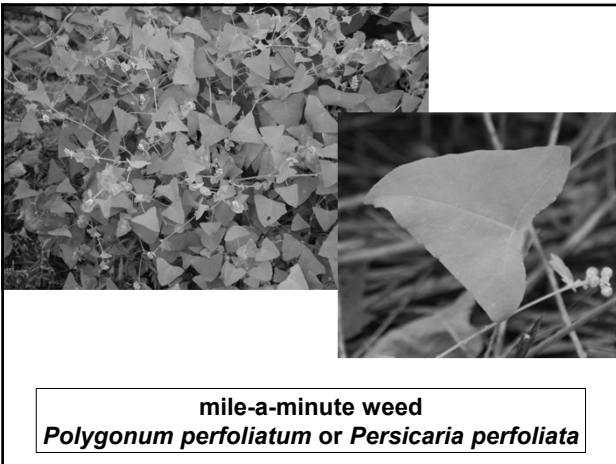
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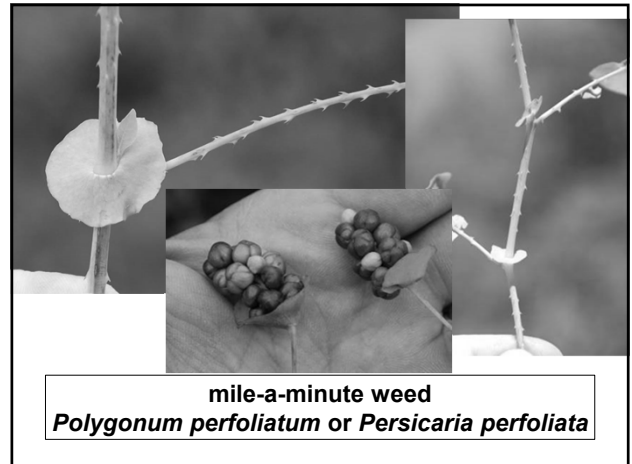
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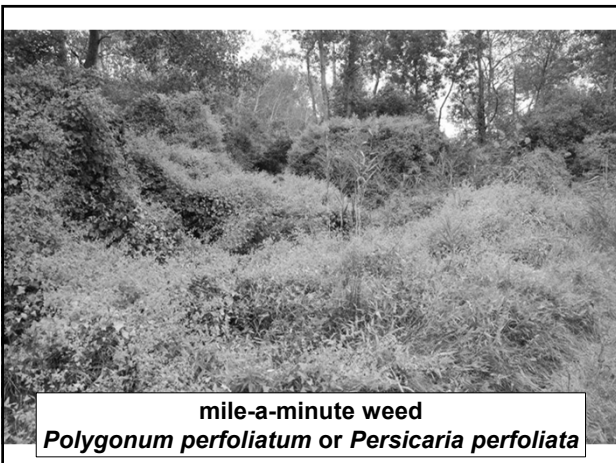
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Dormant Phase of Summer Annuals:
as a seed from late summer/early fall
through winter to germination in
spring/early summer of the next year
or in future years.

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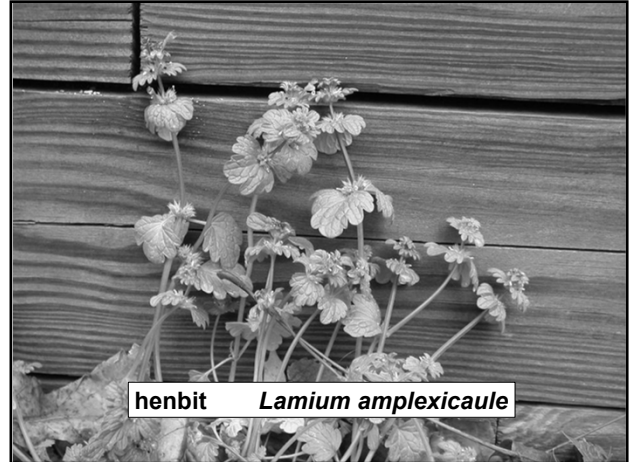
Winter Annual

fall to spring:

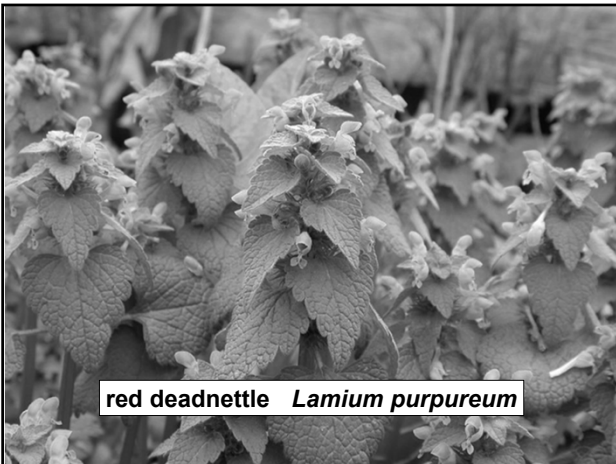
- germinate in fall & grow vegetatively
- dormant with cold weather
- spring continue vegetatively
- flower & produce seed
- die with hot weather

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

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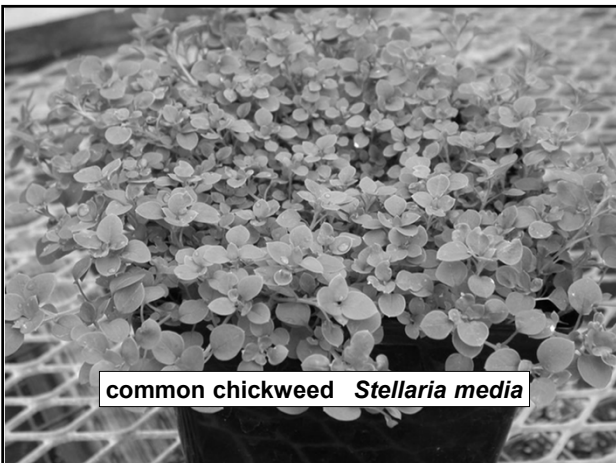
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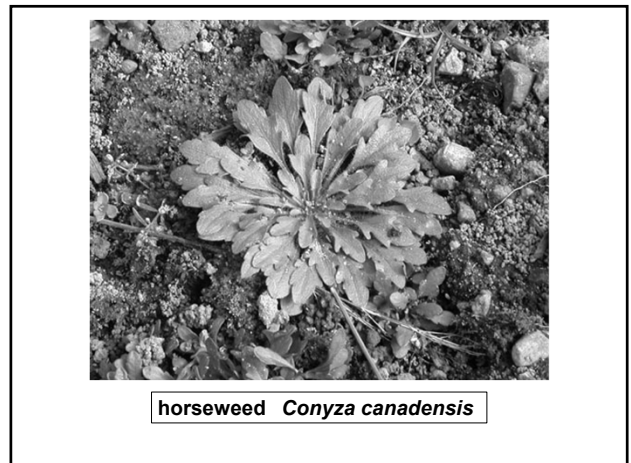
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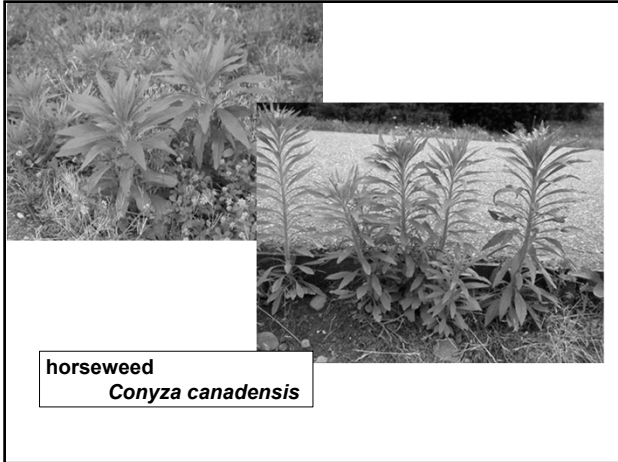
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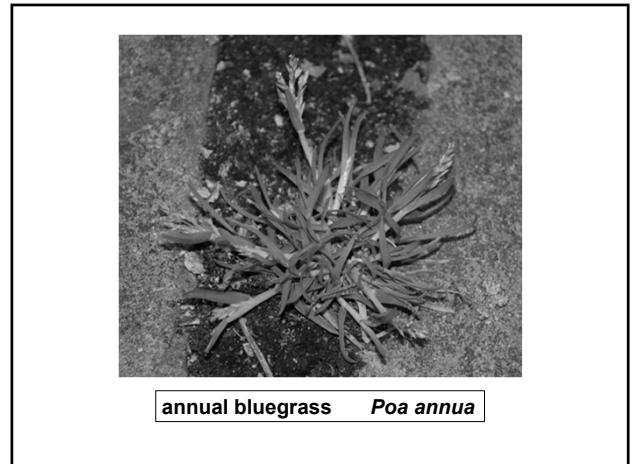
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Dormant Phase of Winter Annuals:

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.

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Biennial

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

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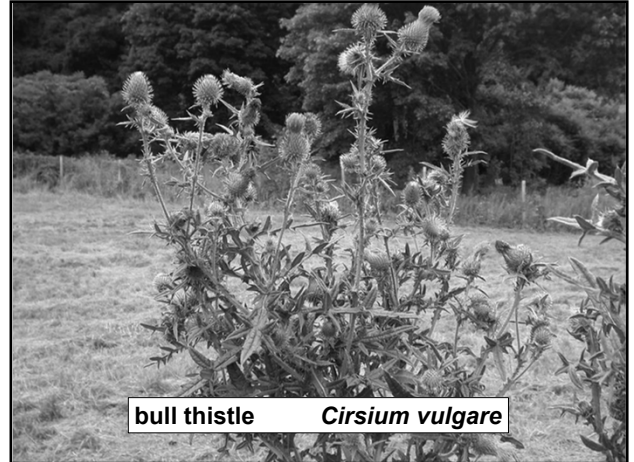
1st year - germinate, grows vegetatively and forms rosette



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

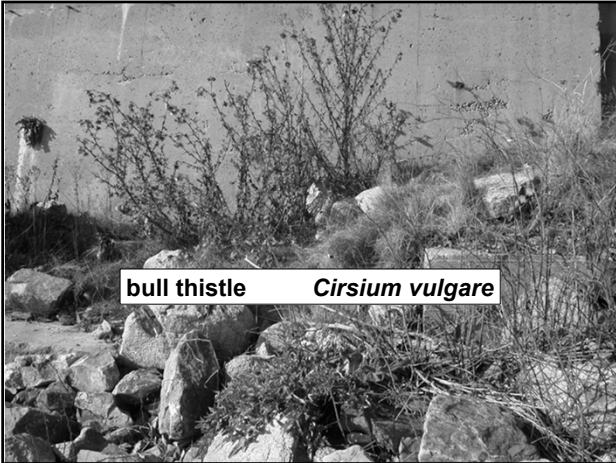
Ex: bull thistle, wild carrot, common mullein, burdock, garlic mustard

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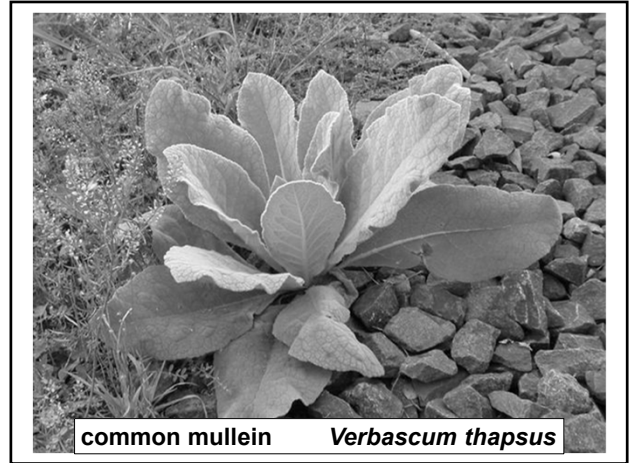
bull thistle *Cirsium vulgare*

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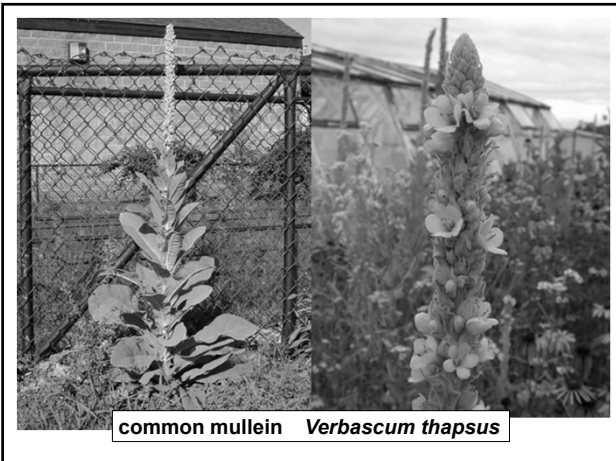
bull thistle *Cirsium vulgare*

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common mullein *Verbascum thapsus*

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common mullein *Verbascum thapsus*

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garlic mustard *Alliaria petiolata*

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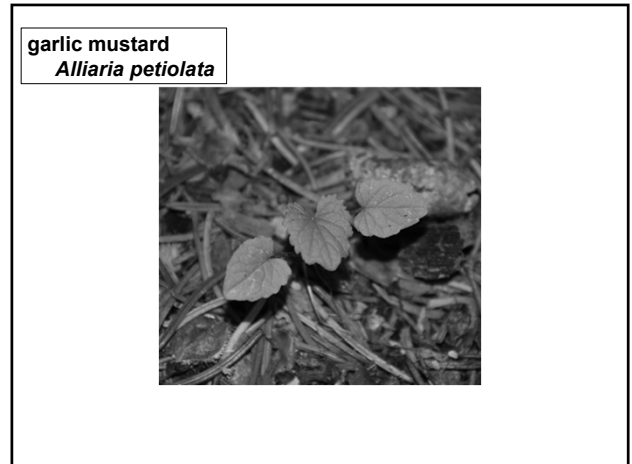
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Dormant Phase of Biennials:

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

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Perennial - live 3 or more years

- simple or solitary
- creeping or spreading

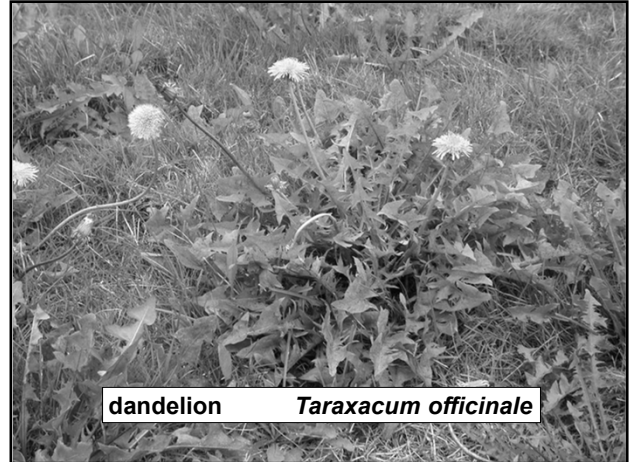
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Simple or solitary

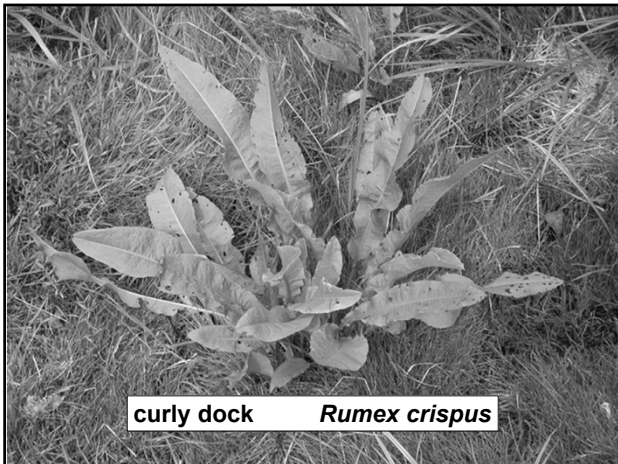
- reproduce by seed
- no natural vegetative propagation (taproot splitting??)
- new growth replaces last years dead top growth

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

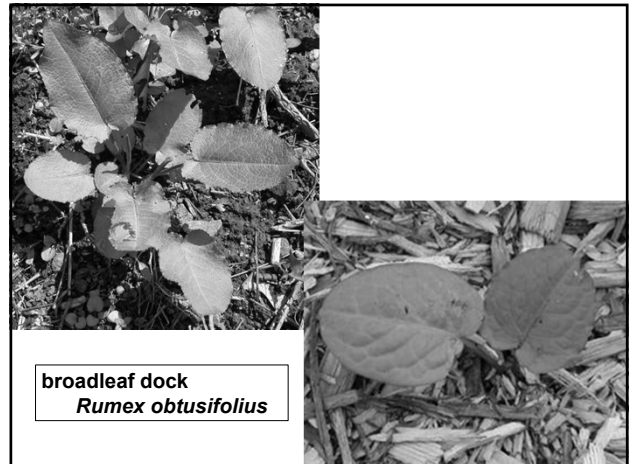
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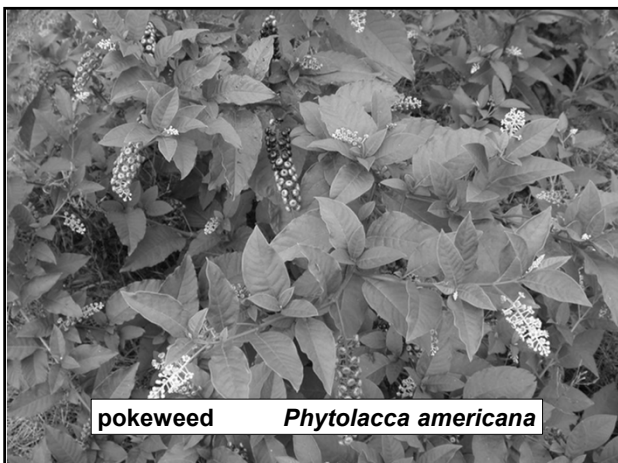
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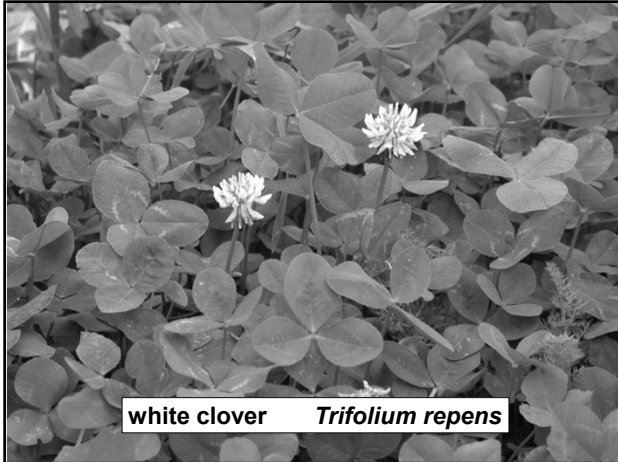
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Creeping or spreading

reproduce by seed and asexual means

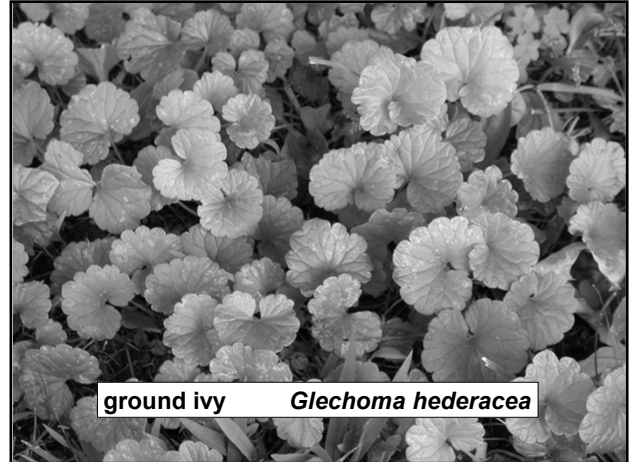
- rhizomes (below ground stems) - quackgrass, mugwort, yellow woodsorrel, Japanese knotweed
- stolons (above ground stems) - wild strawberry, creeping bentgrass, creeping woodsorrel
- creeping roots - Canada thistle, common milkweed, horsetruffle

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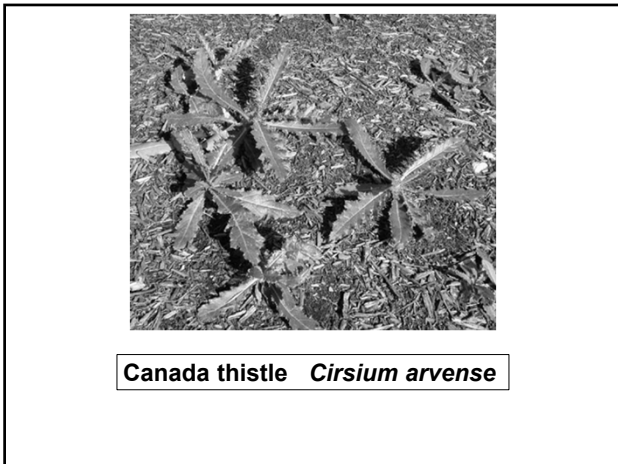
white clover *Trifolium repens*

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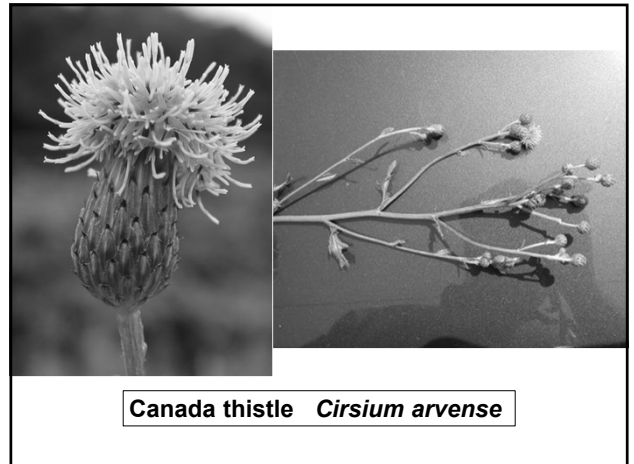
ground ivy *Glechoma hederacea*

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Canada thistle *Cirsium arvense*

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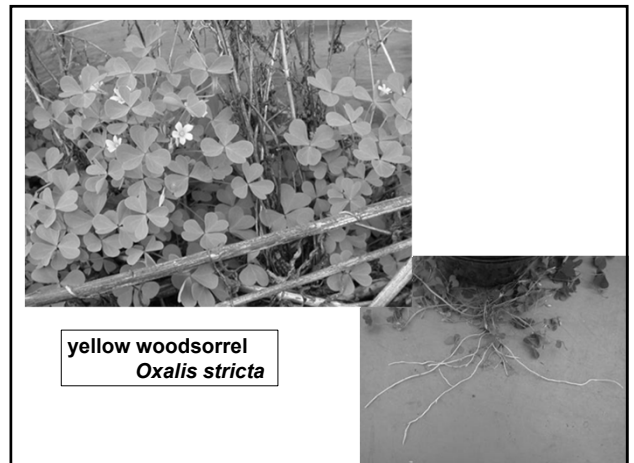
Canada thistle *Cirsium arvense*

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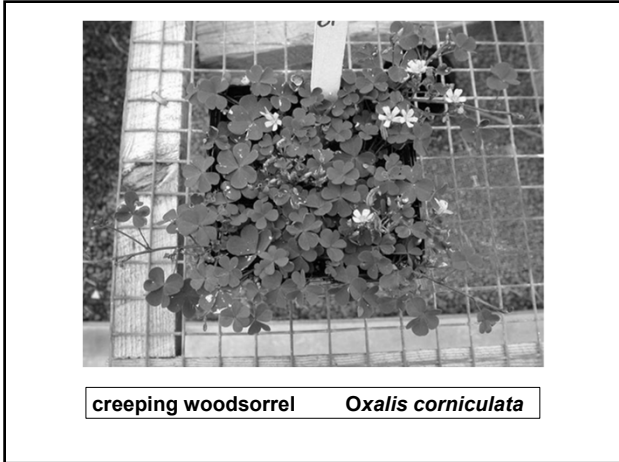
mugwort
Artemisia vulgaris

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yellow woodsorrel
Oxalis stricta

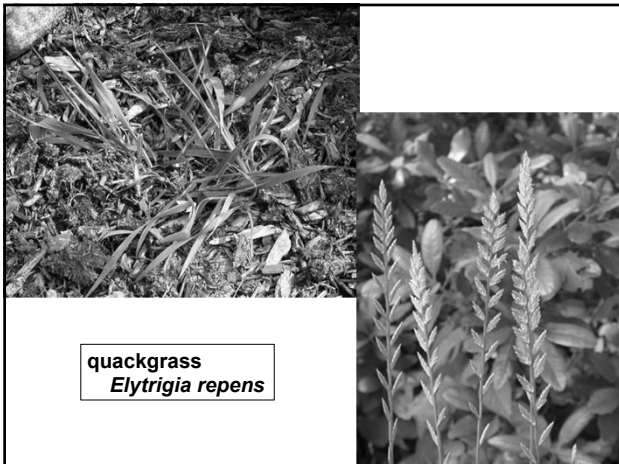
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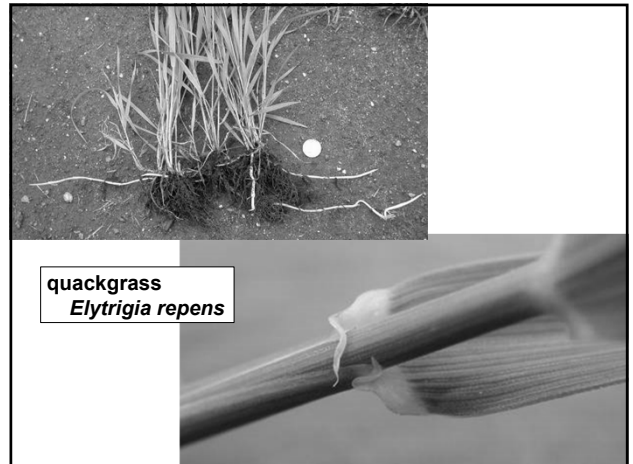
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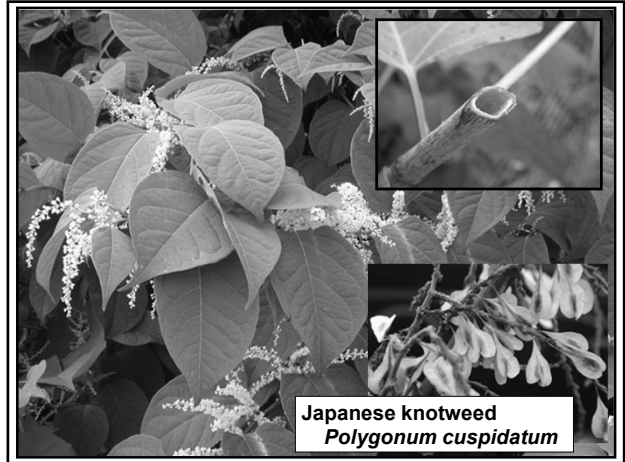


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black swallowwort
Cynanchum louiseae

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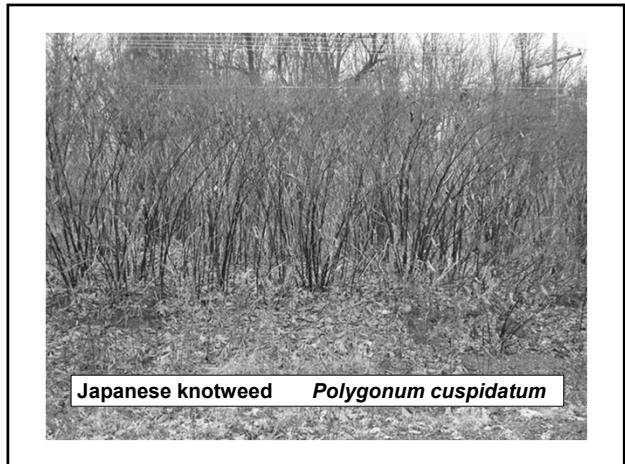
Japanese knotweed
Polygonum cuspidatum

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Japanese knotweed
Polygonum cuspidatum

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Japanese knotweed *Polygonum cuspidatum*

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Dormant Phase of Perennials:

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

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Weed dissemination

Associated w/ man's exploration and colonization

"We carry weeds with us"

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movements of reproductive parts
from place to place

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

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Means of dissemination

natural

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

artificial - associated with man activity

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Natural

1. wind
small, light seed moved by wind
heavier use special appendages



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



tumbling action
tumble pigweed,
genus *Panicum*

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

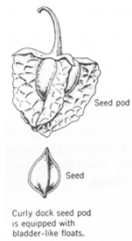
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2. water

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



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

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3. animal

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



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4. force dehiscence
- exploding seedpod

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

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Artificial - associated with man's activity

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

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Dormancy of weed seeds

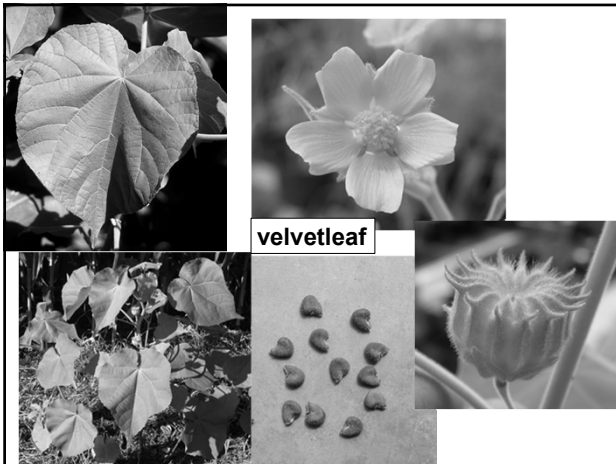
state of suspended development

spread of weeds over time

crop seed --- no dormancy

"A year of weed equals seven of seed"

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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

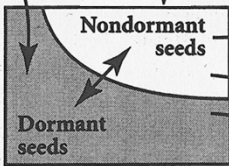
Withdrawals (removals) - germination, seed death, predation, decay

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WEED SEED BANK

Seed-rain, dispersal and dissemination

germination



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

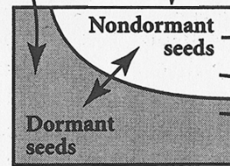
predation, decay and seed death

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WEED SEED BANK

Seed-rain, dispersal and dissemination

germination



Important note: Dormant weed seeds are alive and viable

predation, decay and seed death

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Three Levels of Weed Management

- prevention
- control
- eradication

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Prevention

stopping new weeds:

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

(prevent introduction, establishment and/or spread)

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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

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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

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effective:

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

could involve soil fumigation

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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

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Herbicides

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

ability to selectively kill weed, not crop

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Herbicides vary in terms of:

- absorbed by roots, emerging shoot or aerals
- 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

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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

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

CONTACT or
SYSTEMIC/TRANSLOCATED

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SYSTEMIC/TRANSLOCATED!!!!

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Timings of Herbicide Application

- PREEMERGENCE
- POSTEMERGENCE

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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

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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

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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

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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

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Plant factors

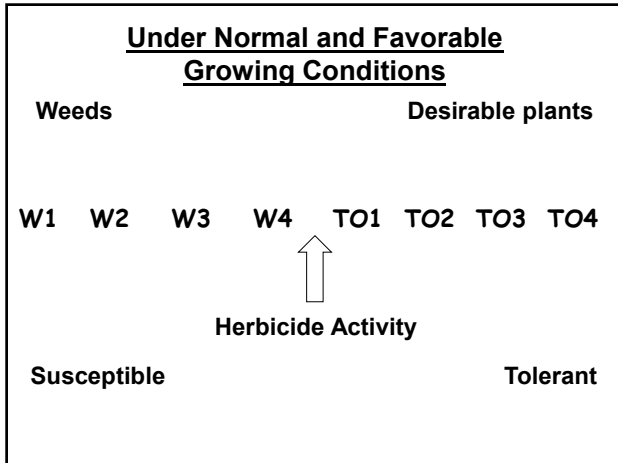
1. age of plant, stage + condition of growth
younger plants usually more susceptible

faster growing plants are more susceptible

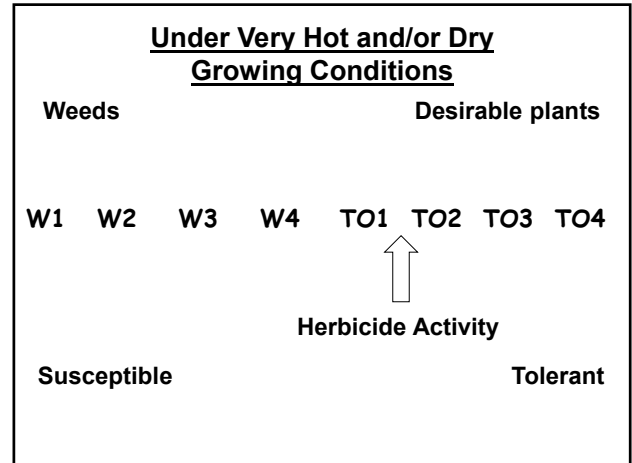
susceptible or tolerant, desirable plant under low temp. or drought

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

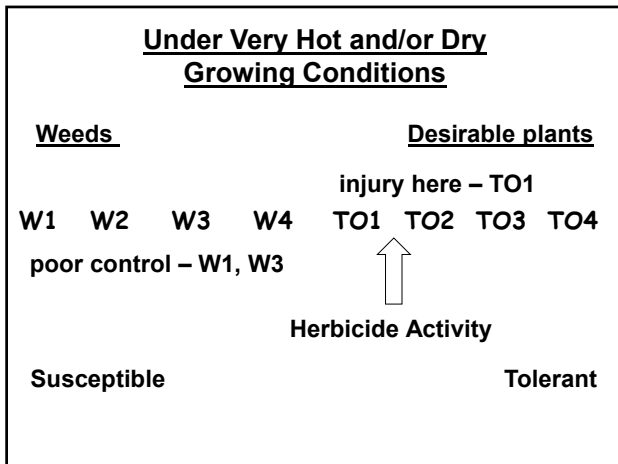
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2. species
 - grasses or broadleaves
 - annuals or perennials
3. genetic makeup of species
 - bio-types
 - cultivar
 - transgenic, herbicide resistance

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- Herbicide factors**
1. rate
 - rate increase results in less selectivity
 - excessive rates - toxic to most plants
 2. molecular configuration
 - small modifications effect selectivity

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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

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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

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2. nozzle type
droplet size function of orifice
size and design
smaller - increase
3. spray pressure
higher - increase
4. height of boom
higher - increase

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Importance of calibration

insures target rate is achieved

- problems with incorrect rate
- crop injury
 - reduced efficacy

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Herbicides
- tank-mix
- combination products

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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

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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

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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

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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

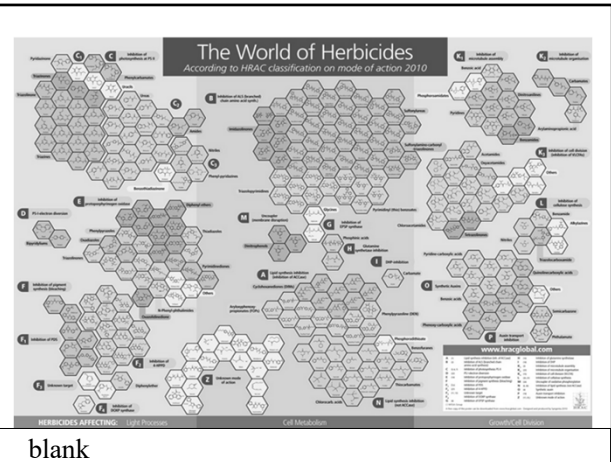
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What does rotate mean?

Herbicide???

Modes-of-action???

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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??

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Barricade 4FL
syngenta.
trade name

Herbicide
common name

For selective preemergence control of grass and broadleaf weeds in:
• established turfgrasses (including golf courses)
• putting greens, lawns, and sod nurseries
• ornamentals, field, green, and landscape ornamentals
• ornamentals in nurseries and greenhouses
• ornamentals in lawns

KEEP OUT OF REACH OF CHILDREN
CAUTION
See additional precautionary statements and directions for use inside booklet.
EPA Reg. No. 100-1139
Reg. Act. 70815-GA-002
Product of India
Furnished in the USA
SC99 1159A-L10B 1211
40/535

1 gallon
Net Contents

Active Ingredient: Proflar® 40.7%
Other Ingredients: 59.3%
Total: 100.0%
*CAS No. 28091-01-2
Barricade 4FL contains 4 pounds active ingredient per gallon.

“herbicide concentration” is NOT this!!!!

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Which can be replicated?

herbicide rate

or

herbicide concentration

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“herbicide concentration” = concentration of herbicide in a volume of water, it is a solution concentration of herbicide in water in the spray tank.

units: 1%, 2%, 5%, 25% (spray-to-wet)
amount mix vol/vol to create spray solution

rate can be calculated is you know spray output in gallons per acre

NOT ABLE TO BE READILY REPLICATED OR DUPLICATED UNLESS YOU KNOW SPRAYER OUTPUT IN GALLONS PER ACRE!!!!

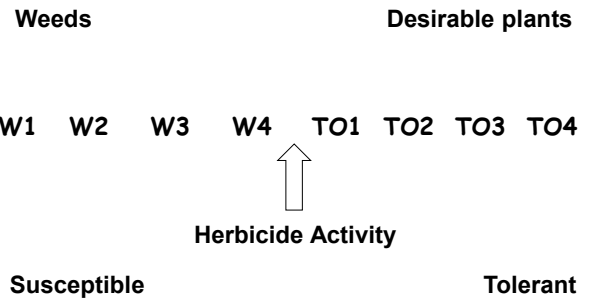
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Should we be adding spray adjuvants to our herbicide spray treatments??

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

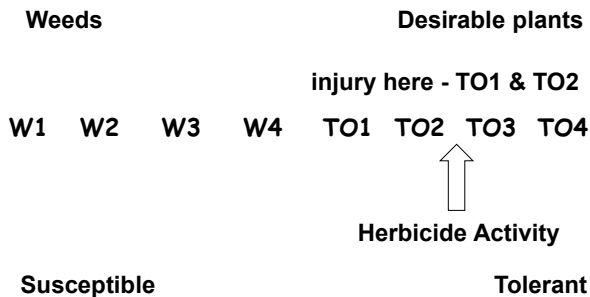
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Label herbicide application



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Add a surfactant that is NOT called for on label



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Thank You for Your Attention!!
Have a Great 2022 Season!!

rprostak@umass.edu 413-577-1738

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