Mechanical Management of Perennial Weeds

Objective: Students should understand the effects of tillage practices on established perennial weeds.

Table 4.1

- Tillage implements differ in the way they move in the soil.
- Effectiveness for uprooting, dismemberment, and burial differ.

Susceptibility of perennial weeds to tillage can often be predicted by their growth habit

Table 4.2

Wandering or creeping perennials

- Do perennating organs occur above or below the path of the implement
- Below – implement just cuts vertical branches
- Above – direct impact on the perennating organs

Stationary perennials – susceptibility based on whether the weed has a taproot or equivalent organs such as a bulb.

- without taproots – readily controlled by tillage
- with taproot – it must be uprooted and allowed to dry on soil surface or severely fragmented and buried

Effect of Timing on Tillage Effectiveness

Perennial weeds tend to be most susceptible to mechanical control shortly after the reserves have been utilized for new shoots.

- With bulbs this may be in spring following fall sprouting
- With some rhizomatous species when metabolically active, fragmentation promotes shoot growth and subsequent operations can be used to kill the fragments.

Methods for managing perennial weeds:

(1) Depleting storage reserves:

a) fallow cultivation
   - Repeated tillage or cultivation can effectively suppression all types of perennial weeds.
   - Complete eradication may need several seasons; not recommended due to adverse effects on soil.
   - Suppression may be adequate to permit good crop growth and yields in a subsequent crop.
   - Optimum tillage interval affected by: depth of the operation and season
     - Usually 2 – 4 week intervals.
     - Longer – shoots replenish perennating organs
     - Shorter – insufficient time for shoot regrowth prior to the next operation

b) chopping and burying storage organs (Fig. 4.1)
   - To control shallowly wandering perennials
   - Chop into small pieces with shallow tillage
   - Bury with deep plowing
   - Shoots emerging from short pieces of rhizomes fail to reach the surface from depths greater than 10 cm

(2) Exposure of perennating organs to adverse conditions: eg desiccation and freezing.

- Desiccation

Traditional approach in Europe
Summer fallow to desiccate roots and rhizomes of wandering perennials:
Plow; allow soil to dry into clods
Stir clods periodically – with plow or heavy cultivator to promote complete drying.

Botswana: an extra moldboard plowing (especially in dry season) suppressed *Cynodon dactylon* and enhanced sorghum yield.

In Nicaragua plowing dry soil at the end of a 4 month dry season considerably decreased purple nutsedge infestation due to desiccation.

Florida (Chase and Koenig last page of handout)

- Purple nutsedge suppressed with 6 – 12 tillage operations in during summer fallow.
- Combination of tuber depletion and tuber desiccation.

- Freezing in regions with cold winters
  - Freezing temperatures can be lethal to perennial organs brought to the soil surface by tillage

(3) Physical removal of perennating organs

Applicable to:

- Species with perennating organs near the soil surface.
- Small fields. (large fields – material falls through tines and remains on the field)

Plow to break up but retain large pieces as these are easier to bring to the surface.
Bring roots and rhizomes to soil surface with spring tooth harrow.
Pull to field edges with rake or harrow.

Mohler indicates that in principle machines could be developed to remove and collect storage organs from the soil. One such machine was developed for removing nutsedge tubers was considered to be too costly to operate.

Mowing

Used for:

1. Preventing seed set and development on tall annual and perennial weed species.
- More than one mowing is often required, as mowed plants may resprout from below the initial cut.
- Make initial cut high.
- Lower 2nd cut to remove the newly sprouted stems.
- Bitter sneezeweed and horseweed after a second mowing develop a hard woody stem no longer capable of producing new sprouts.

2. Depleting the reserves of perennating organs.
- Repeatedly removing the shoot prevents replenishment of perennating organs, regrowth stimulated by cutting utilizes the diminishing stored reserves.

3. Favor competitive crops adapted to mowing.
- Mowing to harvest and maintain hay, pasture, turf, and cover crops helps to control tall growing weeds.

Disadvantages:

- Favors weeds that can grow and reproduce below the cutting height.
- Shifts in weed species from those with upright growth habits to more prostrate species: weeds that form rosettes, mats or are low growing
- Dandelion, buckhorn plantain, bermudagrass, crabgrass, goosegrass.

Table 4.1. *Effectiveness of tillage implements for uprooting, dismemberment, and burial of weeds*

Implement	Uprooting	Dismemberment	Burial
Moldboard plow	Good	Poor	Good
Chisel plow	Moderate	Poor	Moderate
Field cultivator	Moderate to good[a]	Moderate	Moderate
Sweep plow	Poor	Moderate[b]	Poor
Disks	Moderate	Good	Moderate
Rotary tiller	Moderate	Good	Moderate

Notes:

[a] Depending on depth of operation relative to weed roots. [b] Especially good at severing shoots from roots, but poor at fragmenting plants.

Table 4.2. Susceptibility of perennating weeds with different growth habits to uprooting, dismemberment, and burial by tillage implements

Growth form	Uproot	Sever root and shoot	Fragment storage organ	Bury	Examples
Wandering perennials					
rhizomes etc below tillage depth	Very low	Moderate	Very low	Moderate	*Convolvulus arvensis*, *Asclepias syriaca*
rhizomes etc above tillage depth	Low	Moderate	Moderate/propagate	Moderate	*Elytrigia repens*, *Sonchus arvensis*, *Cynodon dactylon*
with bulb, tuber etc	Low	Moderate	Very low	Moderate	*Cyperus rotundus*, *Arrhenatherum elatius* var. *bulbosum*
Stationary perennials					
with taproot, bulb, etc	Low	Low	Moderate/propagate	High	*Taraxacum officianale*, *Rumex crispus*, *Allium vineale*
With fibrous root	Moderate	High	High	High	*Plantago major*

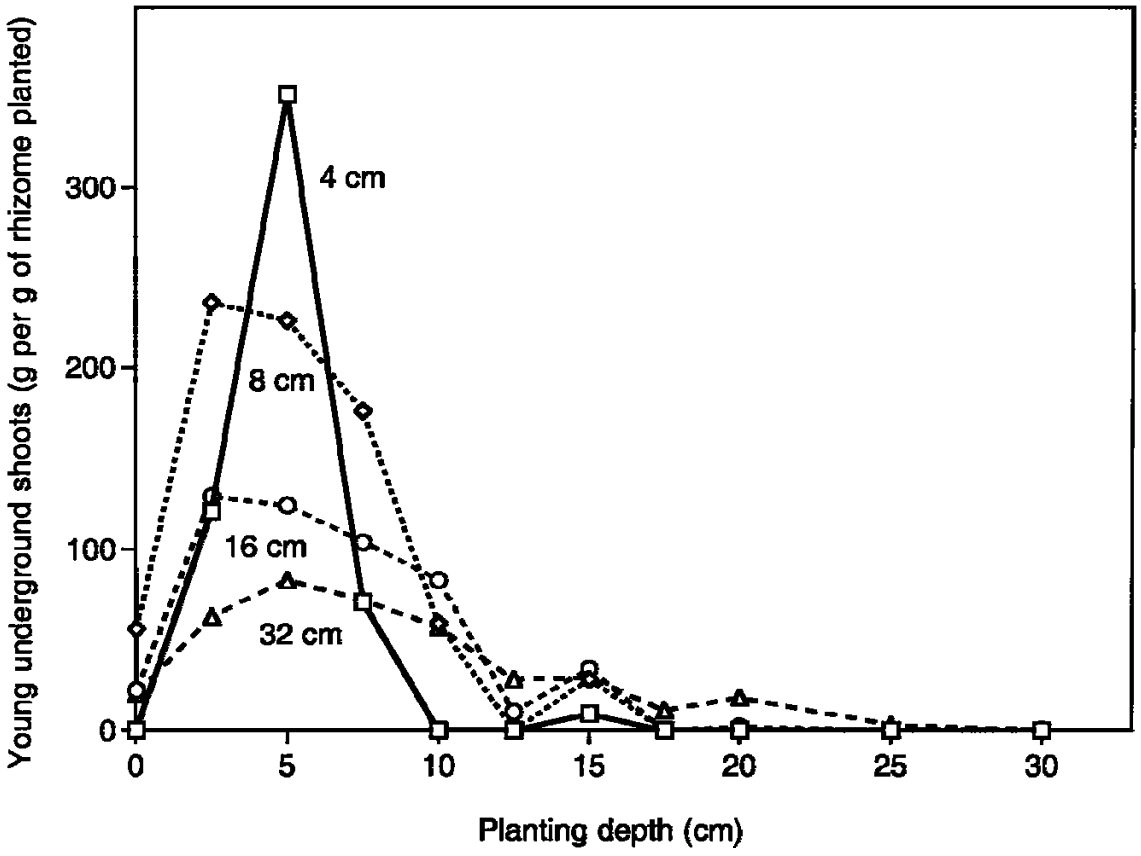
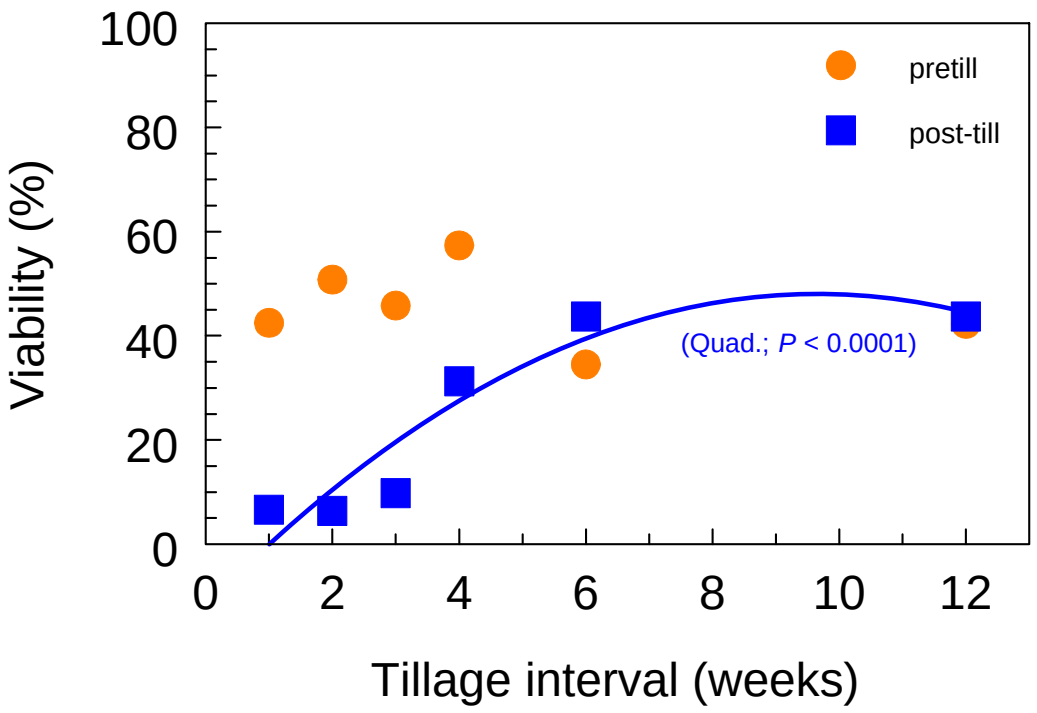
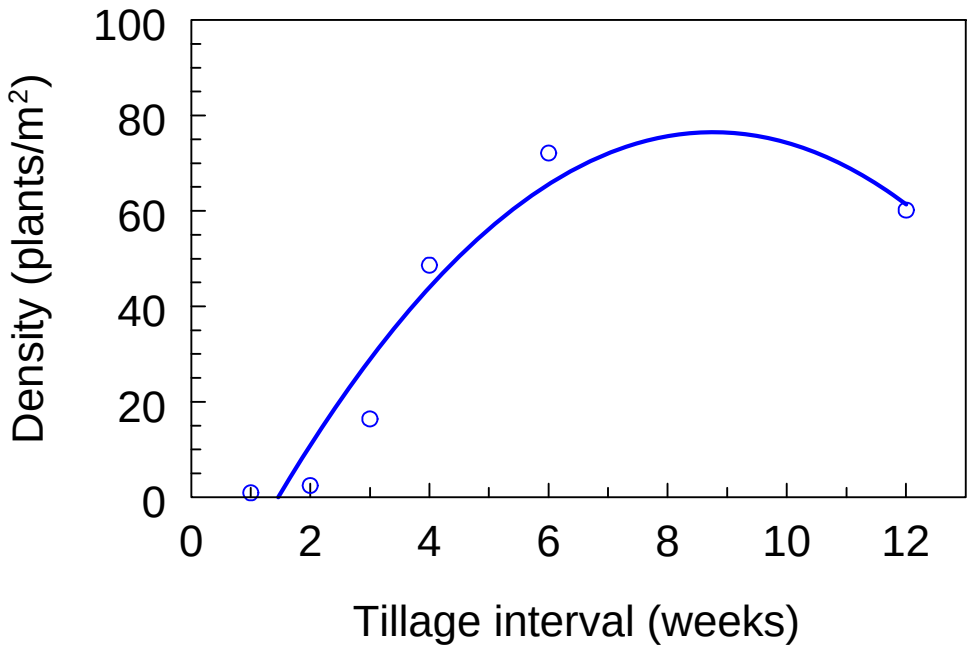


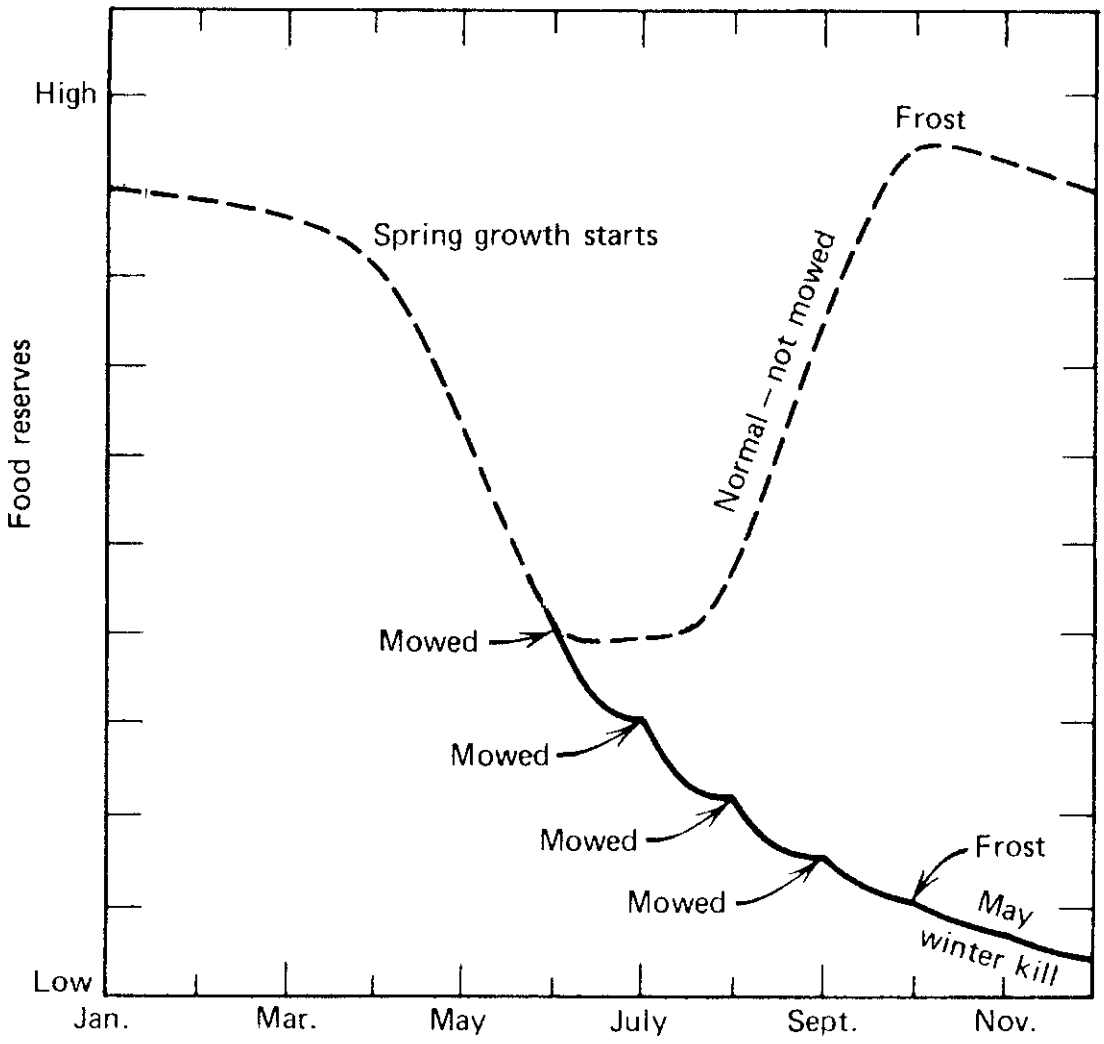
Figure 4.1 Mass of new underground shoots per gram of rhizome planted for *Agropyron* (*Elytrigia*) *repens* rhizomes of several lengths planted at various depths.



Purple nutsedge tuber viability pre- and post-tillage.



Effect of tillage interval on nutsedge density 2 weeks post-treatment



Mowing to deplete the reserves of perennating organs