

VEGETABLE GARDENING

Robert F. Norris

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University of California, Davis.**

A Norris vegetable garden area



Garden area example:



Produce examples



Red cabbage: spring 2009



Winning eggplant: summer 2009

A recent view





Some plants don't know if they are
vegetables or ornamentals.



TOPICS

1. GENERAL

2. CROP SPECIFICS

(warm vs. cool season)

GENERAL TOPICS:

- **Books & resources**
- **Tools**
- **Record keeping**
- **'Experiments'**
- **Planting date**
- **Varieties**
- **Botanical information**
- **Soils**
 - **preparation**
 - **fertilizer**
 - **compaction**

SPECIAL TOPICS:

- **Transplants, soil mixes & potting**
- **Pregermination (chitting)**
- **Irrigation**
- **Mulches**
 - **Soil protection**
 - **Shade**
 - **Floating row covers**
 - **Reflective**
- **Supports**
- **Pest management**

**IF YOU DON'T
ENJOY IT
DON'T DO IT**

Tool and supply sources



Vegetable Gardening Supply Sources

- ✓ **Harmony Farm Supply**
- ✓ **Peaceful Valley Farm Supply**
- ✓ **A. M. Leonard**
- ✓ **Charley's Greenhouse & Garden**
- ✓ **Lee Valley Tools Ltd.**
- ✓ **Gardeners Supply Company**

Seed supply sources



Vegetable Seed Sources

- ✓ **Stokes Seeds**
- ✓ **Burpee Seeds**
- ✓ **Parks Seeds**
- ✓ **Territorial Seed Company**
- ✓ **Thompson and Morgan**
- ✓ **Johnny's Select Seeds**
- ✓ **Pinetree Gardens**
- ✓ **Save your own?**
(Not hybrids!)

BASIC TOOLS 1

Shovel or spade

Garden (spading) fork

Rake

Hoe

Trowel



BASIC TOOLS 2

Watering can
Sprayer



USEFUL TOOLS:

Pruning shears



Wheelbarrow

Push-pull hoe (swoe)

Border fork and spade

1/4" hardware cloth screen

Garden line

High tech garden line



RECORD KEEPING:

Varieties

Planting date(s)

Harvest date(s)

Weather

Location in garden

Photographs

Special notes (e.g. row spacing)

‘EXPERIMENTS’:

Planting date(s)

Varieties

Irrigation

Pest control

Soil amendments/fertilizer

Row spacing

Mulches

ESSENTIALS FOR SUCCESS

1. PLANTING DATE

2. PLANTING DATE!

3. VARIETY






4. EVERYTHING ELSE

Impact of planting date



PHOTO: Feb. 25
SOWING DATE:
→ October 18.
November 18. ←

Vegetable Planting Guide

 preferred time to seed in a greenhouse or other protected area (e.g. coldframe, well lit window)
 preferred time to transplant
 preferred time to direct seed
 seeding
 transplanting

Seeding and transplanting dates may vary between varieties. Please check seed package or nursery for additional information.
Weather can modify planting and harvesting dates.



Information provided by Robert Norris, Department of Plant Sciences, 2008

	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
brussels sprout													
cabbage													
parsnips													
cauliflower & broccoli													
carrots													
rutabaga													
lettuce													
lettuce													
lettuce													
turnips													
spinach													
spinach													
java beans													
peas													

WINTER/SPRING Vegetables for the Sacramento Area

	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
cauliflower & broccoli													
onion													
cabbage													
lettuce													
lettuce													
lettuce													
shallots & garlic													
tomato													
carrots													
carrots													
potato													
chard													
beets													
pepper & eggplant													
cucumber													
cucumber													
corn													
corn													
corn													
corn													
green bean													
green bean													
melon													
melon													
squash													
lima bean													

MATURITY DATE



VARIETIES:

- **Locally adapted**
- **Pest resistance**
- **Maturity date**
- **Special characteristics (e.g. keeping)**
- **Sow two or more**
- **Personal taste**

BOTANICAL CONSIDERATIONS:

- **BIENNIALS AND VERNALIZATION**
- **PLANTING DEPTH VS. SEED SIZE**
- **DENSITY AND THINNING**

VERNALIZATION:

Physiological process by which biennials and some perennials are triggered to flower by cold temperatures.

Therefore:

Biennial leafy/root vegetables must grow their harvested structure before winter,

Otherwise they
bolt (flower)!



BIENNIAL VEGETABLE CROPS

Cabbage, Brussels sprouts,
rutabaga and turnips.

Carrots, parsley, celery,
parsnips.

Beets and Swiss Chard.

Onions (day-length too).

PLANTING DEPTH & SEED SIZE

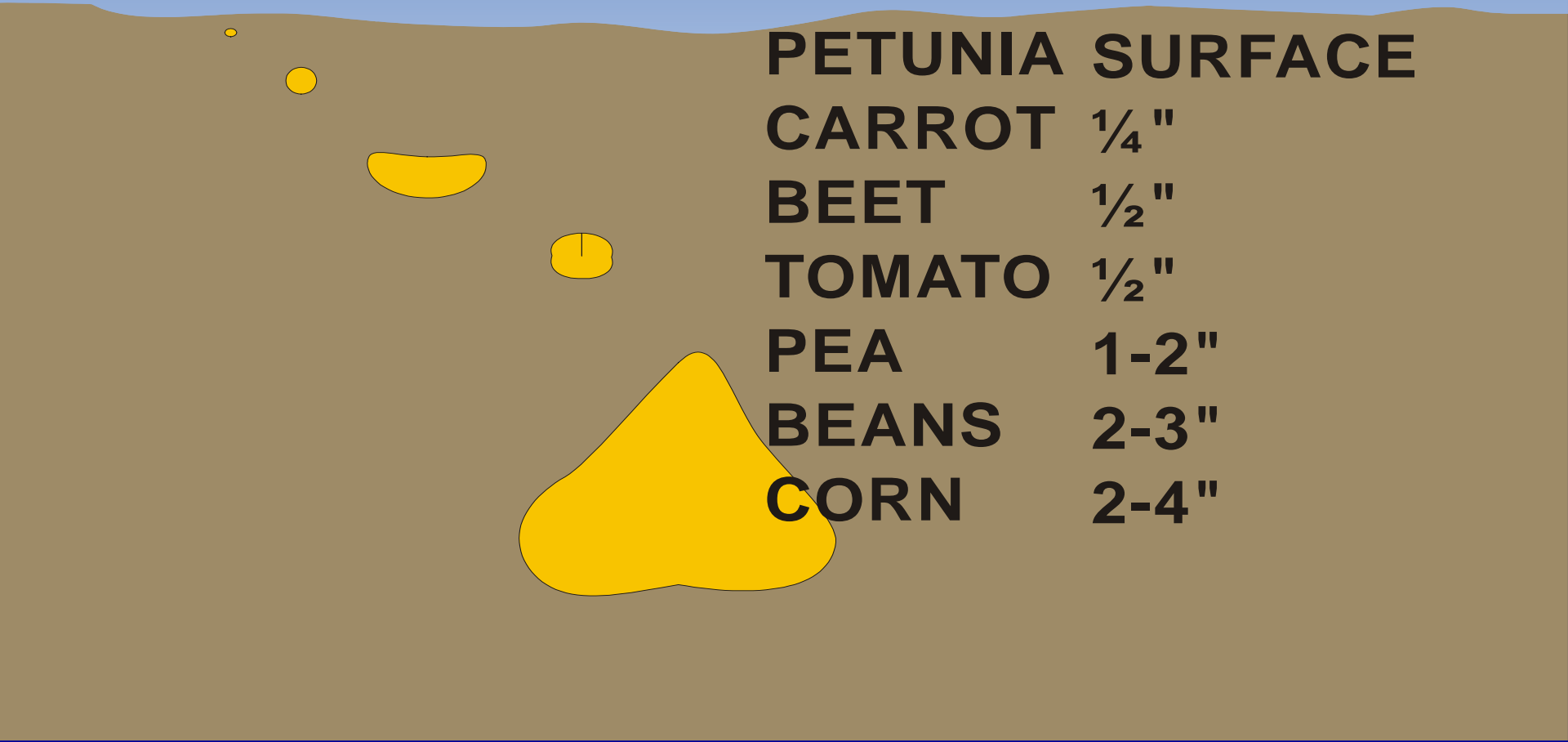
Seed size determines depth from which seedling can emerge.

Simple rule:

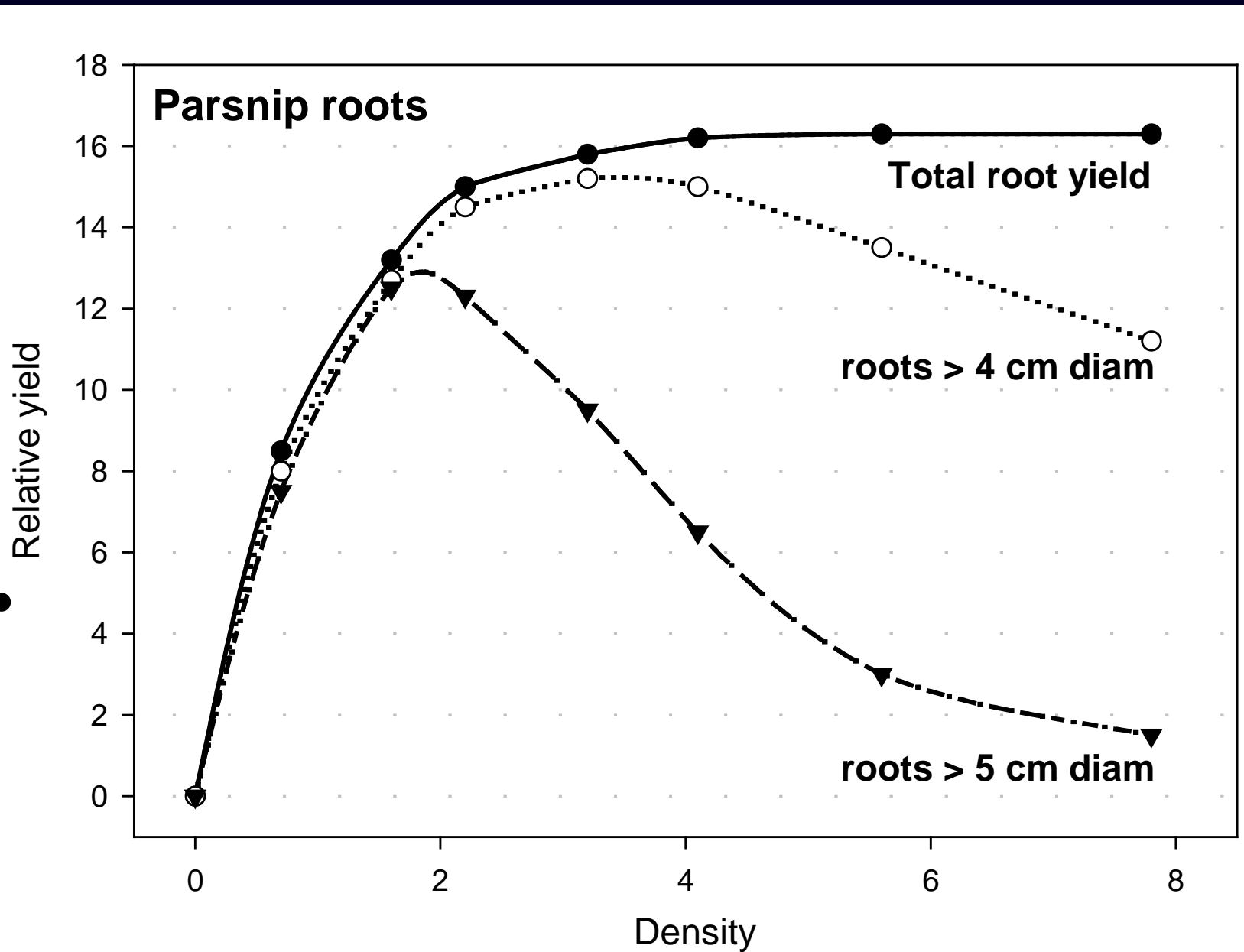
Never plant deeper than 2 to 3 (-4) times width of seed.

SEEDING DEPTH

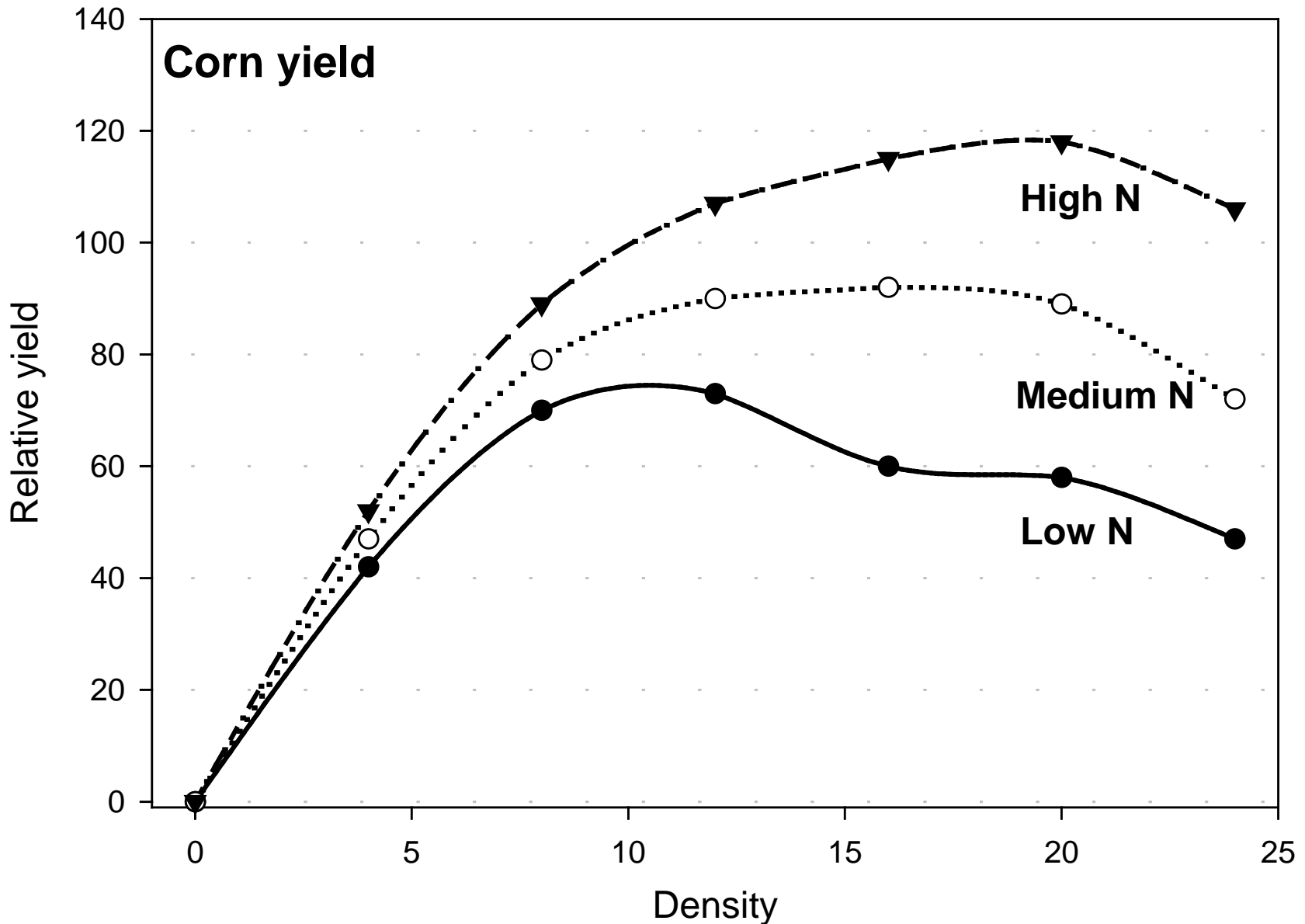
PETUNIA	SURFACE
CARROT	1/4"
BEET	1/2"
TOMATO	1/2"
PEA	1-2"
BEANS	2-3"
CORN	2-4"



DENSITY AND THINNING:

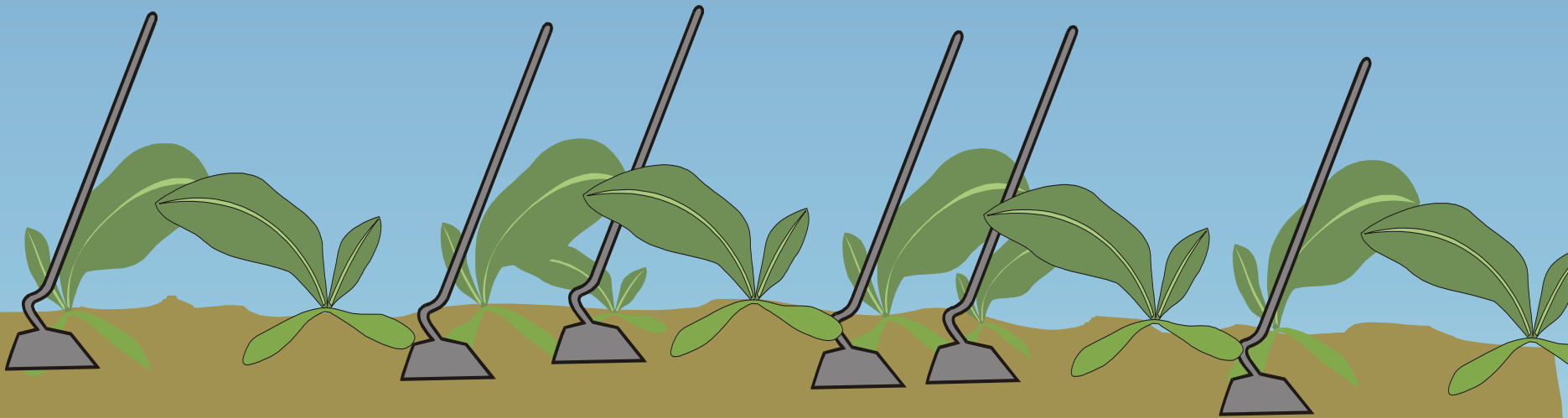


DENSITY AND THINNING:



THINNING:

BE RUTHLESS!



Sequential thinning



ACHIEVE CORRECT SPACING BY:

- ✓ **SOW TO STAND**
- ✓ **OVERSEED AND THIN**
- ✓ **USE PELLETTED SEED**
- ✓ **USE SEED TAPE?**

Carrots



**PELLETED
SEED**

Easier to handle

Sow less seed

Better emergence

Higher cost

Lettuce



SOIL COMPACTION!

- ✓ **Loss of soil structure**
- ✓ **Water penetration**
- ✓ **Restricted rooting**
- ✓ **Soil preparation more difficult**

Do not walk on soil



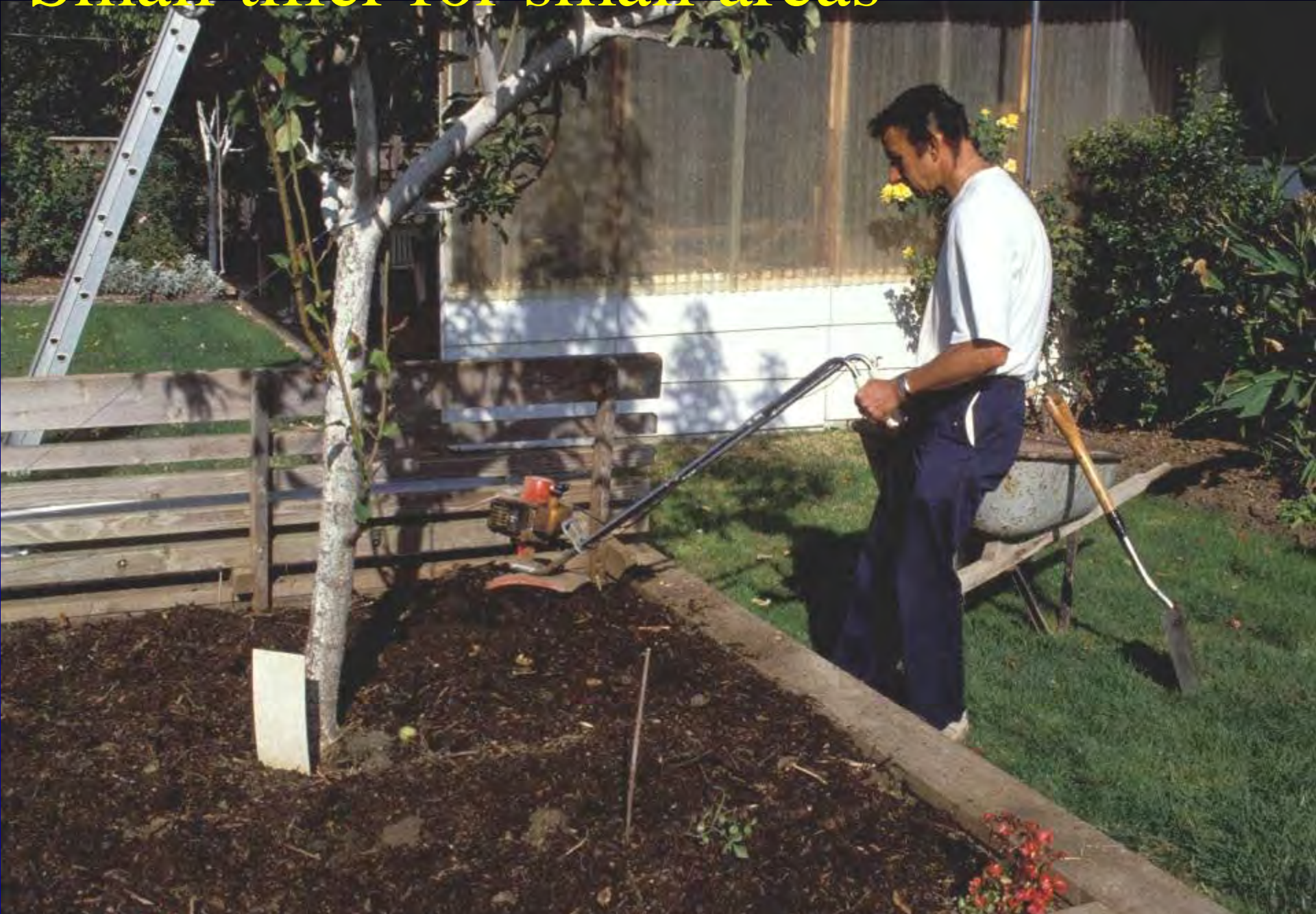
SOIL PREPARATION 1:

- ✓ **Digging**
 - ✓ **Spade vs fork vs shovel**
- ✓ **Double digging**
- ✓ **Rototiller**
 - ✓ **Small – front tine**
 - ✓ **Large – rear tine**

Hand digging



Small tiller for small areas



SOIL PREPARATION 2:

- ✓ Correct planting date is critical!
- ✓ Excess soil moisture can delay ground preparation in winter and early spring
- ✓ Prepare soil, make beds, etc. under dry conditions.
- ✓ Cover beds with black plastic.
- ✓ Remove plastic and plant at correct time.

BLACK PLASTIC MULCH



COMPOST & FERTILIZER

- ✓ **Compost – as much as possible, especially potatoes and cucurbits**
- ✓ **Balanced (15:15:15) at ground prep.**
- ✓ **Nitrogen side-dress**

TRANSPLANTS, WHY?

- **Save space**
- **More crops**
- **Earlier start/harvest**
- **Improved germination**
- **Better stand**
- **Minimize early pest problems**
- **Improved crop vigor?**

TRANSPLANTS, GROW YOUR OWN!

- Correct time to plant
- Correct variety
- Better quality?



TRANSPLANT WELL:

- Tomatoes
- Peppers/eggplant
- Cole crops (not root)
- Lettuce
- Onions/shallots/garlic
- Celery
- Chard/spinach
- Etc.

CAN TRANSPLANT

(with care, and dubious advantage)

- **Cucumbers/squash**
- **Corn**
- **Beans**
- **Peas**

DO NOT TRANSPLANT

- **Turnips and rutabagas**
- **Beets**
- **Carrots**
- **Parsnips**

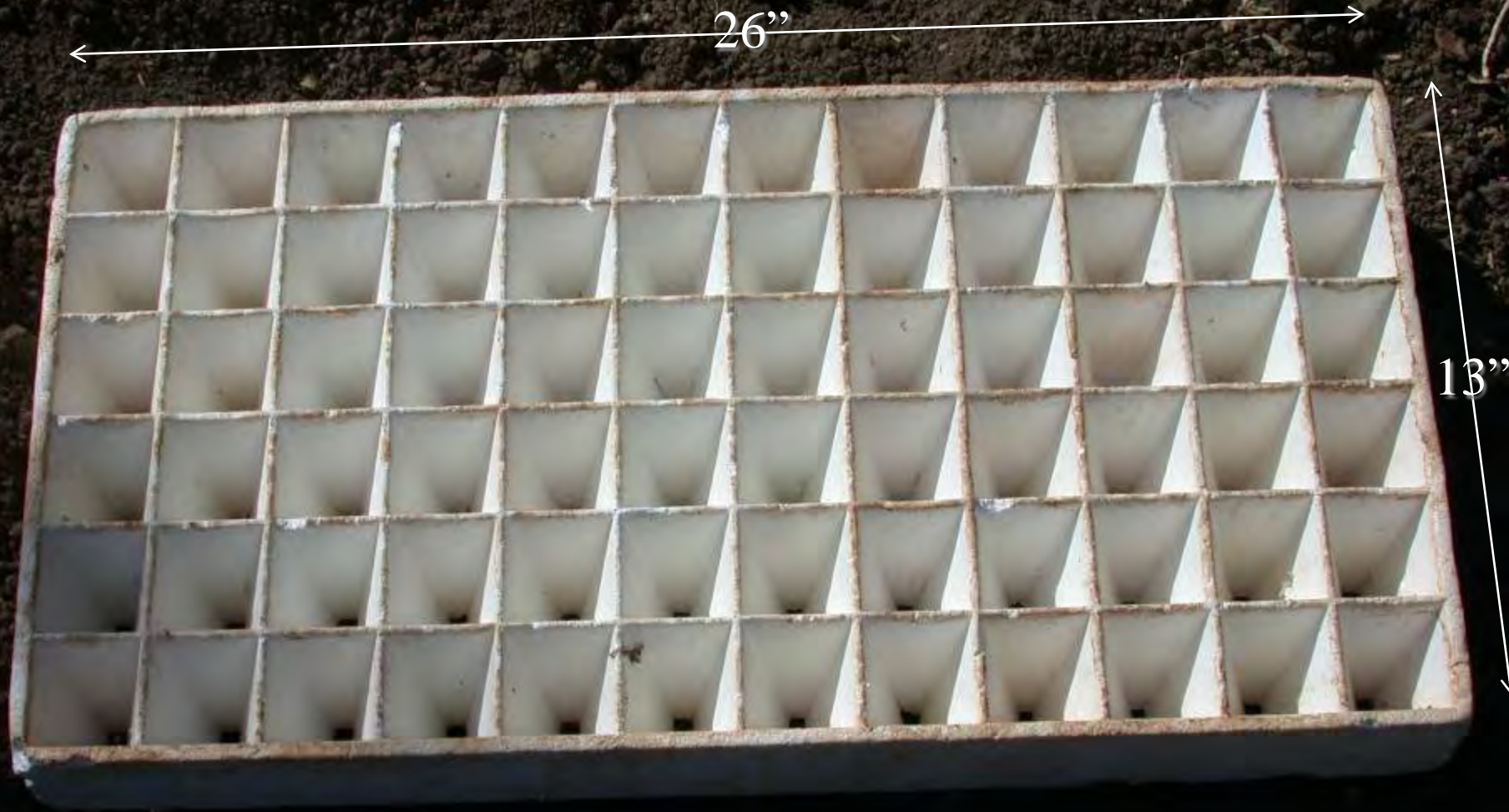
STARTING TRANSPLANTS

[Containers (pots):]

- Reuse cartons (milk, yogurt, etc.)
- Peat pots
- Compressed soil mix blocks
- Plastic 'six-packs'
- 'Speedling trays'
- Rootainers
- Single pots (2" and up)

6-packs, peat pot & yogurt





Empty speedling tray



Seedlings in speedling tray

Speedling trays in commercial greenhouse



Examples of single pots



ROOTRAINERS





ROOTRAINERS OPEN

STARTING TRANSPLANTS

(Starter soil mixes):

- Garden soil (not usually very good)
- Peat:sand:soil (1:1:1 or other)
Note: neither of above are sterile.
- Commercially available mix (cost!)
- *Sphagnum* peat:perlite (N.B. requires nutrient supply)

Beware: coconut husk fiber.

GROWING ON MIX

(larger pots, 2'' and up as needed)

- Same as starter mix
- Sphagnum peat:perlite:redwood bark/sawdust soil conditioner (25:25:50)
- Redwood sawdust compost:sand (50:50)

Transplanting tricks

- 1) Large, leafy plants - remove 50% of leaf area
- 2) Water in - use weak fertilizer solution
- 3) Hot weather – shade the plants in middle of the day
- 4) Pot bound – damage the roots before planting



PREGERMINATION

(‘priming’ or ‘chitting’)

- **BETTER STAND**
- **SAVES TIME AND SPACE**
- **LESS SEED NEEDED**
- **USE FOR:**
 - **Rice**
 - **Peas**
 - **Carrots**
 - **Beans?**

Planting germinated peas



IRRIGATION

- **Essential in a Mediterranean climate!**
- **Most vegetable crops are not drought tolerant.**

IRRIGATION QUESTIONS:

- HOW MUCH?
- WHEN?
- METHOD OF APPLICATION?

WATER USE BY PLANTS:

Inches/day*

- WINTER 0.0-0.1
- SPRING/FALL 0.05-0.20 (-0.5)
- SUMMER 0.15-0.35 (-0.6)

* Well watered, solid canopy

**NEVER
LESS THAN
1 TO 1¼ INCHES**

**(Must irrigate to wet entire soil
profile to rooting depth)**

DON'T 'SHOOT IN THE DARK'

- **Measure sprinkler output**
 - Rain gauge(s), coffee cans
- **Measure hose delivery rate**
 - Gallons/min (run time X area watered)
- **Use manufacturers information**
 - Gallons/emitter; gallons/100 ft of tape
- **Trial and error**
 - Check depth of water in soil

WHEN TO IRRIGATE?

For sprinklers:

- **BEST:** midnight to 6:00 a.m.
- **OK:** 9:00 p.m. to midnight & 6:00 to 8:00 a.m.
- **POOR:** 8:00 to 10:00 a.m. and 5:00 to 9:00 p.m.
- **WORST:** 10:00 a.m. to 5:00 p.m.

For furrow or drip:

Not so critical, but beware hot water in hose

HOW OFTEN TO IRRIGATE ?

- **DAILY**
 - NEVER FOR ROUTINE IRRIGATION
 - EXCEPTION FOR TRANSPLANTS AND SEEDLING EMERGENCE
- **EVERY 2 DAYS**
 - MAY BE NEEDED FOR SANDY SOIL
- **EVERY 4 DAYS**
 - PROBABLY OK FOR MOST LOAM SOILS
- **WEEKLY**
 - OK FOR DEEP ROOTED CROPS IN HEAVIER SOILS

IRRIGATION METHODS:

Do not use hand held hose!

- 1. Furrow** (cheapest to set up, but hard to automate)
- 2. Sprinklers** (hard to water small areas)
 - 1. Spray**
 - 2. Pulsating (Rainbird-type)**
- 3. Drip**
 - 1. Tubing and emitters; soaker hoses.**
 - 2. Tape (8" T-Tape & 'tape-loc' connectors)**

Spray heads on risers



Leaky pipe



T-tape attached to header



T-tape in corn (sequential planting)



Valve, filter & pressure regulator



A tape-loc fitting

Emitter hole in tape





Tape-loc removed from header



Tape-loc inserted into header



**Tape-loc removed,
'goof' plug inserted in hole in header**

ADVANTAGES OF TAPE:

- **Low cost (from 4.8 to 12 c/ft for 15 mil)**
- **Easy to automate**
- **Irrigates only where needed**
- **Reduces water use**
- **Reduces fertilizer use**
- **Improves plant growth & soil structure**
- **Makes floating row covers feasible**
- **Improves ease of germination and establishment, especially in summer**
- **Easier to use on sloping ground**

Seedlings at tape emitter



MULCHES

Type depends on intended use:

1. Soil structure/water penetration
2. Keeping soil dry
3. Water saving
4. Weed control
5. Insect management/other pests
(e.g. birds & cats)
6. Climate modification/protection
from extremes

MULCH MATERIALS

- **Natural products**
(bark, compost, chips, grass clippings, etc.; beware slugs & snails, sow bugs, earwigs)
- **Rock, gravel, etc.**
(not in veg. garden)
- **Solid plastic** (clear, black, colored, IR)
- **Woven plastic**
(weed mat & shade-cloth)
- **Floating row covers**
- **Reflective**

Chipper/shredder





CHIPS AS MULCH

CLEAR PLASTIC MULCH

In winter:

- 1. Protects from crusting**
- 2. Warms soil**

In summer:

- 1. Used for solarization**



WOVEN PLASTIC MULCH (weed mat)



Drip lines under weed mat



**Example of
'floating'
row cover**



FLOATING ROW COVERS?

(spun bonded polyester: 'Reemay[®]')

- **Pest exclusion**

- Flying insects: aphids, moths & butterflies, cucumber beetles, whiteflies, etc.
- Protects against viruses transmitted by flying insects
- Birds
- Cats

- **Modifies climatic extremes**

- frost protection/ warmth
- humidity
- reduces/diffuses sunlight

Supported row cover; carrots & beets



Supported row cover



Supported row cover; lettuce



Drip lines under row cover



FLOATING ROW COVERS: PROBLEMS

- Weeds
- Rain/sprinkler water penetration
- Slugs and snails
- Unseen insect attack
- Not sealed
- Durability
- Cost (7' x 500' Agribon-30: \$197.00)

SHADE

- **Protect seedlings in summer**
- **Protect transplants during establishment**
- **Stop sunburn**

SHADE MATERIALS

- **Solid**
 - Black plastic
 - Shingles, etc.
- **Woven**
 - Sack cloth
 - Shade cloth (50%)
- **Row cover**

Shingles for shading transplants



Sack cloth for shading seedlings



Shade cloth for shading seedlings



Shade cloth tunnel



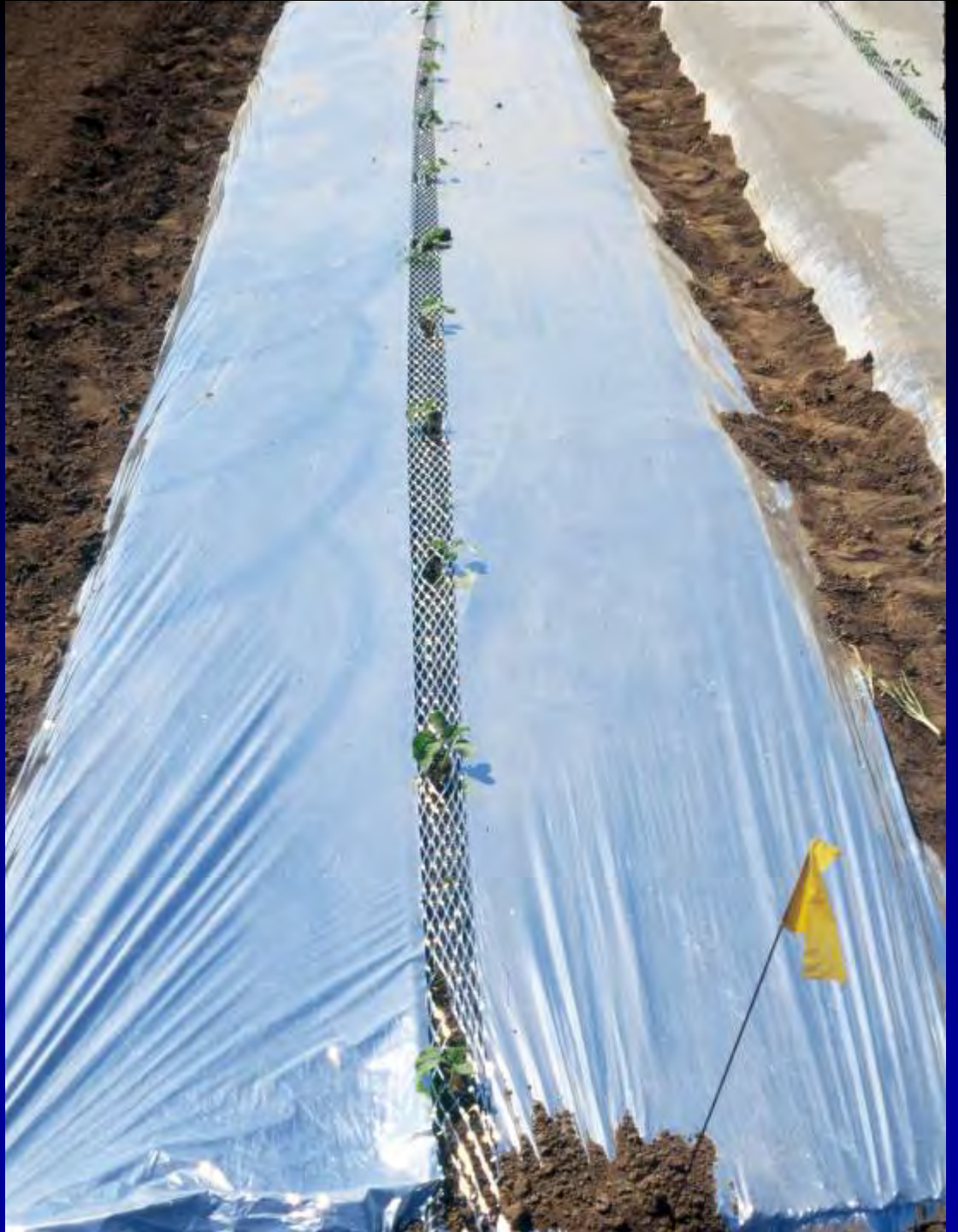
Shade cloth strips



Row cover for shade



REFLECTIVE MULCH



SUPPORTS

Crops needing supports include:

- **Tomatoes (non-determinate)**
- **Pole beans**
- **Most peas**
- **Cucumbers**
- **Cantaloupes, crenshaws, etc.**
- **Fava beans**
- **Other**

WHY SUPPORTS?

- **Save space**
- **Needed by tall plants**
- **Duration and quantity of production increased**
- **Lack of sunburn**
- **Better quality fruits**

SUPPORTS

Note:

Most commercially available supports in garden stores and catalogs are ‘toys’.

AVAILABLE SUPPORTS:

- Poles and strings
- Commercial 'trellises'
- Homemade horizontal trellis for 'scrambling' plants that are not climbers
- Garden fencing cylinders (for light duty climbers, e.g. sweet peas)
- Concrete reinforcing mesh & 'T' posts (for heavy duty climbers)

Strung 'Alderman' peas



Welded wire fencing cylinder



Peas on concrete reinforcing mesh



Cucumbers on concrete reinforcing mesh



Cantaloupes and crenshaws on concrete reinforcing mesh





Cucumbers and melons need 'help'



Crenshaw's need support



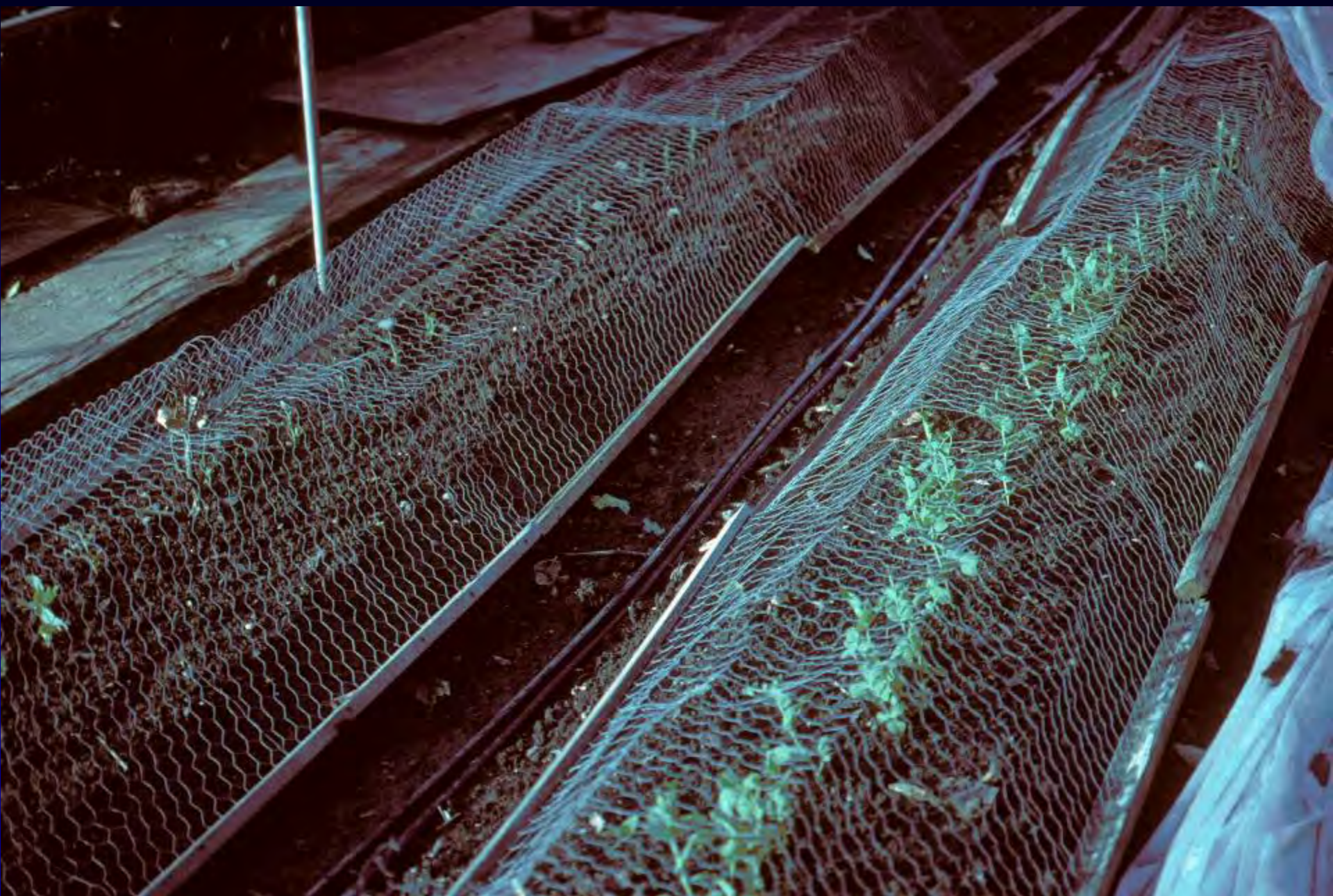
**Beans 'go'
by themselves**



Tomato 'trellis'



Chicken wire 'cloches'



PEST MANAGEMENT

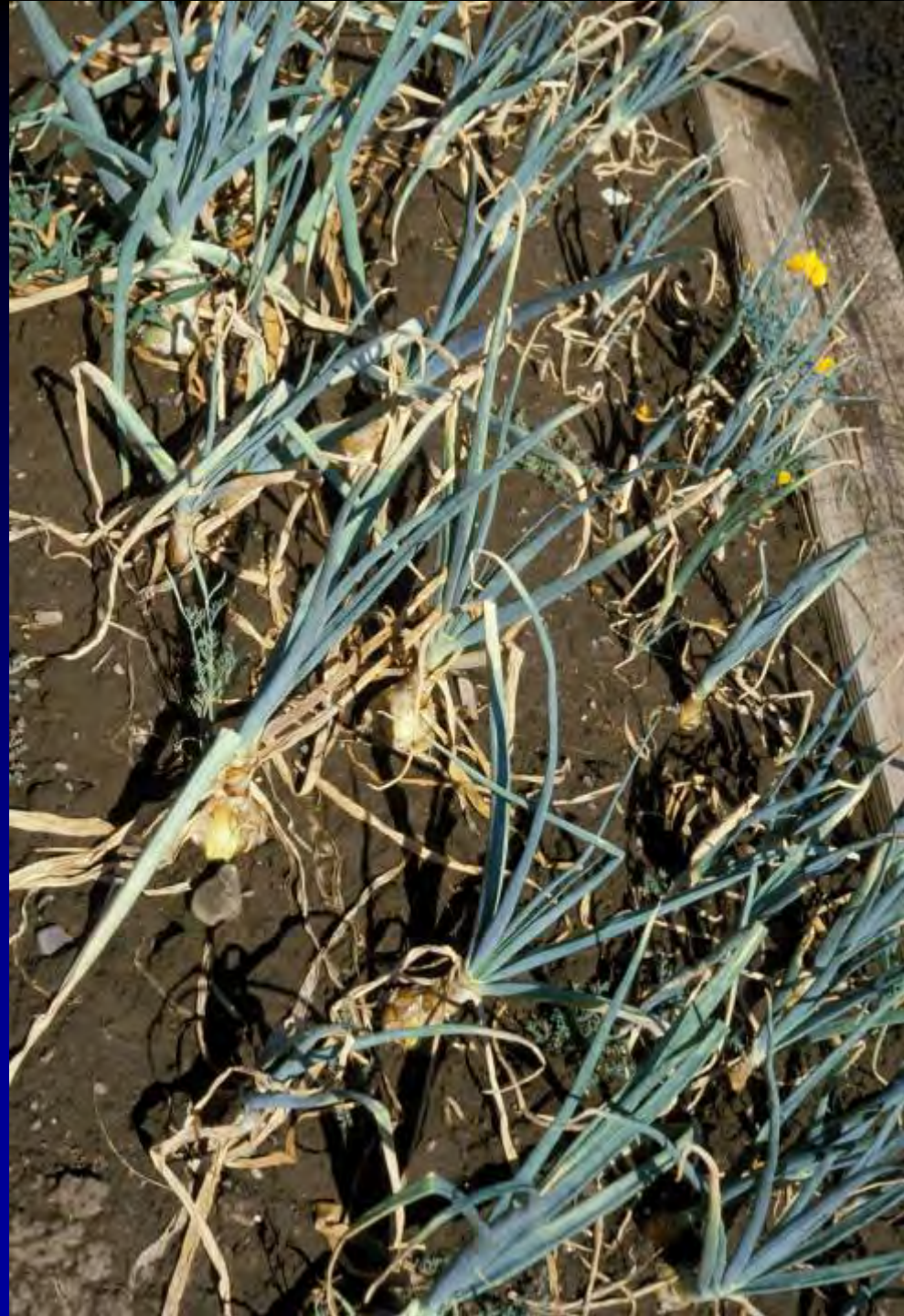
Correct identification of the problem/pest involved is essential in order to devise best management strategy







Onion thrips



Carrot root aphid damage



Black bean aphid damage to chard



Selected pesticides for vegetables

- Safer's soap (fatty acids)
- Botanicals
 - Azadirachtin (extract from tropical neem tree)
 - Nicotine (distillate from tobacco)
 - Rotenone (from *Derris* plant)
 - Pyrethrin (from African *Pyrethrum* plants)
- *Bacillus thuringiensis* (Bt; Dipel[®] or Thuricide[®])
- Sulfur dust
- Metaldehyde (snail bait, various)
- Malathion (various, organophosphate)
- Carbaryl (Sevin[®]; very toxic to honey bees)

Bacillus thuringiensis 'Bt'



TEAR CORNER

Biological Insecticide

DiPel® DF

Dry Flowable

Active Ingredient:
Bacillus thuringiensis, subsp. *kurstaki*,
strain ABTS-351, fermentation solids and solubles 54%
Other Ingredients 46%
Total 100%

Potency: 32,000 Cabbage Looper Units (CLU) per mg (14.5 billion CLU per pound)



For Organic Production

The percent active ingredient does not indicate product performance and potency measurements are not federally standardized.

KEEP OUT OF REACH OF CHILDREN
CAUTION

FIRST AID	
On skin or clothing	<ul style="list-style-type: none"> Take off contaminated clothing Rinse skin immediately with plenty of water for 15-20 minutes Call a poison control center or doctor for treatment advice
Inhaled	<ul style="list-style-type: none"> Move person to fresh air If person is not breathing, call 911 or an ambulance. Then give artificial respiration, preferably by mouth-to-mouth, if possible Call a poison control center or doctor for treatment advice
In eyes	<ul style="list-style-type: none"> Hold eye open and rinse slowly and gently with water for 15-20 minutes Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye Call a poison control center or doctor for treatment advice

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS
CAUTION
Harmful if inhaled or absorbed through the skin. May cause eye irritation. Avoid breathing dust or spray mist. Avoid contact with skin, eyes, or clothing. Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash before reuse.
Mixer/loaders and applicators must wear a dust/mist filtering respirator meeting NIOSH standards of at least N-95, R-95, or P-95. Repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.

HOTLINE NUMBER
Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-892-0099 (24 hours) for emergency medical treatment and/or transport emergency information. For all other information, call 1-800-6-Valent.

VALENT BIOSCIENCES CORPORATION
670 TECHNOLOGY WAY SUITE 100
LIBERTYVILLE, IL 62088 USA

EPA Reg. No. 73049-39
EPA Est. No. 33762-1A-001
List No. 12046-04-01

©2003

NET CONTENTS: 1 POUND (454 GRAMS)

23-0314/R5





ORTHO[®] BUG-GETA PLUS

SNAIL, SLUG & INSECT KILLER

• Remains Effective After Rain or Watering • Can Be Used Around Fruits & Vegetables • Baits 6,000 sq ft

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

PRODUCT FACTS

Treats 6,000 sq ft (approximate size of 3 tennis courts)

ATTRACTS & KILLS PESTS
 Snails and Slugs Plus Ants, Armyworms, Crickets, Cutworms, Earwigs, Grasshoppers, Millipedes, Pillbugs and Sowbugs

WHERE TO USE

- In ornamental gardens and planted borders
- In groundcovers and lawns
- Around fruits and vegetables: Beans, beets, broccoli, Brussels sprouts, cabbage, carrots, cauliflower, collards, corn, cucumbers, eggplant, endive, kale, lettuce, melons, parsley, parsnips, peas, peppers, potatoes, radishes, rutabaga, spinach, squash, strawberries, Swiss chard, tomatoes and turnips

AMOUNT TO USE

1 lb for each 2,000 sq ft



Questions, Comments or Medical Information?

Call 1-800-225-2883

www.ortho.com

WHEN TO APPLY

- Apply anytime you see signs of listed pests
- To prevent damage to transplants and seedlings, apply immediately after spring planting
- Repeat treatment every 2 weeks or as needed. During periods of high rainfall or frequent watering, it may be necessary to treat more often

HOW TO APPLY

- If grounds dry, water area to be treated
- Scatter directly from container or by using the ORTHO WHIRLWIND Multi-Purpose Spreader at setting number 4
- Do not put granules in piles. Always wear protective gloves. Scatter the granules in groundcovers and lawns, and on soil surface around plants. Do not apply to foliage or edible parts of plants
- Sprinkle lightly with water after application. Withhold heavy watering for at least 2 days after application. Carcinogen Banned

STORAGE & DISPOSAL

STORAGE: Keep pesticide in original container. Do not put in food or drink containers. Avoid contamination of food and feedstuffs. Store in a cool, dry place, preferably in a locked or locked area. **DISPOSAL:** PRODUCT - Pesticide (and container) may be disposed of by loosely wrapping original container in several layers of newspaper and discard in trash. **CONTAINER** - Do not reuse container. Discard container in trash.

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS & DOMESTIC ANIMALS:
CAUTION: Causes eye irritation. May be harmful if swallowed. Avoid contact with eyes, skin or clothing. Avoid breathing dust. Wash thoroughly after handling.

Keep out of reach of children and domestic animals.

IMPORTANT! KEEP GRANULES AWAY FROM CHILDREN, DOGS AND PETS. BAIT MAY BE ATTRACTIVE TO DOGS. CONFINE PETS DURING APPLICATION TO PREVENT THEM FROM BELIEVING THEY ARE BEING FED. USE AND STORE UNDER CONDITIONS WHERE THERE WILL NOT BE A HAZARD.

WHEN TO HARVEST

NOTE: In treated soil plant only the vegetables and fruits listed on this label.

AROUND FRUITS AND VEGETABLES: 1 lb treats 2,000 sq ft (40' x 50') of garden area (1 lb treats 2,000 sq ft for cucumbers, melons and squash). Distribute granules around fruit and vegetables. Do not contaminate edible parts.

PLANTS	DAYS TO WAIT TO RE-TREAT	DAYS TO WAIT TO HARVEST
Beans (fresh and dried), Peas, Cowpeas	7	3 (soybeans) 21 (dried) 14 (fava)
Cabbage, Broccoli, Brussels sprouts, Cauliflower, Kohlrabi, Chinese Cabbage, Kale, Collards	3	Brussels sprouts, broccoli, cabbage, kohlrabi, cauliflower: 3 Chinese cabbage, kale, collards: 14
Corn (field and pop)	14	14 (usage stage) 40 (grain/field)
Corn (sweet)	3	7
Cucumbers, Melons, Squash	7	1
Do not use this product on watermelons in Florida.		
Carrots, Beets (root), Radishes, Parsnips, Turnips (root), Horseradish, Rutabaga, Taro	7	7
Lettuce (head and leaf), Endive, Marrow Squash, Swiss Chard, Parsley, Spinach, Beets (leaf), Turnip (leaf)	7	14-15
Muskrat Greens	7	13-14
Potatoes, Eggplant, Peppers	7	potatoes: 7 eggplant, peppers: 1
Strawberries	7	7
Tomatoes	7	3

NOTE: This package is sold by weight. Contents may have settled during shipment.

FIRST AID

IN CASE OF EYE CONTACT: Wash eyes immediately with fresh water for at least 15 minutes. See a doctor if irritation persists. **IF SWALLOWED:** DO NOT induce vomiting unless directed to do so by a doctor. Immediately take person and container to hospital for an emergency medical. If in a rural location, telephone for medical advice. **IF ON SKIN:** Wash thoroughly with soap and water. **IF INHALED:** Move person fresh exposure area. Have a physician evaluate. Information call 1-800-225-2883. Carfentra is a trademark, worldwide, of Ortho-McNeil, a division of Ortho.

ENVIRONMENTAL HAZARDS: This product is extremely toxic to aquatic and aquatic invertebrates and may be toxic to other wildlife. Do not apply directly to water. Do not contaminate water when disposing of equipment washwaters. This pesticide may be fatal to dogs if they ingest bait. Keep pets out of treated areas.

NOTE: Buyer assumes all risk of use, storage or handling of this product and is knowledgeable with directions.

If satisfied with this purchase to obtain a return.

Ortho Group
 P.O. Box 42276



04625 5

1025

USING PESTICIDES

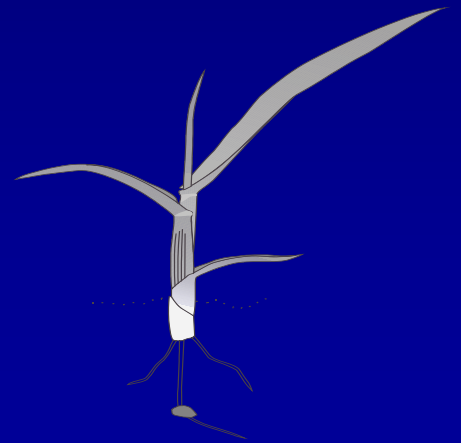
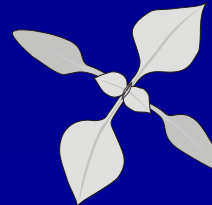
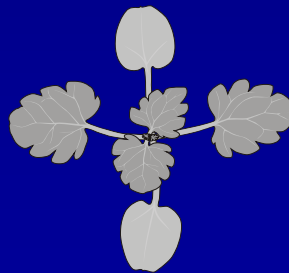
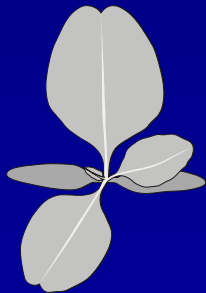
- **Label is a legal document; it is illegal to apply a pesticide contrary to the label directions.**
- **Always read the label and follow the directions**

WEEDS

CONTROL THEM

WHEN THEY ARE

SMALL



SUCCESSFUL GARDENING

=

HAPPY GARDENERS

UNHAPPY GARDENERS

=

**BOATERS, FISHERMAN,
COUCH POTATOES, ETC.**

KNOWLEDGE

=

SUCCESSFUL GARDENING

INTERMISSION

