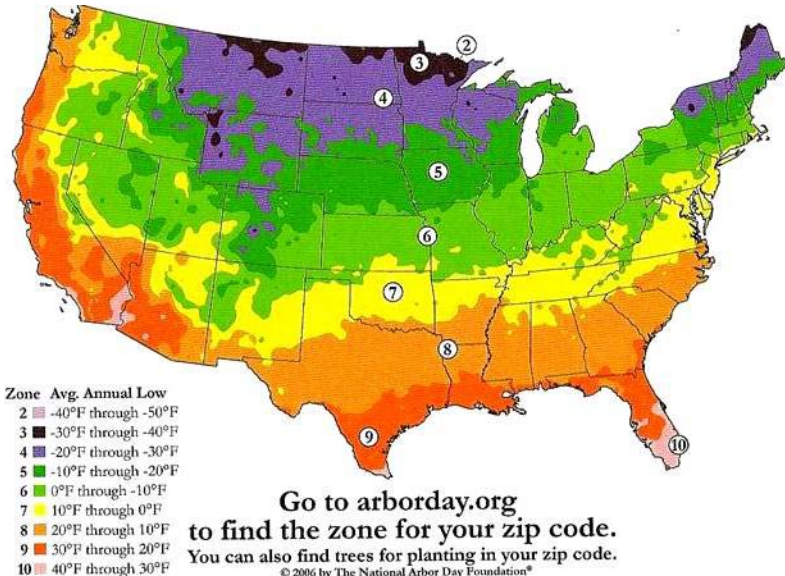
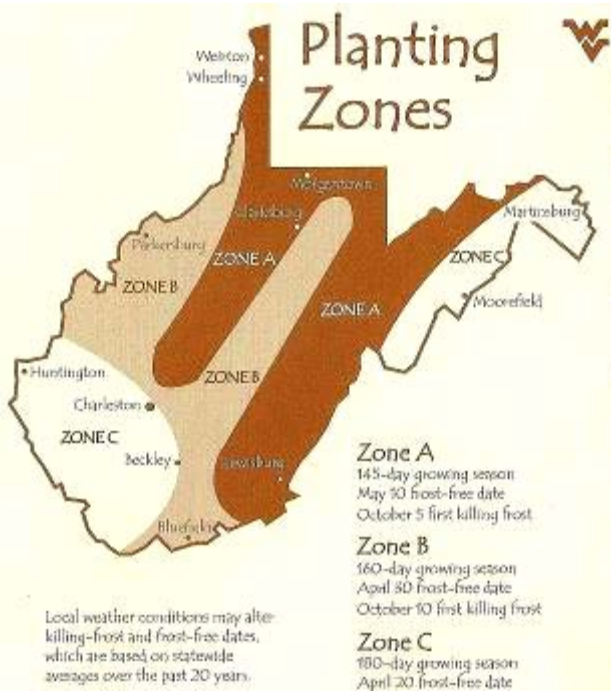


High Tunnel Winter Cropping Systems

Farming the Backside of the Garden Calendar



The traditional growing season in West Virginia limits local food production.





2010

Sun	Mon	Tue	Wed	Thu	Fri	Sat
JANUARY						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Sun	Mon	Tue	Wed	Thu	Fri	Sat
FEBRUARY						
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28				

Sun	Mon	Tue	Wed	Thu	Fri	Sat
MARCH						
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Cool Season

Sun	Mon	Tue	Wed	Thu	Fri	Sat
APRIL						
					1	
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

Sun	Mon	Tue	Wed	Thu	Fri	Sat
MAY						
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

Sun	Mon	Tue	Wed	Thu	Fri	Sat
JUNE						
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

Warm Season

Sun	Mon	Tue	Wed	Thu	Fri	Sat
JULY						
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

Sun	Mon	Tue	Wed	Thu	Fri	Sat
AUGUST						
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

Sun	Mon	Tue	Wed	Thu	Fri	Sat
SEPTEMBER						
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

Warm Season

Sun	Mon	Tue	Wed	Thu	Fri	Sat
OCTOBER						
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Sun	Mon	Tue	Wed	Thu	Fri	Sat
NOVEMBER						
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

Sun	Mon	Tue	Wed	Thu	Fri	Sat
DECEMBER						
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

Cool Season





What is a High Tunnel?

High tunnels are plastic-covered, solar greenhouses which are used to lengthen the growing season and protect the crop(s) from stresses such as rain, wind, **snow/ice**, diseases, insects and wildlife.





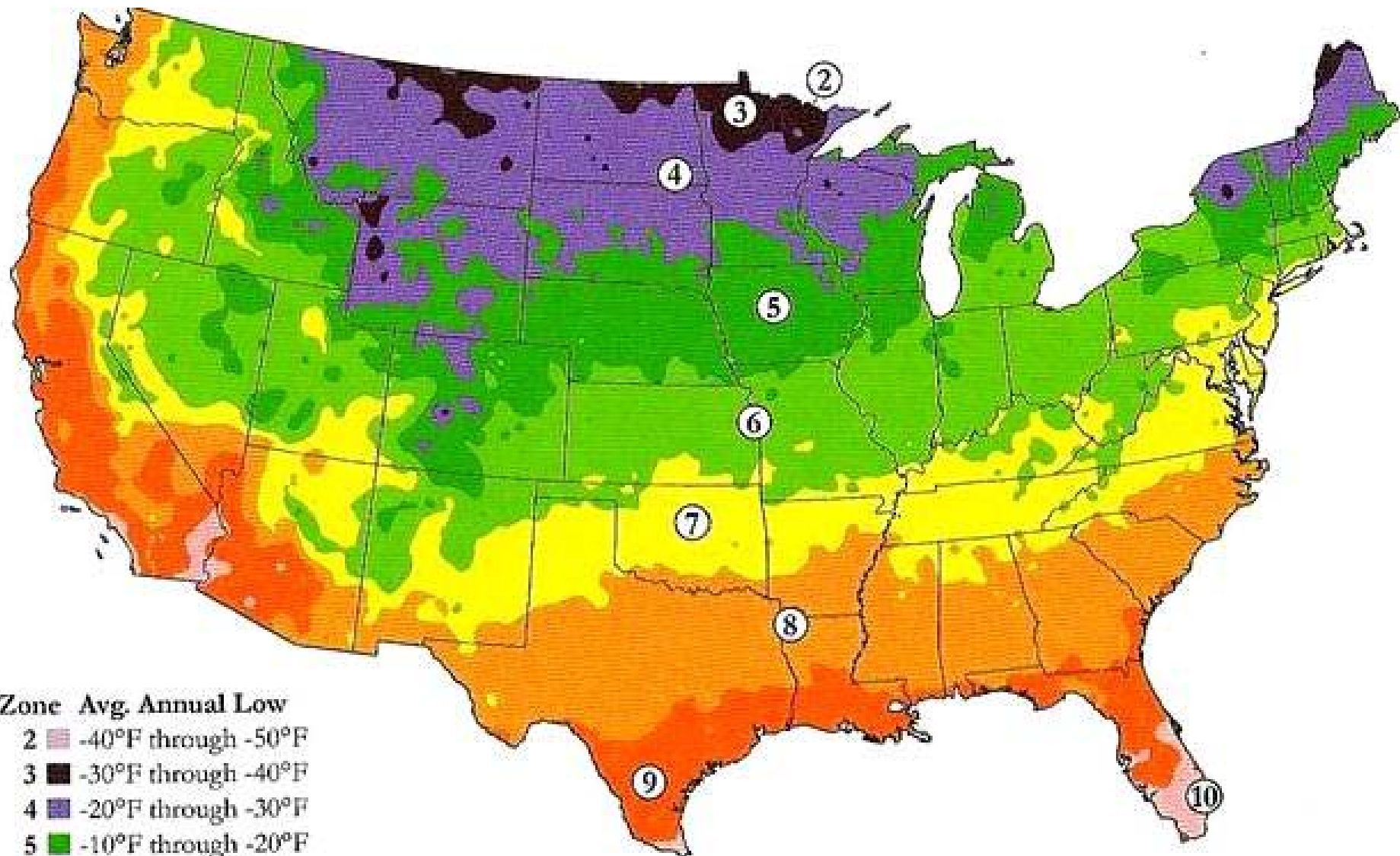


Soil and air are heat sinks during the winter.









- Zone Avg. Annual Low**
- 2 -40°F through -50°F
 - 3 -30°F through -40°F
 - 4 -20°F through -30°F
 - 5 -10°F through -20°F
 - 6 0°F through -10°F
 - 7 10°F through 0°F
 - 8 20°F through 10°F
 - 9 30°F through 20°F
 - 10 40°F through 30°F

**Go to arborday.org
to find the zone for your zip code.**

You can also find trees for planting in your zip code.

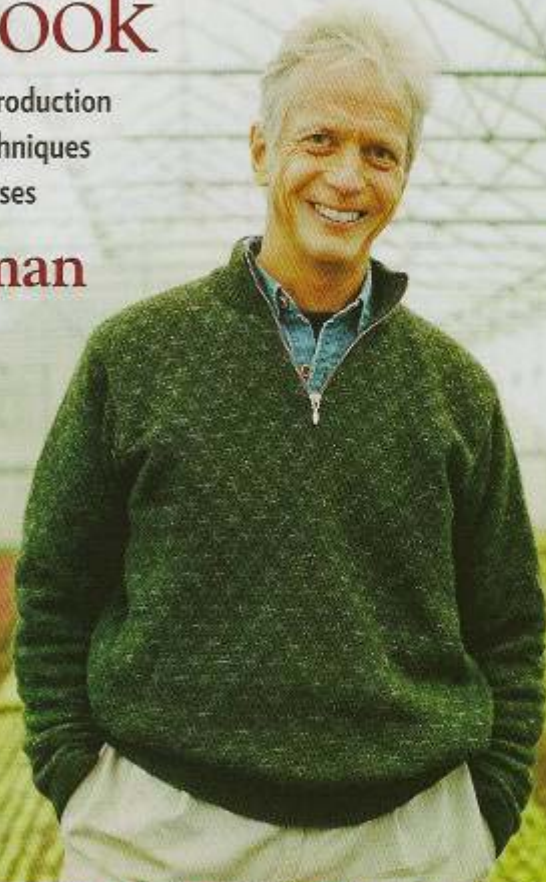
© 2006 by The National Arbor Day Foundation®



The Winter Harvest Handbook

Year-Round Vegetable Production
Using Deep-Organic Techniques
and Unheated Greenhouses

Eliot Coleman



Walking to Spring

Using High Tunnels to grow produce 52 weeks a year



Paul and Alison Wiediger

of Au Naturel Farm



Produce Auction



Supermarket



Restaurant

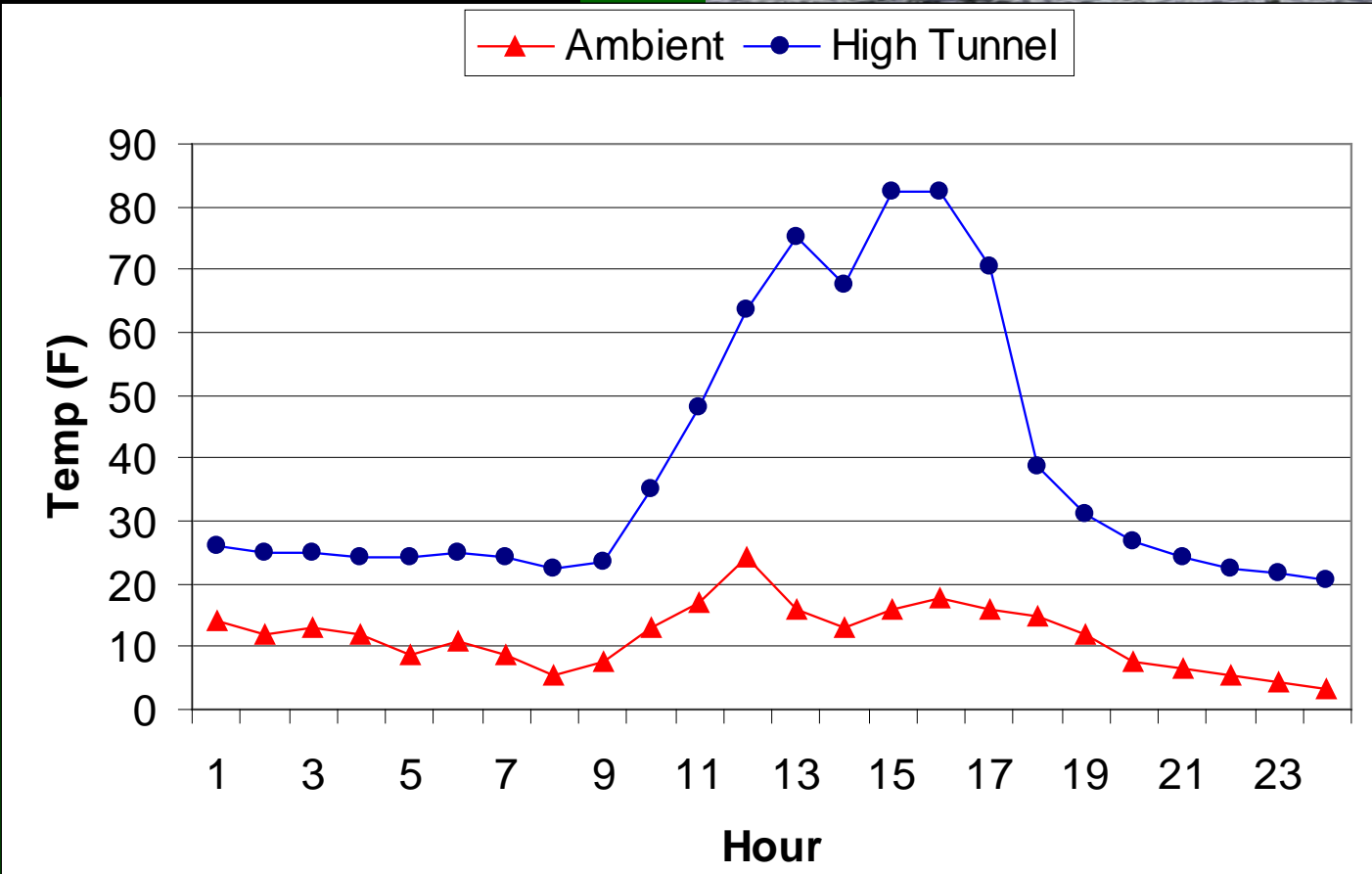


Farmers' Market



How do high tunnels accumulate heat?





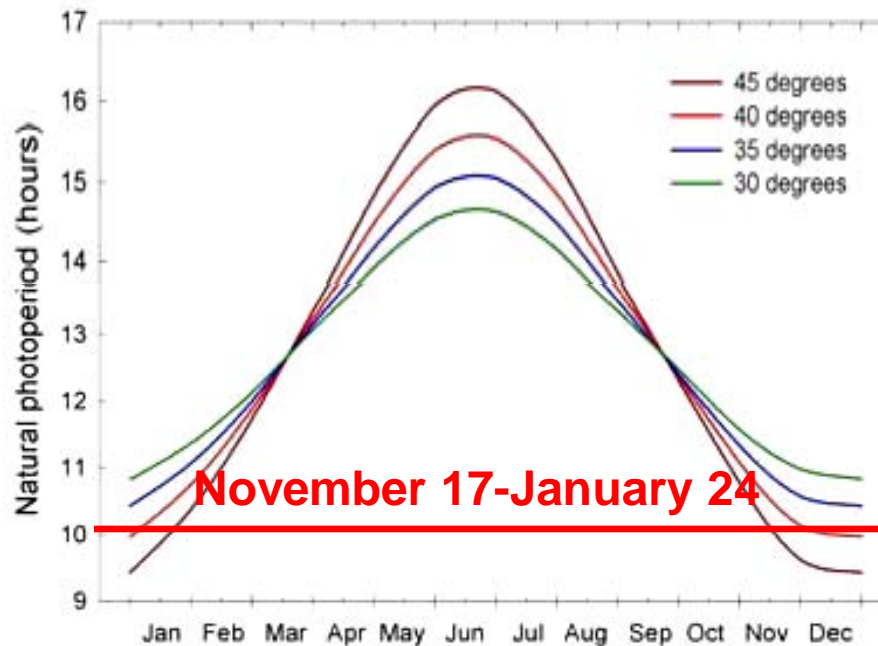


Midday height of sun in winter



LIGHT

**>10 hour
photoperiod
needed for
good
growth**





Temperature



Single or Double Plastic Layer



Inflation
blower fan

Table 2-2 Light-Transmission Values for Various Greenhouse Coverings

<i>Covering</i>	<i>Number of Layers</i>	<i>Percent Transmission</i> ¹
Glass (double-strength float, 3.2-mm)	1	88
	2	77
Glass (low-iron, 3.2-mm)	1	90-92
	2	81-85
FRP (clear, 0.64-mm)	1	88
	2	77
Polyethylene (4- or 6-mil, 0.10- or 0.15-mm, UV-stabilized)	1	87
	2	76
Polyethylene (4- or 6-mil, 0.10- or 0.15-mm, IR-absorbing)	1	82
	2	67
Vinyl, clear ²	1	91
Vinyl, hazy ²	1	89
Polyvinyl fluoride film (4-mil, 0.10-mm)	1	92
	2	85
Acrylic panels (8- or 16-mm, 2-layer)	2	83
Polycarbonate sheet ²	1	90
Polycarbonate panels (6- or 8-mm)	2	79
Polycarbonate panels (8-mm) ²	3	77

¹Light-transmission values for photosynthetically active radiation (PAR, 400-700 nm) and for single sheets are from American Society of Agricultural Engineers (1995), unless otherwise indicated. Transmission values for two layers were computed by squaring the single-layer values.

²Manufacturers' specifications.





























Seeding Tools



6-row seeder



JOHNNY'S
Selected Seeds

HYBRID LEEK
90 DAYS
LPTON F1
LOT NO. 33224
2140 31 APPROX 250 SEEDS

JOHNNY'S
Selected Seeds

LEEK
PANDORA
90 DAYS
MIDWEST 1400 SEEDS
LOT 3472
MINIMUM
SELL BY

SOUTHERN EXPOSURE
SEED EXCHANGE

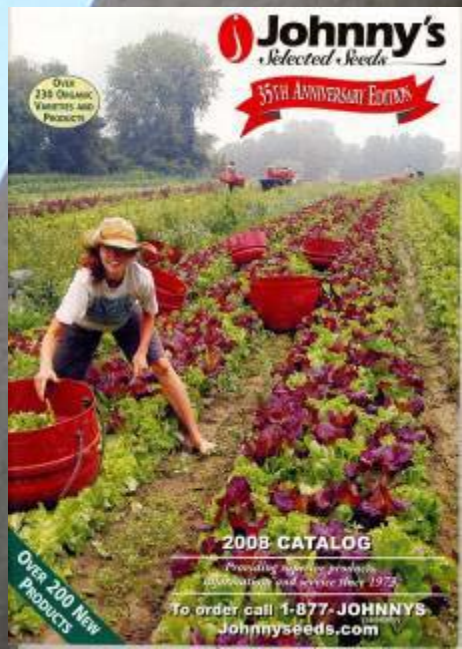
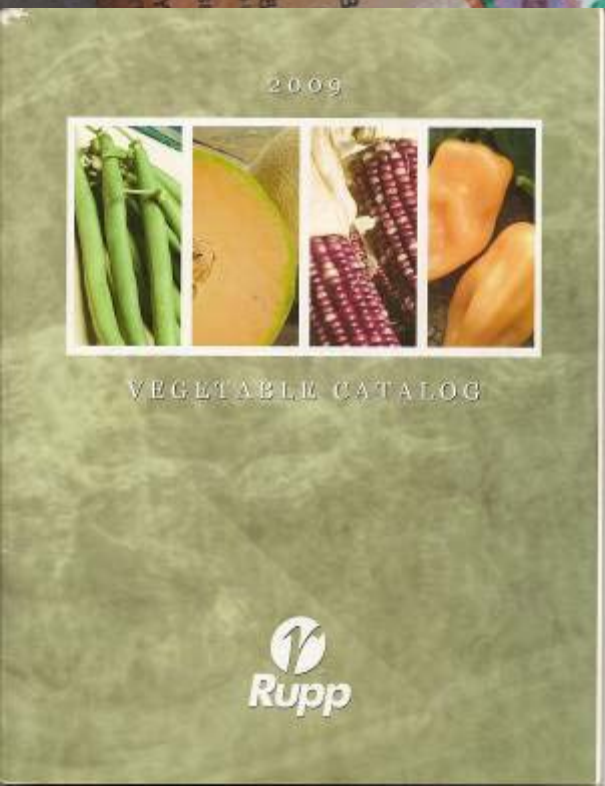
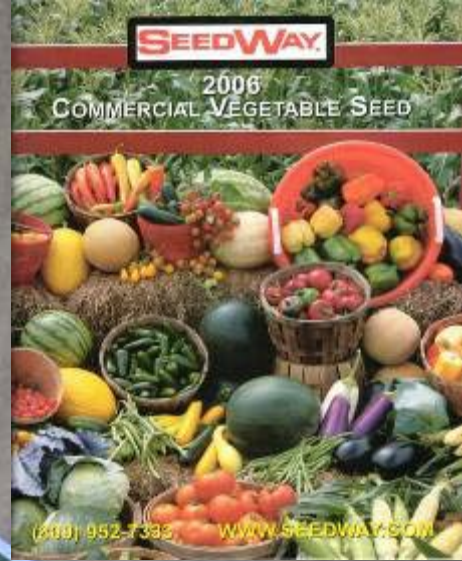
15401
LEEK
American Flag (Broad Leek)
85%
Fro G0
3.000

JOHNNY'S
Selected Seeds

2413 33 APPROX 1000 SEEDS
HYBRID BROCCOLI
GYPSY F1
58 DAYS
LOT NO. 31985
GERM DATE: 98% 4/07
2413 33

2401 11
LEEK
LINCOR
90 DAYS
MIDWEST
LOT 3490
MINIMUM
SELL BY

945 Benton Avenue, Windsor, Maine 05091
(207) 861-1901 • www.johnnyseeds.com









Row Cover Tunnels





**With row
cover**



**Without
row cover**



*Photo courtesy of Steve
Moore*





Winter Crop Choices for High Tunnels







Onions

Spinach

Asian greens

Swiss Chard

Lettuce



Cool Season Crops



Cold Crops

Spinach

Chard

Claytonia

Leeks

Garlic

Mache

Radish

Turnip

Onion

Scallions

Kale

Kohlrabi

Collards

Brussels Sprouts

Broccoli

Cool Crops

Lettuce

Carrots

Watercress

Potatoes (Irish)

Beets

Chinese Cabbage

Celeriac

Celery



Spinach





“The dependable spinach crop”



- 40-60 days from seeding
- Tolerant of low light
- Tolerant of cold temperature
- 12-20 oz/ft²

Spinach

(*Spinacia oleracea*)





**'Space'
Spinach**



GIANT
EAGLE

Nature's
Basket
ORGANIC

BABY SPINACH

ORGANIC • WASHED AND READY TO EAT



BEST IF USED BY
02-01-08 18:35
YTF016B34

Product Of U.S.A



KEEP REFRIGERATED
NO PRESERVATIVES



NET WT. 5 OZ. (142g)



Chard

(Beta vulgaris)









11
BERRY
with
red
chard
root



Kohlrabi

(Brassica oleracea)

- Cold tolerant
- Enlarged stems and young leaves are edible.
- Sweet, cabbage flavor





Kale

(*Brassica oleracea*)

- Very cold tolerant



‘Red Russian’

‘Winterbor’









Dinosaur Kale

Collards

(*Brassica oleracea*)



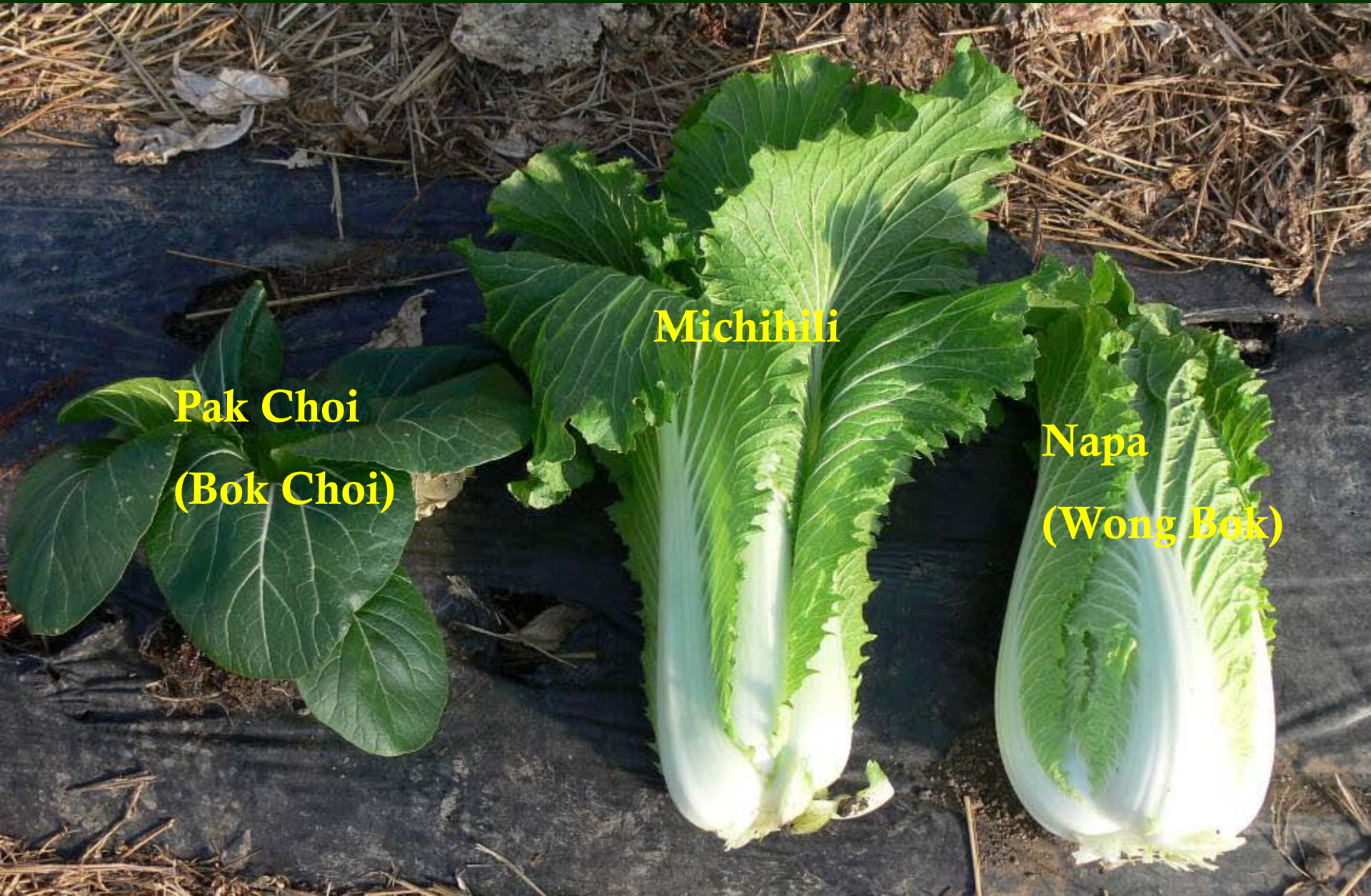




Asian Greens

Mizuna

Chinese Cabbages



Pak Choi
(Bok Choi)

Michihili

Napa
(Wong Bok)



'Mei Quing Choi'





Lettuce

(Lactuca sativa)

- Cold tolerant
- Highly productive
- Downey mildew tolerance



A top-down view of a garden bed filled with numerous green oakleaf lettuce plants. The leaves are bright green and have a distinctively wavy, lobed edge. The plants are densely packed, with some dark soil visible between them. A few dry, brown stems or twigs are scattered across the top of the plants.

Green Oakleaf



Soil Temperature









Turnips

(Brassica campestris)

Very cold
tolerant

Roots and tops
edible

'Hakurei' Salad Turnip



Carrots

(Daucus carota)

Extremely sweet in
winter

Cold tolerant









Winter Annual Weeds

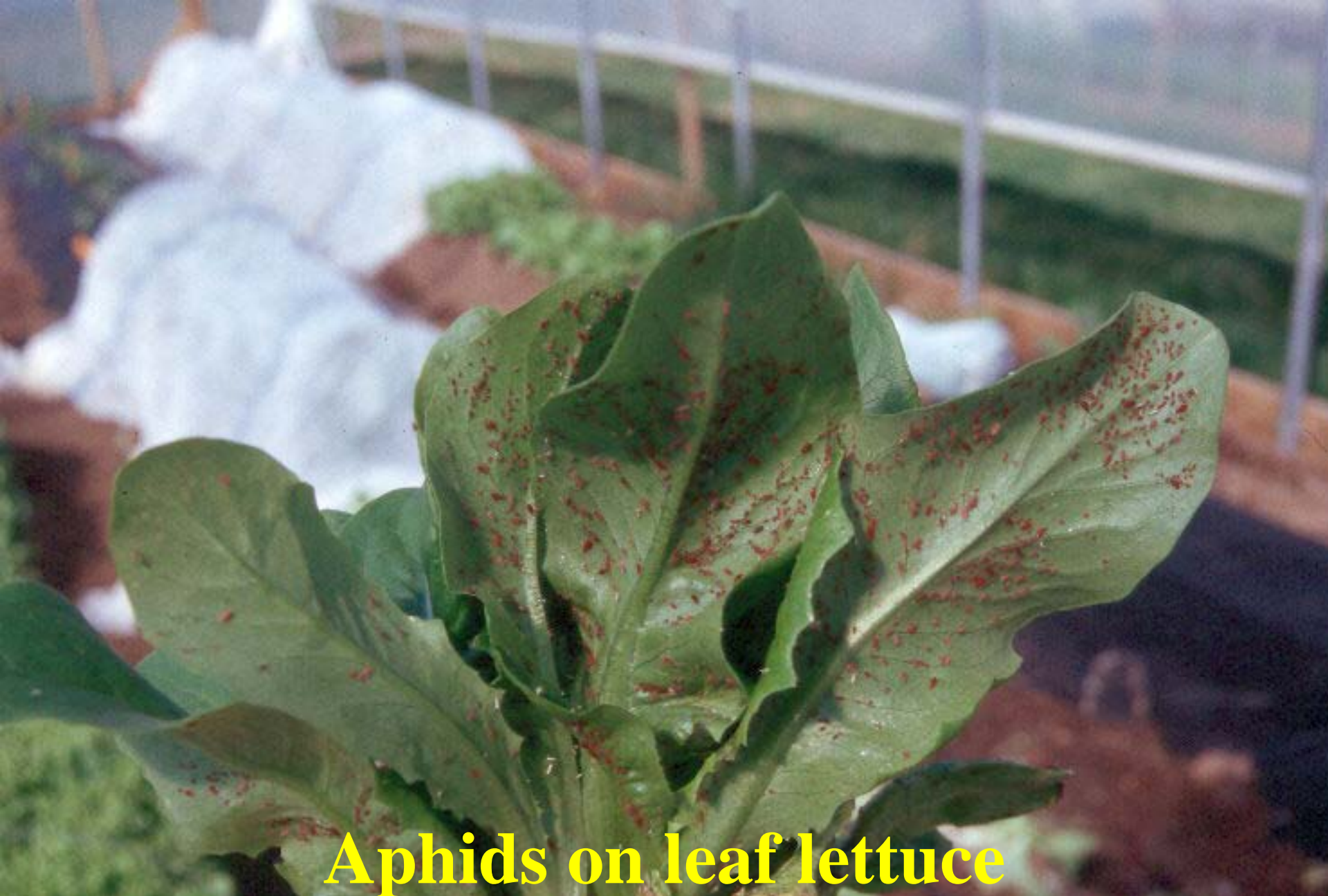






**Downey Mildew on leaf
lettuce**





Aphids on leaf lettuce



Questions?