

Wind, Vegetables, Yield, and Quality

Laurie Hodges, Ph. D. , C. P. H. & James R. Brandle, Ph. D.



Wind protection is **essential** to produce optimum yields of high quality fresh produce, herbs, and cut flowers importance is indicated by it being the primary reason for greenhouse production, with temperature regulation being the secondary factor. Yields are reduced for most horticultural crops when the wind speed is 9 mph, although some crops respond as low as 4 mph. This is known as the threshold wind speed. On the Beaumont Scale, 9 mph is between a "light breeze" when leaves first move and a "gentle breeze" when small twigs move with the wind. This low wind speed alters plant physiology sufficient to reduce yield without visible injury. Mechanical damage to horticultural plants usually is not evident until winds exceed 14 mph. In Nebraska, the threshold wind speed for horticultural crops is exceeded almost every day for varying durations. In eastern Nebraska, the average daily wind speed is 5 mph. Portions of western Nebraska have average daily wind speeds as high as 14 mph. Wind protection has pronounced beneficial effects on horticultural crop yield and quality. More than 12 years of research at the University of Nebraska documented the substantial benefits of windbreaks on commercial horticultural crops.

Protecting Crops from Wind Pays

- Best protection to distance of 10-15% height of the barrier
- 40-60% density protects greatest distance
- Yield increases, especially early and late in the season
- More marketable product per acre
- Higher quality product
- Price advantage in early and late harvests

Sheltered & Exposed Snapbeans (Frosted Fall Crop)



Sheltered Snapbeans (2 yr avg. of multiple planting dates)

- 31% taller plants
- 25% higher yield
- 52% more total weight
- 60% more marketable weight
- \$4,784 (yr 1) and \$6,378 (yr 2) increased crop value

Protected Zones for Windbreak of Moderate Density (40-60%)

1-1.5 H Windward	Quiet zone
0-10 H Leeward	Quiet zone
10-15 H Leeward	Wake or Turbulence
15-30 H Leeward	Decreasing protection

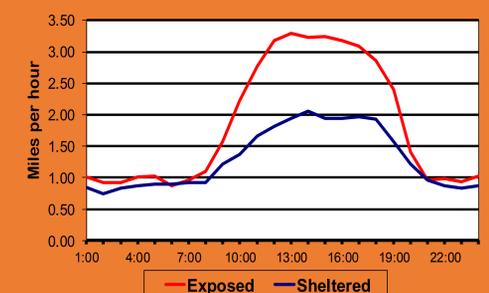
H = height of windbreak



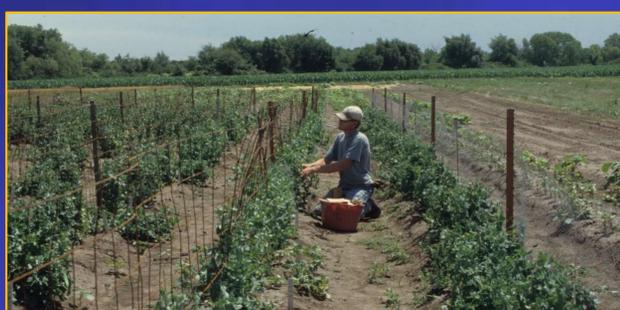
Significant Increases in Bell Pepper Production

30 days after transplanting	
Plant Height	1 inch taller
Buds per plant	10% more
Flowers per plant	5.3X
Fruit set per plant	4.5X
After 5 harvests	
Total Wt	3.5X
Marketable Wt	3.6X
Avg fruit Wt	1.3X
Total No.	2.7X
Marketable No.	3.2 X
Bacterial leaf spot	10X less
Mg deficiency	17X less

Windbreaks Reduce Average Hourly Wind Speed (16 inches above ground)
Pepper ARDC Average 6/14 – 9/9/1996



A single occurrence of as little as 7.5 minutes of wind alone at 30 mph on young tomato transplants significantly increased catfacing. Greig, et al., 1974. J. Amer. Soc. Hort. Sci. 99:530-534.



Microclimate Changes Due to Wind Protection – Spring Green Pea Trial

- Lower average windspeed and gusts
 - 2.4 mph lower windspeeds
- Higher average air temperature
 - 1.5 degrees F
- Lower average humidity
 - 3% lower RH in sheltered treatment
- Over the 4 spring planting dates, soil temperatures averaged 1 degree F warmer in the sheltered area
- However, soil temperature in unprotected area could be as much as 5.5 degrees warmer than the protected soil

Green (English) Pea Cultivar Response to Wind Protection

Cultivar	% Sheltered Yield Increase Over Exposed Per Plant
Knight	161%
Maestro	153%
Freezonia	144%
Olympia	124%
Little Marvel	123%

11 out of 17 cvs showed a positive yield increase with protection.



Muskmelon pulled from clay soil by wind during rain storm

Sheltered Muskmelon Crops (3 yr study)

- 14-28% longer vines
- 8-21% more leaf area
- 7-9 day earlier first flower
- 5-7 day earlier maturity

Sheltered Crop

Pest Insects

- 39% less cucumber beetles
- 37% less western corn rootworm beetles
- 48% less northern corn rootworm beetles

Beneficial Insects

- 43% more lady beetles
- 117% more Ichneumonid parasitic wasps
- 71% more Braconid parasitic wasps

Survival of 6-day old seedlings to wind erosion of 34 miles per hour with 1 lb/yd/sec sand flux

	Percent Survival		
	25%	50%	75%
Exposure Time in Minutes			
Carrots	11	8	4
Onions	31	21	11
Peppers	12	8	4
Cabbage	15	10	5
Cucumber	21	14	7