Texas Agricultural Extension Service

Vegetable Production & Marketing NEWS

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Windbreaks: An Important Component in a Plasticulture System

This article by Laurie Hodges and James R. Brandle appeared in HortTechnology, July/September 1996, 6(3)

Wind has direct and indirect effects on plant growth. Most people associate wind damage with the direct mechanical effects of wind on plants, but the indirect effects on altered microclimate and associated changes in *flora* and *fauna* can have a great influence on yield.

The benefit of shelter on crop growth and yield has been shown for many crop species throughout the world; however, the magnitude of the effect is variable, and the response mechanisms are understood only partly. Wind affects biological processes. Any change in wind speed will be accompanied by other changes in microclimate, which also affects plant growth. The degree of benefit or the severity of damage depends on crop species and growth stage, the seedling and reproductive stages being the most sensitive. Lodging can be a problem when heavy rains coincide with strong winds late in the season when plants are heavy with fruit.

Wind stress affects plant morphology, resulting in smaller, more compact plants with a higher root : shoot ratio than non-stressed plants. Plants respond to the physical motion of wind by altering growth patterns to increase the mechanical strength of various plant parts. Two types of wind events must be considered: gusts and mean daily winds. The morphological response of crop plants depends more on the intermittent and turbulent nature of wind than on the mean daily wind speed. The exposure time necessary to induce these responses may be very low, in some cases 30 s or less. As wind speeds increase, direct damage by wind become more of a problem. In much of the United States, wind speeds of 10 to 20 $m \cdot s^{-1}$ (1.0 $m \cdot s^{-1}$ = 2.24 miles/h; miles/h x 0.447 = $m \cdot s^{-1}$) occur periodically during the growing season, either due to passing storms or weather fronts. There is considerable literature documenting the damage to growing crops that occurs with wind speeds in this range (10 to 20 $m \cdot s^{-1}$). Under these conditions, windbreaks provide significant protection, reducing wind speeds by 50 percent or more.

Vegetables have a very low tolerance to wind stress. The critical threshold wind-speed for specific vegetable crops -- or that wind-speed above which vegetable crop yields are

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Appearing Within . . .

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reduced -- has not been well established. However, taken as a group, vegetables generally are listed in the most-sensitive or low-tolerance category compared to other crops. Limited research indicates that wind speeds of 4 to 5 $m{\cdot}s^{-1}$ can have physiologically harmful effects on many vegetables. These include serious disruption of plant water balance, suppression of growth, lower photosynthetic efficiency, and adverse impact on pollination and fruit maturation. There is some indication that crops grown for their vegetative parts, such as cabbages, may be more sensitive to wind stress than plants grown for their reproductive tissues. In contrast, many of the grain crops used as temporary windbreaks are among the more tolerant crops.

Vegetable and other specialty crops are very sensitive to abrasion by windblown soil. As soil flux, wind velocity, or exposure time increase, crop survival, growth, and yield decrease. For the most erosive soils, the threshold wind velocity for soil movement is between 3 and 4 $m{\cdot}s^{-1}$. Abrasion by larger particles from soil saltation and soil creep may injure plants close to the soil line. Physical abrasion, either by soil particles or from plant parts rubbing together, reduces crop stand and decreases yield and crop quality from the remaining plants. In some cases, crops may need to be replanted, causing delayed harvest or, occasionally, complete loss of a crop to an early frost. Since crop quality is a primary factor in the price received for the product, most vegetable and specialty crops benefit from extensive wind protection systems.

The greater sensitivity of young plants to soil abrasion is recognized. Survival of tomato transplants from sandblast injury increased as the transplant root volume increased (up to 6 percent) or the age of the transplant increased (up to 7 weeks). We may assume that this also is true for the indirect effects of lower wind speeds on stand establishment and flowering.

In most of the major vegetable production areas of the United States, concern with wind and/or windblown soil is greatest during the early spring when stand establishment coincides with seasonally high winds and large areas of exposed soil during field preparation. Vegetable producers need to be especially aware of the problems associated with wind erosion, since the soil characteristics that favor production are the same as those typical of erosive soils. Vegetable operations frequently are located on well-drained sandy soils or highly organic soils such as muck soils. Sandy soils are favored for early-season planting and the use of plasticulture, since they warm up earlier in the spring, and the benefits of plastic mulch are supplemented by natural soil warming. However, these same soils tend to dry out quickly and, thus, are subject to erosion.

Soil loss and abrasion are not the only costs of wind erosion to vegetable producers. When winds erode soil during field preparation and planting, herbicides and nutrients that have been applied to the surface are lost. It is estimated that the soil blown from a field may contain 10 to 20 times more organic matter and phosphates than the heavier particles that remain.

Crops that have an indeterminate growth pattern, such as cucumbers, or produce multiple flowers, such as beans, may be better able to compensate for losses caused by wind erosion than determinate crops such as cabbage, carrots, or onions. Carrots, peppers, and tomatoes were extremely susceptible to sand injury, whereas southern peas could withstand about 5 times more abrasion injury than carrots.

Soil particles carried by the wind, or plant parts rubbing against each other as the plant moves with the wind, can disrupt the cuticular layer on the leaf. As a result, transpiration increases, and water loss from the plant can be substantial. The physical abrasion of leaf on leaf may disrupt the normal vapor barrier, but it is difficult to differentiate this from changes brought about in the microclimate from water use. The damaged cuticle also can predispose the leaf to pollution stress or invasion by pathogens.

Windblown soil can carry inoculum for bacterial and fungal diseases. It also can wound plant tissues, providing entry points for pathogens, especially bacteria. Shelter from wind and windblown soil may reduce the incidence and severity of crop diseases. For example, common blight of bean [*Xanthomonas phaseoli* [E.F.Sm.)Dows] increased 120 percent when the duration of exposure to windblown infested river-sand increased from 3 to 5 minutes. Similarly, pepper plants injured by sandblast, or leaves subjected to wind abrasion by rubbing together, were significantly more susceptible to bacterial spot, developing twice the number of lesions as plants not subjected to wind stress. Wind velocity (8 $m{\cdot}s^{-1}$) and durations (5 to 10 minutes) in this study were typical of the gusty winds in late summer storms. Wind scab on 'French' prune (*Prunus domestica*), caused by wind abrasion, increased infection by pathogens, resulting in lost marketable yields equivalent to those caused by russet scab. In New Zealand, the economic benefits of wind protection for horticultural crops are at least equal to those of pest and disease control.

Windbreaks influence the distribution of both crop pests and their natural enemies. Most pollinating insects are found in sheltered areas; for example, bee flight is inhibited at wind speeds of 6.7 to 8.9 $m{\cdot}s^{-1}$. Windbreaks also can reduce damage associated with aphid-transmitted viruses.

Enhancement of Snap Bean Emergence by *Gliocladium virens*

This article by V. L. Smith appeared in ***HortScience*** *31(6):984-985. 1996.*

Preemergence and postemergence damping-off are major factors in poor stand establishment in garden and commercial plantings of snap beans. Damping-off is caused by several soilborne fungi, including *Fusarium* spp., *Rhizoctonia solani*, and *Pythium* spp., and is exacerbated by cold, wet soil. Damping-off may be reduced, but not controlled, by planting when soils are relatively warm and dry.

Species of *Trichoderma* Pers.:Fr. and *Gliocladium* Corda have exhibited promise in laboratory and greenhouse trials for control of soilborne pathogens. Their applicability for use as biocontrol agents in field situations has not been extensively demonstrated.

One difficulty is using fungi as biocontrol agents on a large scale is the production of inoculum in a convenient, easily applied form. Recently, a method for encapsulating fungi in alginate pellets has been developed. The object of my study was to test the efficacy of using an alginate pellet formulation of *Gliocladium virens* for control of snap bean damping-off in the field.

Emergence of snap beans (*Phaseolus vulgaris* L.) in field soil in 1993-95 was enhanced by the biocontrol agent *Gliocladium virens*. The fungus was applied to each seed at planting as a wheat-bran alginate pellet formulation in 1993-95. Preemergence and postemergence damping-off were reduced in plots treated with *G. virens*. Nodulation on the roots of treated plants numerically increased in 1993 and 1994, compared to untreated plots. Efficacy of *G. virens* was reduced in 1995, probably due to high ambient temperatures at the time of planting. In plots with reduced stand, leaf area was increased and yield on a per-plant basis was larger than in plots with a better stand. Total yield also was increased in plots with fewer plants, except in 1994. Fungi isolated from failed seedlings included *Fusarium* spp., *Pythium* spp., and *Rhizoctonia solani* Kuhn.

Reduction in damping-off incidence in snap beans was achieved by the addition of *G. virens* at the time of planting. Damage by *Fusarium* and *Rhizoctonia solani* especially was reduced. As damping-off may be caused by many pathogenic organisms, this study demonstrates that there is potential for control of or decrease in the number of these pathogens on other host plants in naturally-infested field soil. Current control measures for damping-off of many plants are limited to alteration of planting time or use of broad-spectrum fungicides. Use of biological control agents may be a more economical and ecologically acceptable method of controlling damping-off in the not-too-distant future.

COMING EVENTS

CENTRAL TEXAS
VEGETABLE CONFERENCE
DeLeon, Texas
January 16, 1997 • 8 AM - 4:30 PM

For information contact:
Bob Whitney, County Extension Agent-Comanche (915) 356-2539

EAST TEXAS
VEGETABLE CONFERENCE
Tyler, Texas
February 18, 1997 • 8 AM - 4 PM

For information contact:
Wayne Lacy (903) 535-0885

Water to be Key Issue at High Plains Vegetable Conference

This year's conference will examine the status of water sources, water requirements, irrigation scheduling, water purity, conservation, low-energy precision applications (LEPA) and drip irrigation systems, large-scale mulching, use of heat units and the potential evapotranspiration (PET) network, and development of whole-farm water conservation plans that meet state and federal requirements. "Water is our highest priority for the future of the High Plains vegetable industry," said Dr. Roland Roberts, vegetable specialist with the Texas Agricultural Extension Service and conference coordinator.

Speakers will be professionals representing all aspects of water management in crop production. Keynote speakers will be Wayne Wyatt, manager of the High Plains Underground Water Conservation District Number One, and Dr. Edward Martin, Extension Service engineer with the University of Arizona, Tucson. Wyatt will address the present and future outlook for the area's water supply. Martin will report on his research on vegetable irrigation requirements, and timing the application of vegetable irrigation with heat units. Others on the program will be Leon New, irrigation specialist; Mark Griffith, Extension Assistant for water quality; Dr. Frank Dainello, Extension horticulturist; Dr. Greta Schuster, Extension Agent for integrated pest management; Dr. David Bender, Experiment Station associate professor of horticulture; Levon Harmon, TDA pesticide specialist, and Dr. Roberts.

Some 25 exhibits and educational displays will be presented by agribusiness professionals serving the vegetable industry. The conference begins at 8:30 AM at the Hereford Community Center, 100 Avenue C at Park Avenue. It is sponsored by the Extension Service, High Plains Vegetable Growers and Shippers Council, Texas Agricultural Experiment Station, Texas Tech University, Deaf Smith County Extension Vegetable Development Committee, Deaf Smith County Chamber of Commerce, and the Texas Department of Agriculture.

The program has been approved by TDA for five continuing education units to maintain certification for applicators of restricted-use pesticides. The $25 registration fee includes lunch.

HIGH PLAINS VEGETABLE CONFERENCE
Hereford, Texas
January 21, 1997 • 8 AM - 5 PM
For information contact: Dr. Roland Roberts, TAMU-AREC Lubbock (806) 746-6101

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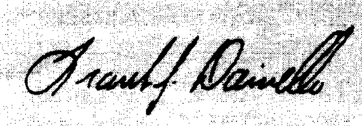

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Onion Trial Results

Results from the 1995-96 onion trial in Maverick County are available. The trial was planted on October 19, 1995, and harvested on May 5, 1996, and included 20 different onion cultivars, primarily yellow gano types, in a replicated trial in a commercial onion field. The trial was rated for bolting, maturing, and for purple blotch disease severity on two different dates (Table 1). Harvest data were recorded for four different size categories and for total yield of all sizes combined (Table 2). For copies of the complete report, contact Jorge Guzman at (210) 773-5064, Dr. Mark Black at (210) 278-9151, or Dr. Lynn Brandenberger at (210) 968-5581.

TABLE 1. TAEX FALL 1995 MAVERICK COUNTY ONION TRIAL - BOLTING, MATURITY, AND PURPLE BLOTCH RATINGS.

Treatments	% Bolters [a]	Maturity Rating [c] 4/30/96	Purple Blotch Rating [bd] 4/8/96	Purple Blotch Rating 4/30/96
PSX 1190	0.9	1.8	3.0 a	3.0 b
Candy	3.4	2.7	3.0 a	3.0 b
Linda Vista	0.2	0.9	3.0 a	3.2 ab
PSR 13589	3.9	2.0	3.0 a	3.0 b
Chula Vista	0.3	2.5	3.0 a	3.0 b
PS 492	0.0	2.5	2.7 ab	3.2 ab
PS 292	0.0	2.9	3.0 a	3.0 b
SSC 6011	0.0	3.4	3.0 a	3.0 b
Daybreak	0.0	3.1	3.0 a	3.2 ab
Marquis	0.6	3.6	2.5 b	3.0 b
XPH 6787	0.2	1.8	3.0 a	3.0 b
XPH 6777	2.2	2.5	3.0 a	3.0 b
Encino	0.2	1.8	3.0 a	3.7 a
XPH 6781	0.2	4.0	3.0 a	3.7 a
Henry's Special	0.0	2.4	3.0 a	3.2 ab
SunSweet 1504	0.5	3.0	2.5 b	3.2 ab
Sunex 1503	0.4	3.2	3.0 a	3.0 b
SunUp 1502	1.6	3.2	3.0 a	3.0 b
Grano 502	0.9	2.5	3.0 a	3.0 b
Rojo	0.4	2.9	3.0 a	3.2 ab
Average	0.8	2.6	2.9	3.1

[a] Numbers not followed by a letter are not statistically different with P=0.05

[b] Numbers followed by the same letter are not statistically different with P=0.05

[c] Maturity rating scale was from 1 to 5 where: 1+no tops down, 2=1-25% down, 3=26-50% down, 4=51-75% down, and 5=76-100% of the tops down

[d] Disease severity rating scale was a 1 to 10 scale where 1=no disease symptoms and 10=complete die-back of the plant foliage

*This article by Lynn Brandenberger appeared in **Valley Vegetable Notes**, Vol. 4(10) October 1, 1996.*

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TABLE 2. TAEX FALL 1995 MAVERICK COUNTY ONION TRIAL - TOTAL YIELD AND YIELD OF 4 DIFFERENT ONION BULB SIZE CATEGORIES

	Yield of 50 lb. bags/acre							
Treatments	> 4" [a]		> 3" to 4"		2" to 3" [b]	< 2"	Total	
PSX 1190	7.0	d	350.4	def	87.2	20.0	464.6	bcde
Candy	0.0	d	108.5	g	111.1	17.4	237.0	f
Linda Vista	20.9	abc	550.9	abc	209.2	34.9	815.9	a
PSR 13589	0.0	d	489.9	abcd	94.1	10.5	594.5	bcd
Chula Vista	7.8	cd	566.1	ab	86.3	13.1	673.4	ab
PS 492	1.3	d	576.6	a	77.1	11.8	666.8	abc
PS 292	22.2	ab	458.0	abcde	74.5	17.0	572.7	bcd
SSC 6011	3.5	d	334.7	ef	92.4	10.5	441.1	de
Daybreak	5.2	d	423.6	bcde	109.8	13.7	552.4	bcd
Marquis	2.6	d	410.6	cde	149.1	12.4	574.6	bcd
XPH 6787	11.8	bcd	383.1	de	92.8	10.5	498.2	bcde
XPH 6777	0.0	d	353.0	def	69.3	7.8	430.2	def
Encino	0.0	d	364.8		125.5	19.6	509.0	bcde
XPH 6781	0.0	d	388.3	de	62.8	5.2	456.3	bcde
Henry's Special	2.6	d	457.6	abcde	132.1	10.5	602.8	bcd
SunSweet 1504	3.9	d	428.9	bcde	107.2	8.5	548.5	bcd
Sunex 1503	26.1	a	392.2	de	66.7	9.4	498.4	bcde
SunUp 1502	0.0	d	350.4	def	85.0	11.8	447.2	cde
Grano 502	0.0	d	235.4	fg	66.7	12.4	314.5	ef
Rojo	0.0	d	288.2	de	133.4	17.0	538.7	bcd
Average	5.6		399.2		100.6	13.4	518.9	

[a] Numbers followed by the same letter are not statistically different with P=0.05

[b] Numbers not followed by a letter are not statistically different with P=0.05

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