WIND- AND SANDBLAST-DAMAGE TO TOBACCO PLANTS AT VARIOUS GROWTH STAGES[1]

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Large areas of flue-cured tobacco are grown on coarse-textured soils that are susceptible to wind erosion. In this study, the wind-erosion tolerance of flue-cured tobacco (*Nicotina tabacum* L. var. 'Hicks Broadleaf') was studied at various growth periods after transplanting.

Greenhouse-grown tobacco plants were exposed in a wind tunnel to a wind velocity of 13.4 m/sec (30 mph) for 20 min or to wind-plus-sand (0.297-0.42 mm diam) for 5, 10, or 20 min at 7, 14, 21, or 28 days after transplanting. Total dry weight of leaves 14 days after exposure and 48 days after transplanting was reduced 30 to 63% by all sand exposures at 7 and 14 days after transplanting and by 5- and 20-min exposures at 21 days after transplanting. Exposing plants at 28 days after transplanting and all wind-only treatments did not reduce the total dry weight of their leaves.

Dry weight of undamaged leaves 14 days after exposure to wind or wind-plus-sand and 48 days after transplanting was reduced 19 to 84%.

Wind-erosion damage can markedly reduce flue-cured tobacco yields. Wind-erosion-control methods must be a part of the normal management practices when tobacco is produced on coarse-textured soils.

INTRODUCTION

Wind erosion regularly damages plant seedlings in the southeastern United States, where tobacco is an important crop.[3] Flue-cured tobacco seedlings, transplanted at wide spacings (0.45 m^2/plant) in coarse-textured soils early in the spring (March-April), are subject to wind-erosion damage (8). Since 286,880 ha (7) or 66% of the total tobacco grown in the United States is flue-cured types, the Soil Conservation Service has requested information on wind-erosion damage to flue-cured tobacco at the transplant stage.[3]

Several crop species have been evaluated for wind and sandblast injury. Yields of cotton (1, 4), alfalfa (5), soybeans (2), and winter wheat (3, 9) are reduced by wind-erosion damage. No data, however, is available on wind and sandblast injury to tobacco plants.

The objectives of this research were to evaluate the response to wind erosion of flue-cured tobacco at several growth stages.

MATERIALS AND METHODS

Flue-cured tobacco (*Nicotiana tabacum* L. var. 'Hicks Broadleaf') was grown in a greenhouse with a minimum temperature of 21 °C; a combination of fluorescent and incandescent bulbs was used to extend the day length to 12 hr. Tobacco seeds were broadcast on flats filled with sandy loam soil, packed, and watered. Seeded surfaces were kept moist until seedlings had emerged and then were watered daily. All watering was done with 0.2 N dilute Hoagland solution modified to double the concentration of magnesium (Mg).

Healthy, 15- to 20-cm-tall plants were transplanted, 1 plant/pot, to 18-cm-diam plastic pots filled with masonry sand (sieved to removal all particles > 3.35 mm) and watered to saturation 80 days after seeding.

Plants were exposed to a wind velocity of 13.4 m/sec for 20 min and to wind-plus-sand (0.297-0.420 mm diam) for 0, 5, 10, or 20 min (sand flux of 30 g/cm width/min) at 7, 14, 21, or 28 days after transplanting. Sand was introduced into the windstream at the beginning of the wind period. Plants were exposed to wind and sand in a laboratory wiind tunnel. Each treatment was replicated three times in a completely random experimental design. Plants were returned to the greenhouse after exposure.

Three plants per exposure treatment were harvested 14 days

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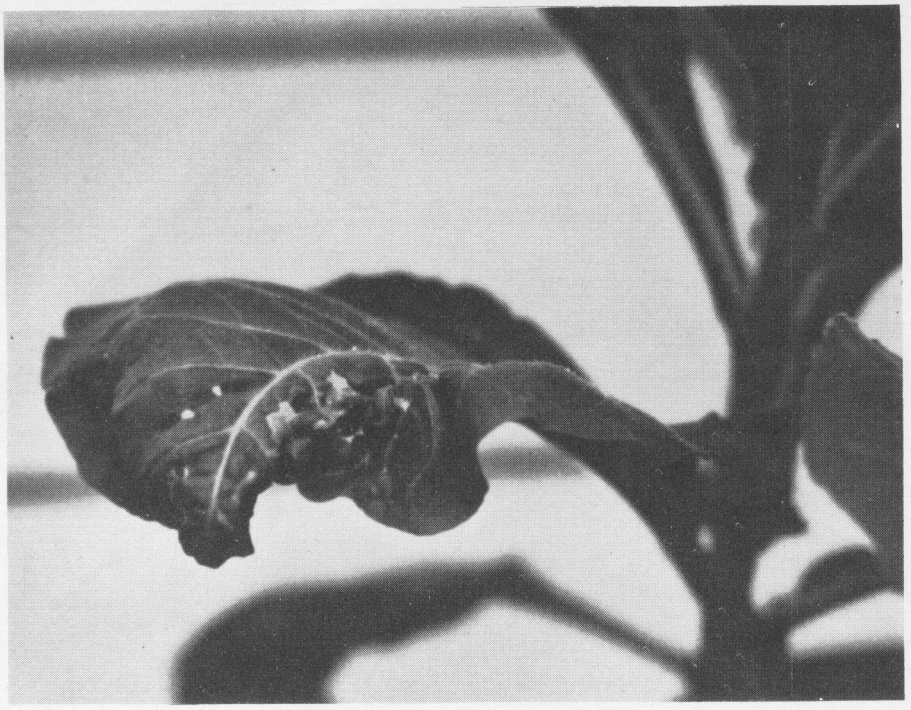

Fig. 1. Tobacco leaf showing wind-erosion damage.

after exposure and three plants from each exposure treatment and date of exposure were harvested 48 days after transplanting. All damaged and undamaged leaves present on each plant were separated, weighed, dried (70°C for 96 hr), and reweighed.

RESULTS AND DISCUSSION

Total dry weight of tobacco leaves harvested 14 days after exposure was reduced significantly (30 to 60%) for plants exposed to wind-plus-sand at 7 or 14 days after transplanting (**Table 1**), depending on plant age and exposure time. Sandblasting plants at 21 days after transplanting significantly reduced total leaf dry weight for 5- or 20-min exposures but not for 10-min exposures. Sandblasting plants 28 days after transplanting did not significantly reduce total leaf dry weight for any exposure treatment. The younger the plant was when it was exposed to wind-erosion damage, the greater was the reduction in total leaf dry weight. Wind alone did not significantly reduce total leaf dry weight.

Total dry weight of leaves harvested 48 days after transplanting was decreased by sandblast injury at all exposure dates, except for 28 days after transplanting (**Table 2**). Wind alone did not reduce yields for any exposure date. Average total leaf dry weight was lowest for plants exposed 7 and 14 days after transplanting.

Observations of damaged leaves indicated that the leaf edges are damaged first with resulting necrosis of the leaf edge. Continued growth of the living cells in the leaf center caused gross deformity of leaf shape (**Fig. 1**). Wind injury resembled sand injury, except that it was not as extensive. Stems were not damaged.

Wind alone reduced the weight of undamaged leaves 50%, regardless of the age of the plant when exposed to wind injury (**Table 3**). Sandblasting further reduced the yield of undamaged leaves 57 to 84%, depending on the age of the plant when exposed and the amount of sand.

Plants exposed 7 days after transplanting, however, lost all severely damaged leaves; thus, all leaves grown after that date were undamaged, so that by final harvest (48 days), only 3 to 12% of the leaves produced were damaged (**Tables 2** and **4**). Plants had only a small amount of new growth after they

Table 1. Total dry weight of wind- and sandblast-damaged tobacco leaves harvested 14 days after exposure.

Exposure	When exposed (days after transplanting) 7	14	21	28	Avg
	% of control				
Control	100a†	100a	100a	100a	100a
Wind only, 20 min	100a	102a	94a	88a	96a
Wind + sand, 5 min	68b	57b	61b	86a	68b
Wind + sand, 10 min	44b	70b	83a	96a	73b
Wind + sand, 20 min	37b	59b	61b	92a	62b
Avg	70b	78b	80b	92a	

† Column means followed by the same letter are not statistically different at the 5% level by Duncan's NMRT.

Table 2. Total dry weight of wind- and sandblast-damaged tobacco leaves harvested 48 days after transplanting.

Exposure	When exposed (days after transplanting) 7	14	21	28	Avg
	g				
Control	45.3a†	45.4a	47.2a	42.3a	45.1a
Wind only, 20 min	36.7a	44.6a	43.4a	36.8a	40.4b
Wind + sand, 5 min	27.0b	32.7b	31.5b	34.4a	31.4c
Wind + sand, 10 min	27.0b	22.2c	34.5b	38.5a	30.6c
Wind + sand, 20 min	25.0b	25.3bc	33.5b	40.5a	31.1c
Avg	32.2b	34.0b	38.0a	38.5a	

† Column means followed by the same letter are not statistically different at the 5% level by Duncan's NMRT.

were exposed 28 days after transplanting and all wind-erosion-damaged leaves were still present. Thus, 50 to 70% of the leaves produced were damaged. Wind or wind-plus-sand reduced the weight and quality of marketable product, regardless of exposure date. When plants were damaged 14 days or more after transplanting, they produced fewer undamaged leaves than did those damaged earlier.

The plant size was reduced in this study by the pot size, but the results were similar to those reported by Pointer and Woltz (6) for hail-damaged tobacco. They reported decreases in both yield and value per acre with an increase in leaf area destroyed. Losses up to 100% due to hail could be recovered by cutting off the damaged plants to promote sucker growth and controlling weeds and diseases. However, this practice reduced yields 9% and value 9% for each week cutting occurred later than 3 weeks after transplanting.

The same practice would probably increase yields from severely wind-erosion-damaged plants. However, control of wind erosion by maintaining cover crops on sled rows planted perpendicular to prevailing March and April winds would be easier and less time-consuming.

Another control method would be to transplant tobacco after a long-term sod crop, i.e., bahiagrass (*Paspalum notatum* Flugge) or bermudagrass (*Cynodon dactylon* L. Rich.). The grass sod residue would help prevent soil movement between tobacco plants.

Table 3. Dry weight of undamaged tobacco leaves harvested 14 days after exposure.

Exposure	When exposed (days after transplanting) 7	14	21	28	Avg
	g				
Control	6.7a†	15.6a	25.4a	35.2a	20.7a
Wind only, 20 min	3.7b	8.6b	12.8b	16.8b	10.5b
Wind + sand, 5 min	2.3bc	4.5c	7.8c	15.0b	7.4c
Wind + sand, 10 min	1.1c	4.4c	8.4c	13.4b	6.8c
Wind + sand, 20 min	1.1c	4.0c	6.7c	14.1b	6.5c
Avg	3.0d	7.4c	12.2b	18.9a	

† Column means followed by the same letter are not statistically different at the 5% level by Duncan's NMRT.

Table 4. Dry weight of undamaged tobacco leaves harvested 48 days after transplanting.

Exposure	When exposed (days after transplanting) 7	14	21	28	Avg
Control	45.3a†	45.4a	47.2a	42.3a	45.1a
Wind only, 20 min	35.3b	36.6b	30.8b	18.0bc	30.2b
Wind + sand, 5 min	26.2bc	26.8c	18.6d	13.4cd	21.3c
Wind + sand, 10 min	23.8c	18.4d	23.8c	19.3b	21.3c
Wind + sand, 20 min	23.7c	21.8cd	15.1d	12.6d	18.3c
Avg	30.9a	29.8a	27.1b	21.1c	

† Column means followed by the same letter are not statistically different at the 5% level by Duncan's NMRT.

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