Published March, 1987

# NOTES

## INDUCTION OF ADVENTITIOUS SHOOTS IN COTTON[1]

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### Abstract

**Plants of the tetraploid cotton species *Gossypium hirsutum* L. ordinarily produce secondary shoots only from axillary buds. Destruction of the primary shoot by excision below the cotyledonary axils occasionally leads to the production of adventitious shoots. Two plants of the cultivar Coker 201 produced adventitious shoots from what appeared to be callus tissue growing outward from stem cambium after 12 plants had been severed at the ground line. A plant of the "houseyard" stock Orinoco produced several shoots from globular masses of tissue that grew from the roots after the shoot was removed. Another plant of Orinoco, grown from seed produced on the first, produced shoots at two sites near the ground line of a stump from which the trunk had been removed. After removal of the shoots, the plant grew three additional groups of shoots, including one group from a root about 2 cm from the stump.**

***Additional index words: Gossypium hirsutum* L., Axillary buds, Callus tissue, Fire adaptation.**

Plants of the tetraploid cotton species *Gossypium hirsutum* L. usually produce shoot initials in an orderly and predictable fashion. These buds are laid down near the axils of leaves, which include cotyledons, prophylls, and "true" leaves (Mauney and Ball, 1959; Mauney, 1984). Because Mauney did not mention adventitious budding in cotton in his review of 1984, I came to suspect that he regarded the phenomenon as rare or nonexistent. Cotton plants apparently do not produce adventitious buds as long as there are viable axillary buds, even when the plant is severely wounded.

Esau (1953) described adventitious buds as those produced at sites other than axils on obviously differentiated tissues, which presumably include roots as well as shoots. Using such a criterion, there is evidence that some stocks of cotton produce adventitious shoots but only after all axillary buds have been destroyed.

### Materials and Methods

*Production of Shoots from Cambium Outgrowths*

Twelve cotton ('Coker 201') plants were germinated in pots of soil in a greenhouse 12 Feb. 1976. After a crop of bolls had been produced, all plants were excised below the cotyledonary node on 17 May. The stumps remained in the soil and were routinely watered. Outgrowths of what appeared to be callus formed on the ends of eight stumps. The tissue formed a protruding ring, suggesting that the cambium was involved. By 20 June two of the plants had small shoots growing from the tissue masses at the ends of the stumps. One of the stumps was saved, and the newly regenerated shoot grew into an apparently normal, reproductive plant.

*Production of Shoots from Roots*

A single plant of Orinoco, a "houseyard" stock of *G. hirsutum,* presumably from Venezuela, was grown in a greenhouse ground bed for 3 yr. The plant grew to a height of about 5 m and became reproductive. On 5 June 1978, the plant was severed at the ground line and the shoot discarded. By 20 July, several Orinoco-like shoots emerged from the soil around the stump. These shoots grew from globular masses of tissue attached to the roots. One such mass was about 6 cm in diameter. In all there were 17 shoots, the most distant growing about 1.5 m from the stump.

*Production of Shoots from the Lateral Surface of a Stump*

In 1984, seed from the Orinoco plant described above were planted in a greenhouse ground bed. A single plant was saved, and this became reproductive in the second winter of growth. The plant was about 5 m in height and had a stump diameter of 9 cm. The shoot was removed on 12 Apr. 1986, the intent being to duplicate the production of shoots from roots as in 1978. Instead, the lateral surface of the stump developed two small, hemispherical masses of tissue about 1 cm above the ground line, and these gave rise to shoots (Fig. 1). The larger mass proliferated four shoots, and the smaller, which developed at the same level on the stump and about 45° from

**Fig. 1. Stump of Orinoco cotton with two groups of adventitious shoots. Arrow points to perimeter of cut stump (9 cm in diam.). Adventitious shoots emerged from the back side of the cut stump.**

[1] Contribution of the North Carolina Agric. Res. Serv. and the USDA-ARS. Paper no. 10618 of the Journal Series of the North Carolina Agric. Res. Serv., Raleigh NC 27695-7601. Received 14 Aug. 1986.

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Published in *Crop Sci.* 27:349–350 (1987).

the larger mass, grew two shoots. The shoots were removed, and two additional groups of shoots sprouted from the stump, plus one from a root about 2 cm from the stump.

## Discussion

Evidently, some stocks of *G. hirsutum* have the capacity to develop adventitious shoots when provided with the proper stimulus, i.e., the removal of all axillary buds. The data presented, although scant, suggest that the yield of adventitious buds in upland cultivars such as Coker 201 is low. The "primitive" Orinoco cotton seems to have a well-developed capacity for the generation of shoots from roots and/or stumps. I speculate that this might be an adaptation for survival in a savanna habitat where destruction of the shoot by fire is likely to be a frequent event.

## References

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# USE OF GREENBUG BIOTYPE MIXTURES IN EVALUATING WHEAT SEEDLINGS FOR RESISTANCE[1]

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## Abstract

**Currently, no single source of greenbug [*Schizaphis graminum* (Rondani)] resistance in wheat (*Triticum aestivum* L.) germplasm available to wheat breeders provides resistance to all known greenbug biotypes in the field. Therefore, two sources of resistance are being combined in several wheat breeding programs. This requires the evaluation of progeny for reaction to two greenbug biotypes instead of one. Our objective was to test the efficacy of infesting seedlings in the greenhouse with greenbugs of two biotypes simultaneously. Such a procedure, if feasible, could economize breeding protocols. OK81322, resistant to biotypes B and C, a 'Largo' derivative, resistant to biotypes C and E, and $F_1$ and $F_2$ progeny from the crosses of these genotypes were infested with a 1:1 mixture of biotypes B and E greenbugs. All plants of both parental genotypes were susceptible, all $F_1$ plants were resistant, and the population of $F_2$ plants segregated for greenbug resistance. Results indicated that evaluation of breeding material with mixed greenbug populations is reliable, and this technique should be more efficient than conducting separate biotype tests.**

***Additional index words:* *Schizaphis graminum* (Rondani), *Triticum aestivum* L., Insect biotypes, Breeding techniques.**

[1] Cooperative investigations of the USDA-ARS and The Oklahoma Agric. Exp. Stn., Stillwater, OK 74078. Journal article J-5015 of the Oklahoma Agric. Exp. Stn., Oklahoma State Univ., Stillwater, OK 74078. This research was funded in part by a grant from the Oklahoma Wheat Research Foundation. Received 27 May 1986.

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Published in *Crop Sci.* 27:350–351 (1987).

Breeding efforts to develop greenbug [*Schizaphis graminum* (Rondani)] resistant hard red winter wheat (*Triticum aestivum* L.) cultivars were initiated more than 25 yr ago in the southern Great Plains. Typically, segregating early generation breeding material has been evaluated in greenhouse flat tests using techniques described by Starks and Burton (1977). Greenbug cultures composed entirely of one biotype generally have been used for testing purposes. Development of such genetically homogeneous greenbug populations is relatively easy due to the greenbug's asexual (parthenogenetic) mode of reproduction. Until recently wheat breeders have not combined sources of greenbug resistance in breeding programs; however, this is necessary now because no single released source provides protection against all biotypes (Tyler et al., 1986, unpublished data). Evaluation of breeding material segregating for two greenbug resistance genes requires testing against two greenbug biotypes. This is done by testing seedlings in two tests separated in time, using one biotype in each, or by delaying the second test until the next plant generation. A more efficient approach would be to infest seedlings with greenbugs of both biotypes simultaneously. The efficacy of such a procedure has not been tested. Use of mixed greenbug populations in one test would be less laborious and faster than conducting two separate tests. This is an important consideration because of the time required to develop winter wheat cultivars, and because of the frequent occurrence of new greenbug biotypes.

The objective of this research was to determine the feasibility of using mixed greenbug populations for testing populations of wheat plants segregating for two major resistance genes. For a detailed history on greenbug biotypes and sources of greenbug resistance in wheat germplasm, refer to Tyler et al. (1985) and Webster et al. (1986).

## Materials and Methods

Homozygous greenbug-resistant plants of the winter wheat genotypes OK81322 ('Payne'//'TAM W-101'/'Amigo') and 'Chisholm' 4*//'Newton'/'Largo' $F_4$ (hereafter referred to as Largo deriv.), $F_1$ and $F_2$ progeny from crosses of those genotypes, and 'Centurk' were used in the study. Centurk has no genes for resistance, and was included as a susceptible check. OK81322 has a single dominant gene derived from Amigo that provides resistance to greenbug biotypes B and C, but not E (Porter et al., 1982). Largo deriv. has a single dominant gene derived from Largo that provides resistance to greenbug biotypes C and E, but not B (Webster et al., 1986). For description and histories of the Amigo and Largo germplasms, see Sebesta and Wood (1978) and Joppa and Williams (1982), respectively.

Procedures used for rearing greenbugs, biotype determination, and evaluation of wheat seedling resistance were described in detail by Starks and Burton (1977). Greenbug cultures used were derived from field collections made in northcentral Oklahoma, and are maintained on a susceptible sorghum [*Sorghum bicolor* (L.) Moench] during the summer and on 'Wintermalt' barley (*Hordeum vulgare* L.) the remainder of the year. Seeds of each genotype were planted in rows, about 20 to 25 seeds/row, in greenhouse flats (36 × 54 cm) containing soil. The flats were uncaged during the test, which was conducted in a greenhouse under natural light where temperatures ranged from 20 to 28°C. Seedlings