

6. Effects of the *Tu* gene on the tassel.

The *Tu* gene, in addition to causing the development of glumes enclosing the kernels of the ear, has numerous effects upon the tassel. In the homozygous condition it frequently causes the production of massive tassels bearing a mixture of staminate and pistillate spikelets. In some stocks the tassels are monstrous and exhibit varying degrees of male and female sterility. Plants bearing monstrous tassels are usually earless. These facts have led some students of maize to question the possibility that the tunicate character might be a primitive one, once characteristic of wild maize. It is possible by repeated backcrossing to appropriate stocks, especially certain popcorn varieties, to provide the *Tu* gene with a modifier complex in which the tassel is not monstrous but is a normal grass inflorescence quite similar in its botanical characteristics to the inflorescences of corn's relative *Tripsacum*. Nevertheless, it is possible that a study of more or less monstrous tassels in which the several effects of the *Tu* gene are greatly exaggerated might yield valid clues to the mechanisms involved in its effects.

Detailed studies of numerous tassels of *Tu Tu* plants reveal that the sterility which occurs is sometimes more apparent than real. The pistillate spikelets are usually fertile if their silks, which appear about two weeks earlier than those of *tu tu* sibs, are promptly pollinated. The proportion of staminate spikelets is often greatly reduced and on some tassels there are none. On others, the anthers of the staminate spikelets fail to develop completely, especially those occurring in spikelets with massive glumes. In still other tassels the staminate spikelets bear well-developed anthers which are not exerted. These contain normal pollen, which is functional if the anthers are crushed between the fingers and applied to fresh silks. In some spikelets the anthers dehisce and shed their pollen without becoming exerted. The development of functional anthers is promoted by the removal at an early stage of the massive central spike which apparently draws heavily upon the total energy. During the past summer we successfully made a number of pollinations with pollen collected from apparently sterile *Tu Tu* plants.

Detailed morphological studies have also been made to determine how other parts of the tassel are affected by the *Tu* gene. Tassels from sib plants of three genotypes, *Tu Tu*, *Tu tu*, and *tu tu*, were directly compared. The results are shown in Table 7. One effect not shown by these data is the elongation of the rachilla which bears the caryopsis. In occasional spikelets this becomes so long that the kernel is borne on a long stem projecting beyond the glumes.

It is obvious from the data in Table 7 that the *Tu* gene causes a shortening and thickening of the internodes immediately below the tassel as well as the internodes of the branches of the tassel itself. The number of spikelets is greatly increased. The glumes, as well as the lemmas and paleas, are elongated, and there is a marked change in the ratio of total spikelet weight to rachis weight. All of these changes can be attributed to a single basic change, probably of a hormonal nature, which diverts the energy of the plants into its terminal inflorescence instead of its upper, ear-bearing, lateral branches. This diversion is easily prevented by removing the tassels

at an early stage, whereupon the lateral ear-bearing branches usually develop.

Some of the effects of the Tu gene can be duplicated in nontunicate plants by growing short-day tropical maize under short-day treatment until the embryonic tassels begin to differentiate. When short-day treatment is terminated at this point and the plants return to a strongly vegetative phase, the tassels which finally emerge are frequently massive, sometimes pollen-sterile, and usually have elongated staminate glumes similar to those of plants of the genotype Tu Tu.

In modern corn varieties, often characterized by a single thick stalk, the diversion of the plant's energy to a single terminal inflorescence may well result in a state of physiological unbalance and a disorderly differentiation and development of its several parts. In wild corn, perhaps a freely-tillering plant with numerous slender stalks, the concentration of energy in the terminal inflorescences may have produced quite normal tassels. The tunicate character is not per se a monstrosity, although on modifier backgrounds provided by some modern varieties it may become one.

Table 7. Effects of the Tu gene on characters of the tassel.

Characters	Genotypes		
	TuTu	Tutu	tutu
Aver. length of 3 terminal internodes, cms.	8.47	15.17	21.49
Aver. diameter of 3 terminal internodes, cms.	0.65	0.55	0.40
Weight of tassel, gms.	48.4	20.5	5.2
Weight of glumes, gms.	33.6	15.2	2.1
Weight of rachices, gms.	9.3	4.9	1.0
Glume/rachis ratio	3.61	3.10	2.10
No. of branches per tassel.	35	25	18
No. of spikelets per tassel.	2445	1826	1228
Distance between spikelets, cms.	0.16	0.22	0.28
Lower glume length, cms.	1.89	1.48	0.96
" width, cms.	0.57	0.54	0.39
Lower lemma length, cms.	1.84	1.02	0.18
" width, cms.	0.56	0.36	0.18
Lower palea length, cms.	1.27	0.95	0.83
" width, cms.	0.17	0.22	0.24
Upper glume length, cms.	1.91	1.40	0.92
" width, cms.	0.63	0.58	0.37
Upper lemma length, cms.	1.34	0.69	0.65
" width, cms.	0.48	0.22	0.31
Upper palea length, cms.	0.86	0.62	0.77
" width, cms.	0.42	0.20	0.16

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