DISCUSSION

FACTORS INFLUENCING TREE DESTRUCTION DURING THE NEW ENGLAND HURRICANE

COMPARED to hurricanes in the South, the New England hurricane of September 21, 1938, was extraordinarily destructive to trees, both shade and forest, in its path. This seems all the more startling, since the great storms on the South Atlantic or Gulf coast frequently rage for 15 to 20 hours longer, while the high wind velocity of the New England catastrophe covered a period of only about 4 hours.

As it had been the privilege though not the pleasure of the writer to witness, at various times, five different hurricanes in the southern states, the contrast between the results of these so far as trees are concerned and those of the northern hurricane of last fall seemed the more striking and stimulated interest in determining the factors which may have been responsible for the greater tree damage in New England.

In the great Caribbean pine areas in South Florida, which were comparatively untouched by turpentining or lumbering, the great hurricane of 1928 did not affect the contour of these woods, as seen from a distance, to any great extent. True, there were trees blown over here and there, but there was not the picture of annihilation that was represented by the New England woods after the hurricane.

Apart from the obvious thought that the forests of the South, buffeted so frequently by great storms, represent the survival of the fittest to endure these conditions, there are six factors which seem paramount in explaining the greater susceptibility of the northern trees to the gale. These are here enumerated.

(1) *Extremely high wind velocities in local areas.* During the storm there were local gusts of great intensity, taking everything before them, the largest and strongest trees as well as the weakest. There are very few weather instruments in New England for the recording of gust velocities, but the Blue Hill Observatory recorded a gust of about 187 miles per hour and on Mt. Washington, 163 miles per hour. These compare with the strongest gusts of the southern storms. Over the broad path of the hurricane, however, the storm crushed the weak trees, the strong surviving.

(2) *The type of tree prevalent.* This undoubtedly had some bearing. The hard pines of the South are more gale-resistant than the white pines, Norway spruces, willows, poplars, locusts and soft maples of the North. In New England the types of trees standing the storm best were sycamores, oaks, old well-rooted elms and sugar maples, and beech.

(3) *Tree ages.* The age class was very important. The very youngest (under 20 years for white pines, under 30 for hardwoods) and the very oldest survived the gale. The younger trees were more supple, giving with the wind, and were comparatively better anchored in the soil by the tap root, while the very oldest trees were tougher, had deeper and stronger root systems and, due to natural branch spacing, offered less resistance to the wind in their tops. Casualties were greatest in the age range of 30 to 90 or 100 years. Inasmuch as a number of our dominant trees, such as white oak, hemlock and white pine, are known to exceed 500 years in age, a 100-year-old tree may be considered as "young."

(4) *Man-made conditions.* This was an important factor not only in regard to shade trees, but to woodlands as well. Cutting of roots of shade trees in construction of sewers, pipe lines, curbings and the like, thus depriving trees of anchorage, was probably the one most important factor in the destruction of street trees. The loss of shade trees on lawns, greens and commons by overthrow was also disproportionately great. This in many cases may be traced to the giving of lawns precedence over shade trees in regard to treatment, for example—the application of fertilizer for the benefit of the grass over the surface, which tended to stimulate surface root growth of trees, resulting in shallow root systems, poor anchorage and consequent wind-throw.

The nature of the woodlands in the path of the hurricane was important. Most of the woodlands in this area were composed of young trees, usually about 20 to 60 years old, an age range very susceptible to wind damage. This condition had resulted from the excessive and constant cutting of older trees for lumber and fuel. On the other hand, in many places near manufacturing centers, woods were repeatedly cut for fuel when scarcely double the size of broomsticks and, interestingly enough, these young sprout growths under 20 years of age were little damaged by the storm.

Just as the wind damage is greatest in the pine woods of the South, where the trees have been weakened structurally by turpentining or thinning out by lumbering, the destruction to New England woods was greatest where lumbering and thinning had taken place, and to sugar maple groves which had been weakened from various sources, ultimately traceable to the activities of man.

(5) *Insect and fungus trouble to trees.* There has been in many parts of the hurricane area during the past few decades excessive defoliation of shade trees by insects, such as the gipsy moth, elm leaf beetle and cankerworms. The cumulative result of years of this damage was decided weakening of the trees. Borers and bark beetles gained a foothold leading to infection by wood rot fungi. A large proportion of the hurricane-damaged trees had been structurally weakened by borers and wood rot fungi, prior to the storm.

(6) *Soil conditions.* Tree damage was particularly

great where hardpan or underlying rock restricted root growth, while the wetness of the soil due to four days of rain prior to the storm was an important factor in weakening the anchorage of shallow-rooted trees.

There has been a lesson to be gained from the hurricane by every one interested in trees. While New England may not be visited again by so great a storm for another hundred years or more, the factor of wind destruction to trees is always with us to a greater or lesser extent and the planting of sturdy varieties and proper care of our valuable shade trees should lessen and restrict to a considerable degree storm damage in the future.

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THE POINT OF ORIGIN OF THE BLOSSOM-INDUCING STIMULUS[1]

THE use of such techniques as grafting,[2] defoliation and the exposure of different parts of the plant to unlike photoperiods[3] has given rise to the belief that a "flower-forming hormone" originates in the foliage near the tip of the plant. The classical experience of inducing plants to flower by girdling would suggest that the leaves may not be the exclusive means of control of the blossom-inducing stimulus.

To observe the response of some plants to the transfer of the flower-forming substance by grafting, flowering and non-flowering plants of *Cosmos sulphureus* var. Klondike, morning glory, var. Heavenly Blue, *Petunia,* poinsettia, soybean var. Biloxi, stock (*Matthiola incana*) var. Xmas pink, tobacco var. Maryland Mammoth and *Xanthium echinatum* were grafted by the approach method, a modified tongue being used. Positive results were secured with morning glory, *Petunia,* soybean and *Xanthium,* the "donor"[3] plants stimulating the "receptors" to produce blossoms. The state of growth of the plants as well as the cultural environments appear to affect the results secured from grafts. For example, deflorating the *Xanthium* donors increases their influence. Flowering was not initiated by grafting in the case of plants of *Cosmos,* poinsettia, stock and tobacco.

It appears that a successful transfer of the flower-forming stimulus by a graft contact depends upon whether the species being used will give a systemic or local response to a photoperiod treatment of only a part of the plant. Exposure of a part of a morning glory, *Petunia,* soybean or *Xanthium* plant to the proper environment induces flowering throughout the plant. *Cosmos,* poinsettia[4] and tobacco, on the other hand, give local responses, as the part being exposed to the proper photoperiod comes to flower and the remainder stays vegetative.

The older receptor branches of *Petunia* in a warm environment blossomed in short days before the younger donor branches which were exposed to long days. That is, it appears that the presence of flowers is not essential to the functioning of branches as donors of the stimulus to flower.

Poinsettia and tobacco plants were induced to blossom in a warm, short-day location, contrary to their habit,[5] by the application of a current of cool air to a short length of the stem some three to four inches below the tip of the plant. These species were also stimulated to blossom in warm, short days by wrapping a taut rubber band about the stem a few nodes below the tip to constrict it.

The variable responses to grafting and to donor branches depending upon the flowering habit of the species and the effects of a "temperature girdle" and banding in causing blossoming indicate that the stem of the plant plays a part in the appearance of blossoms as well as does a leaf-formed hormone-like substance.

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[1] Published with the approval of the director of the Agricultural Experiment Station.

[2] M. Ch. Cajlachjan, *Compt. Rend. Acad. Sci. U. R. S. S.,* 18: 606–612, 1938.

[3] K. C. Hamner and J. Bonner, *Bot. Gaz.,* 100: 388–431, 1938.

[4] R. H. Roberts, J. E. Kraus and N. Livingston, *Jour. Agr. Res.,* 54: 319–343, 1937.

[5] R. H. Roberts and B. E. Struckmeyer, *Jour. Agr. Res.,* 56: 633–678, 1938.

ON DESLOTHING THE SLOTH

DURING several visits to Panama and while making other observations, the possibility of raising the level of activity of the sloth made an interesting appeal. Considered academically and also to test the action of certain substances or conditions, this animal makes an excellent subject. Its basal level of movement is exceedingly low, and increments may readily be observed. Other features make it almost ideal for study, including its ease of handling and training and the plentiful supply in the tropics. Tests were made on both two-toed and three-toed species, the experimental work having been carried out mainly at Barro Colorado Island Laboratory, Canal Zone, and Gorgas Memorial Laboratory, Panama. It may be said that several ways were found of speeding up their activities.

Recognition that the body temperature of the sloth is normally much lower than that of other mammals suggested a temperature test. Mere exposure to the tropical sun for an hour or two raised the rectal temperature 4° or 5°, and thereupon the activity of the animal became much greater. This was evidenced by its rate of travel along the under side of a twelve-foot horizontal pole, timed by stop-watch. Again, setting up an emotional reaction in the sloth, by simple feints and passes before it, augmented its speed very markedly. Extract of the adrenal cortex made in this labo-