

SOME EFFECTS OF LIGHTNING ON TOMATO PLANTS

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On September 29, 1932, a furious thunderstorm passed over the Sub-Tropical Experiment Station near Homestead, Florida. Five days later the writer's attention was called to a field about a mile west of the Station in which there was an elliptical area of dead tomato plants. The cause of the trouble was ascribed by the owner, Mr. Morris White, to lightning and this was vouched for by negro laborers who were sitting in an automobile during the storm within a few rods of where the lightning struck.

The field in which the plants were set was a five-acre plot surrounded on two sides by a citrus grove, on one side by pine woods, and on the remaining side by an asphalt road. The characteristics of the "soil," as it might be called, are different from those to be found in most any other locality in the United States. The virgin "soil" is a porous conglomerate limestone of the Miami series that outcrops in all the "pine-lands" south of Miami, Florida. As is the common practice in this locality, the limestone, which is quite fragile, had been scarified and made tillable by combining the rock fragments with the red clay soil (Fig. 1) found in the pockets and interstices of the limestone.



Fig. 1. A tomato plant struck by lightning in which the injured central portion of the stem is ribbed and free of leaves and suckers, while suckers developed at each node below and above the injured portion. Note rocky soil. Photographed November 19, 1932, by W. M. Fifield.

At the time the writer first visited the field the plants in the affected area were being reset but examinations were made of the plants in the area along with a survey of the amount of damage done. It was found that the area in which the plants had been killed or damaged was somewhat elliptical in shape measuring 32 feet by 45 feet, with the greater

diameter parallel to the rows of tomato plants. Within the area 107 plants, set eighteen inches apart in the row, with a space of five feet between rows, had been killed or so badly damaged that they had to be reset. Regardless of the fact that there had been occasional heavy showers between the time the lightning struck and the time the writer first visited the field there was still unmistakable evidence, preserved by the rocky characteristics of the soil, that the lightning had struck in the center of the affected area. At this point there was a small jagged hole, about an inch and a half in diameter, bored into the limestone rock to a depth of eighteen inches. Extending three feet on either side of the hole and almost at right angles to the rows of plants was a U-shaped trough about six inches across and three inches deep. The rows of tomato plants extended east and west. It would seem from the conditions just stated that the direction which the lightning bolt may travel has nothing to do with its destructiveness as far as herbaceous plants set in rows is concerned for in this case, as already stated, and in another instance¹ the greater damage was in the direction of the rows of plants.

An examination of the plants in the affected area showed that conditions were similar to those reported by Brown and Gardner² in that "the plants at the center were killed and the severity of the injury became less towards the outer limits of the area. The interesting feature was that the plants showed, among other symptoms, typical "hollow-stem," a condition characterized by the collapse of the pith within the stem. At the time the writer first examined the tomato plants in the damaged area those plants nearest the center were dead above ground and the tap root of the plants had begun to turn brown and become slimy. The aerial parts of the stems that had died had completely collapsed to their tips and had become shriveled and prominently ribbed or angular, but that portion of the plant below ground had not shriveled even though cross sections of the tap root showed that the pith had collapsed to the tip. Examinations of plants located about half way between the center and outer edge of the affected area showed a somewhat different condition. At this distance, the plants, which were about twelve inches high at the time the lightning struck, had shriveled at the ground line or a little below to a point about half way up the stem. In these plants the distance that the pith had collapsed above and below the shriveled portions of the stems also decreased. The outside portion of the upper part of the stem appeared to be perfectly normal, although the plants were lying prostrate on the ground because the lower part of the stems could not support the tops. A comparison of cross sections of the stem from the shriveled portion of plants in the lightning-affected area with cross sections of corresponding portions of plants outside the damaged area showed a condition similar to that reported by Weber³ for potatoes in that "the vascular bundles occupied very nearly the same amount of area in the injured stems as in the healthy ones, showing that this tissue suffered very little injury. This may account for the turgidness of the foliage of the prostrate plants."

¹ Weber, G. F. Lightning injury to potatoes. *Phytopathology*, 21:213-218. 1931.

² Brown, H. D., and Max W. Gardner, Lightning injury to tomatoes. *Phytopathology*, 13:147. 1923.

³ Lit. Cited. 1931.

At the periphery of the area affected by the lightning the amount of damage to plants had decreased to such a degree that only a few of them were injured. Those that showed injury were only slightly ribbed over a short portion and, although the stems drooped somewhat in most cases, they were turgid enough to maintain a nearly upright position.

So far as the writer has been able to learn, no one has previously reported on any abnormality that might develop in those plants less seriously injured by lightning when allowed to continue growth. It was the privilege of the writer to observe from time to time the 34 injured plants left to grow around the outer edge of the affected area. These 34 plants, without exception, developed so abnormally that they could readily be distinguished from the undamaged plants in the remainder of the field. One strikingly noticeable characteristic of these plants was their squat appearance. The main stems grew but a little taller than they were at the time the lightning struck but became bushy by the growth of an unusual number of short suckers on the stem. These suckers, in all cases where microscopic examinations were made, appeared to be perfectly normal in structure but were short and spindling. This condition came about, no doubt, from the fact so many of them developed on the stem.

One interesting fact noted in regard to the growth of suckers was that none of them originated in that part of the stem which showed injury indicated by the ribbed condition. In all instances the suckers grew either above the injured portion of the stem or below it near the ground line. (Fig. 1.) Another characteristic noted during the period of time these plants were observed was that practically all the injured plants shed their leaves in the injured area of the stem. In some cases where no, or very few, suckers started from the ground line the plant took on a peculiar appearance; there being nothing but the bare stem for some distance up the plant and then this was topped by a dense growth of leaves and short suckers. These plants might be said to have resembled somewhat an inverted featherduster stuck in the ground. Others of the injured plants that put out suckers from below the shriveled area assumed a more bushy appearance that might be compared to a low hedge plant.

One of the most striking things noted by the writer in his examinations from time to time was that the terminal bud in all the injured plants finally died. Without a single exception the plants, upon resuming growth, began its upward growth from the bud in the axis of the uppermost leaf. This would seem strange as none of the axillary buds, to all appearances, were damaged above or below the shriveled part of the stem yet the terminal bud of every injured plant was killed. In all probability the death of the terminal bud was one of the reasons why the plants suckered out and became so bushy.

Considered from the standpoint of productiveness the injured plants were worthless. During the entire season they produced but little fruit and none of commercial value. Most of the vines produced but few flowers and then shed the greater portion of these. The fruit that was set by these plants ripened so small that it had to be discarded as culls, although it appeared normal in other respects.

