Effects of Defoliation and Topping Simulating Hail Injury to Soybeans

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SIMULATED hail damage experiments are conducted primarily to provide information (1) to ascertain ultimate damage to a growing crop and (2) to understand better the physiological processes of plant recovery. For the most part, past investigations were made with an attempt to imitate actual hail injury. Since hail causes many kinds and degrees of damage, considerable difficulty has been encountered in translating resultant data into information useful in determining the extent of injury. Past investigations involving mutilation to soybeans have indicated that the component factors contributing to the ultimate damage should be considered relative to both their separate and combined effects at various stages of growth. Certain components contributing to simulated hail injury on soybeans have been reported in research bulletins by Camery and Weber (3) and Kalton, et al. (4). These components were defoliation percentages, stand reductions, breakages, and shattering and were inflicted at various stages of growth.

This paper is supplemental to these research bulletins. The objective of this study was to examine separately and collectively the effects on seed yield, other agronomic characters, and seed composition of soybeans attributable to defoliation and topping performed at different stages of growth. Literature dealing with this subject has been cited extensively and reviewed in the research bulletins listed above.


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MATERIALS AND METHODS

The Richland variety, because of its use in previous investigations on simulated hail injury, was selected for these experiments conducted on the Agronomy Farm, Ames, Iowa, in 1951 and 1952. Plots were drilled May 19 and 14, respectively, in rows 18 feet long, spaced 40 inches apart, at a rate of 1 bushel per acre. At harvest all plots were trimmed to 16 feet in length. An average stand of 7 to 8 and 10 to 11 plants per linear foot of row was obtained in 1951 and 1952, respectively.

Plants at three different stages of growth were subjected to defoliation percentages within three levels of defoliation, with each repliced four times. A split-plot design was employed with levels of defoliation and topping percentages within three levels of defoliation (see table 1). Thus, 45 treatments were made for oil and protein percentage and for iodine number of the oil.

Defoliation percentages used were: 0, 50, and 100. For 50% defoliation, one-half the leaf tissue from each node (figure 1 A and B). Cotyledons were removed. Each node on the main stalk above the unifoliolate leaf node was counted as bearing a trifoliolate leaf. Topping was done by pulling the terminal bud and the half of the center leaflet of each trifoliolate leaf above the next node (figure 1 C). Cotyledons were removed. Each node on the main stalk above the unifoliolate leaf was counted as bearing a trifoliolate leaf.

Topping was done by pulling the terminal bud and the first partially unrolled trifoliolate leaf from the brittle portion at the top of the plant (figure 1 C). Topping consisted of topping 0, 25, 50, 75, or 100% of the plot.

EXPERIMENTAL RESULTS

For brevity, stages of growth usually are described by the numerical stage or stages which correspond to the numerical stages. Calendar dates for stages of growth (table 1) were not used because planting date and seasonal variation of the 1951 and 1952 seasons was abnormally delayed growth although precipitation was above normal in 1951 and slightly below normal in precipitation; these factors hastened growth and maturity. Plots were kept weed-free. In both years, the plants ripened before frost and harvesting and threshing was completed under excellent conditions.

Characters studied included seed yield, days to first bloom, plant height, lodging, seed weight, and seed oil content. Analyses were made for oil and protein percentage and for iodine number of the oil.

Defoliation percentages used were: 0, 50, and 100. For 50% defoliation, one-half the leaf tissue from each node was removed by pinching off one side leaflet and the terminal lobe of each leaflet of each trifoliolate leaf above the next node (figure 1 A and B). Cotyledons were removed. Each node on the main stalk above the unifoliolate leaf was counted as bearing a trifoliolate leaf.

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