The Effect of Lodging on Spring Oat Yields and Test Weight

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Frequently the oat crop is subjected to windstorms during the period from heading to ripening, which may result in varying degrees of lodging. Factors which may indirectly increase lodging by windstorms are genetically weak straw, high rainfall, relatively high temperatures, and high or unbalanced soil fertility levels.

Although it is common knowledge that yield and quality of grain are reduced by lodging, little information is available as to the actual amount. Harlan and Martini (2) and Welton and Morris (4) referred to the fact that early lodging reduced small grain yields more than late lodging. Egorov (1) measured the effects of lodging in wheat by harvesting lodged and non-lodged areas in the same field. He found that lodging adversely affected yield, test weight, and kernel weight. Sisler and Olson (3) studied the effect of both time of occurrence and degree of lodging on barley, as determined by artificially-lodged plots. As lodging became more severe and as it occurred earlier in the period from heading to maturity, reductions were found for yield, weight per bushel, and kernel weight.

No references were found of studies reporting measured effects of lodging on oats. A thorough knowledge of these effects would enable an oat breeder to better evaluate the effect of straw strength on yield. An understanding of some of these effects might also explain some of the rather common, significant yield interactions of variety by year or variety by location encountered in oat yield trials.

MATERIALS AND METHODS

Clinton oats were artificially lodged on the Agronomy South Farm, Urbana, Ill., during the years 1951, 1952, and 1953. The seeding rate was 2 bushels per acre. Individual plots were 12 feet long and 4 rows wide, with the rows spaced 8 inches apart. The two center rows of each plot were harvested to determine yields.

The plots were artificially lodged at two dates, 4 days after heading and 20 days after heading. Two angles of lodging, 45° and 90° (or flat), were compared to erect plants.

In 1951, lodging was accomplished by driving 2-inch square wooden stakes into the ground at the end of the oat rows and stretching twine between them to obtain the desired angle of lodging (figure 1, left). This was not entirely successful, as the resistance of the oat plants tended to pull the stakes together. The use of additional stakes within the row also proved to be unsatisfactory.

Concurrent with the 1951 experiment, Sisler and Olson (3) reported their results of artificial lodging studies with barley. In 1952 and 1953 the method used to induce lodging was similar to the one used by these investigators (figure 1, right). Two-inch mesh wire was stretched about 18 inches above the ground, and the oat plants were allowed to grow through the wire. On the selected lodging dates the wire was gently moved in a horizontal direction until the desired degree of lodging was reached and then refastened. Some upward bending occurred from growth following the early lodging treatment. The wire netting, along with stakes and guide wires, was used to maintain the check plots in an upright position.

During the 1951 trials it was noted that some of the grain on the completely lodged plots was destroyed by field mice. Because of this, and because of the fact that degree of lodging on the treated plots was not always maintained, the yield data for this season were of doubtful value; thus, they are not reported herein. In 1952 and 1953, when the data presented in table 1 were obtained, the field-mouse problem was eliminated by spraying all oat plants with a chemical animal repellent.

RESULTS

All lodged plots yielded less than upright plots (table 1). The average yield of the early-lodged plots was 10.2 bushels less than the yield of the late-lodged plots and 17.2 bushels less than the yield of the upright or check plots. Plants lodged 90°, as compared to plants lodged 45°, yielded 15.7 bushels less at the first lodging date and 9.8 bushels less at the later lodging date.

When orthogonal yield comparisons were made between individual treatments (table 2), significance was noted each year for (a) lodged vs. erect, (b) early vs. late lodging,