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BOTANY

Experimental Growth of Wild Rice in Relation to Water Levels, Seeding Densities, and Fertilizer Application

Studies concerning the ecology of wild rice (*Zizania aquatica* L.) were conducted at the Quetico-Superior Wilderness Research Center, Basswood Lake, Lake County, Minnesota. Emphasis was placed on experimental investigation of the effects of various water levels and water level changes, various seeding densities, and fertilizer application on growth of the plant. Wooden boxes, 20"x20"x12" deep, filled with lake-bottom muck and planted with wild rice seed, were suspended by ropes from large raft frameworks in Basswood Lake. Depth of the boxes beneath the surface could be adjusted individually at any time during the study. The chief advantages of the method were that it permitted growing the plant in natural lake waters and that it allowed water level control, regardless of natural fluctuations in lake level. The types of conditions established were:

1. Stability of water level; plants were subjected either to constant or changing water levels, with 2 feet and 4 feet the constant levels used;

2. Direction of change in water level, either increasing or decreasing;

3. Growth stage during which water level change occurred, either an early (pre-floating-leaf) or later (floating-leaf) stage;

4. Amount of water level change, either 6 or 12 inches;

5. Rate of water level change, either 2 or 7 days per amount of change.

In the group which had water levels changed, each box was subjected to one of the conditions listed in each of the above categories. All boxes except those at a constant depth of 4 feet were

started at a depth of 2 feet (depth of the muck surface in which the plants were rooted, beneath the surface of the water).

Results were as follows: Rate of development (progression from one growth stage to another) tended to be inversely related to the depth of water in which the plants grew, although the relationship was not a linear one, and there was considerable variation within each group. Using the growth of plants at the constant 2-foot depth as a comparison, decrease in water level tended to accelerate plant development, and increase in water level to retard it. The above findings are in general accord with field observations by other workers. Plants undergoing water-level decrease during the pre-floating-leaf stage developed faster than those subjected to the same change in the later stage. No consistent differences were observed with respect to rates of change. Decrease in light with increasing depth is considered to be the most important factor concerned in the differences in trends.

In the seeding-density and fertilizer experiments, 3 seeding rates were used, 10, 100, and 500 seeds per box (each box having a surface area of approximately $\frac{1}{16}$ milacre). The fertilizer used was 60-20-20, with blood meal as the source of organic nitrogen. All plants in these experiments were rooted at a depth of 2 feet.

Results were as follows: values for fertilized plants were consistently higher than those for corresponding categories of unfertilized plants in survival percentage, mean air-dry plant weight, percentage of flowering plants, mean length of flowering stems, multiple-stem formation (except in the 500-seeds-per-box category, where no multiple-stem formation occurred for either group), and in estimated maximum grain production, the estimate being based on counts of grain pedicels. With the exception of survival percentage, values for each of the above characteristics tended to increase as seeding density decreased. There was no consistent trend in survival percentage, with respect to seeding density. When production values were converted to a per-acre basis from a per-plant basis, however, total production generally tended to increase with increasing seeding density. There was a marked parallel in trends between mean plant weight and grain production. The ratio of *grain produced/grain planted* tended to decrease with increasing seeding density; in the 500-seeds-per-box

group approximately the same amount was produced as planted for the fertilized plants, but considerably less was produced than planted for the unfertilized plants.

Differences in amount of nutrients and light available to each plant are considered chiefly responsible for the difference in trends between treatment groups.