GRAIN PRODUCTION AND WATER USE OF WHEAT

AS AFFECTED BY PLANT DENSITY,

DEPOLLATION AND WATER STATUS

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SUMMARY

A study was made of the effects of plant density, defoliation and water status on grain production and water use by wheat under community conditions. The role of the flag leaves and lower leaves in grain production and water loss was assessed and the effects of water stress on the ear and grain were followed.

Three experiments were conducted during 1964 and 1965. Experiment A was a field trial in which three levels of defoliation, (a) removal of all leaves at the ligule, (b) removal of all leaves except the flag leaf, and (c) no leaves removed (control), were imposed on four occasions between the boot stage and maturity. Experiment B was conducted in four large lysimeters in the glasshouse. The leaf laminae and dead material below the flag leaf were removed from half of the plots at anthesis, and the water use and root growth were followed. In Experiment C, a major glasshouse trial, wheat communities were established in long narrow water-tight boxes. The same three degrees of defoliation as those in Experiment A were imposed on six occasions from flag leaf emergence to maturity. Two water treatments were imposed; one to maintain plants under water stress, the other aimed at non-stress conditions.

The experiments showed that in a community of
plants (as in spaced plants), the lower leaves contribute little to the grain yield during the period after anthesis. However when soil nitrogen was deficient removal of the lower leaves depressed the yield of grain and dry matter. The upper portion of the shoot and the ear are the main sources of carbohydrate for the grain. Attention is drawn to the importance of the flag leaf as a source of carbohydrate for the developing ear and stem during the period from its own emergence until the emergence of the ear. The experiments also showed the vulnerability of the wheat plant to water stress during this period prior to ear emergence; water stress reduced both ear emergence and the fertility of those ears which emerged. The dependence of evapotranspiration on leaf area and on the availability of the water supply was established. Water stress did not increase the efficiency of water use and in fact decreased the efficiency in terms of grain production. Removal of the lower leaves after anthesis increased the efficiency of water use but did not increase the economic yield even in the low water regime. It is considered likely that appropriately timed leaf removal would increase yield when water stress becomes operative after anthesis.