

## THE RATE OF TRANSPIRATION IN TWO OATS VARIETIES GROWN UNDER VARYING SOIL MOISTURE LEVELS

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Studies are being made in the laboratory of plant physiology at the University of Illinois on the metabolism of cereal grasses. Considerable emphasis has been placed on the relationship of the nitrogen metabolism to the vitamin content during the growth period. It is obvious that if the plant is to be used commercially as a protein source, it will be advantageous to get maximum protein content and dry weight yield. A continuous chronological study of the metabolic changes during the various growth stages of the plant from the vegetative to the reproductive phase through maturity is required.

There are several stages of plant development that may be distinguished by a detailed chemical analysis of the plant tissue. Burd (2) divided the growth of barley into three periods: a preliminary period of eight to nine weeks from planting characterized by intense vegetative activity; a second period of about six weeks during which structural differentiation takes place and flowering occurs; a third period of about three weeks characterized by a loss in weight and by desiccation of all parts of the plant. As an indication of these various stages of growth Burd noted that at the beginning of the second period there was a sharp decline in the moisture content of the leaves. At the beginning of the third period there was another decline in the moisture content of the leaves.

Loehwing (3) and his associates studied mineral nutrition in relation to reproduction in higher plants. The results showed that important metabolic, as well as structural, changes originated in the period between the origin of floral primordia and full bloom. With pot culture studies under conditions of adequate mineral nutrition there occurred a sudden and thereafter continuous increase in the rate of transpiration at about the time of flower inception. Tissue analyses

showed that the plants actually underwent a change in water balance toward the direction of lower water content. Frequently the increase in transpiration and change in water balance could be noted before the appearance of any visible floral structures. The experiment reported here was set up to study the varietal differences of oats in respect to the relation between changes in their water balance and morphological differentiation.

Two varieties of spring oats, Kherson and Illinois 30-2088, were seeded in glazed porcelain pots each containing 8 kilograms of composted Flanagan silt loam. The coleoptiles appeared three days after seeding. The plants were uniformly watered until the first leaf was 5 cm. high. Water was then added or withheld from the soil so that 10 pots, each containing 10 plants, were maintained at soil moisture levels of 15%, 22.5%, 30%, 37.5% and 45%. The water holding capacity of the soil was 66%. The pots were weighed three times a week and the desired moisture level maintained by adding water. Part of the water was added to the surface and part to the lower levels by means of inserted glass tubes.

Twenty-eight days after seeding a sudden increase in transpiration was noted in both varieties grown at all soil moisture levels (Fig. 1). An examination of the stem and growing point showed that the stem was starting to elongate and the growing point was beginning to differentiate. Bonnett (1) found that the oat stem passed through two stages of development. In the first stage the growing point remained short, the leaf initials differentiated, the leaves grew, and tiller buds developed in the axils of the leaves at the base of the stem. In the second stage the internodes of the stem elongated, and the branches, spikelets, and flower parts differentiated

and developed. The results of this experiment would indicate that the sudden increase in rate of transpiration took place at the beginning of the second stage.

In both varieties grown at all soil moisture levels, the peak of transpiration was reached on the same day. After an initial fall the rate of transpiration again rose. It was at this period that the two varieties differed. The Illinois 30-2088

rapidly regained a high rate of transpiration which was maintained for the duration of the experiment while the Kherson continued transpiration at a reduced level. The total amount of water lost by transpiration was greater at each soil moisture level in the Illinois 30-2088 variety than in the Kherson variety.

If we assume that the higher level of transpiration is related to the morphological differentiation accompanying the

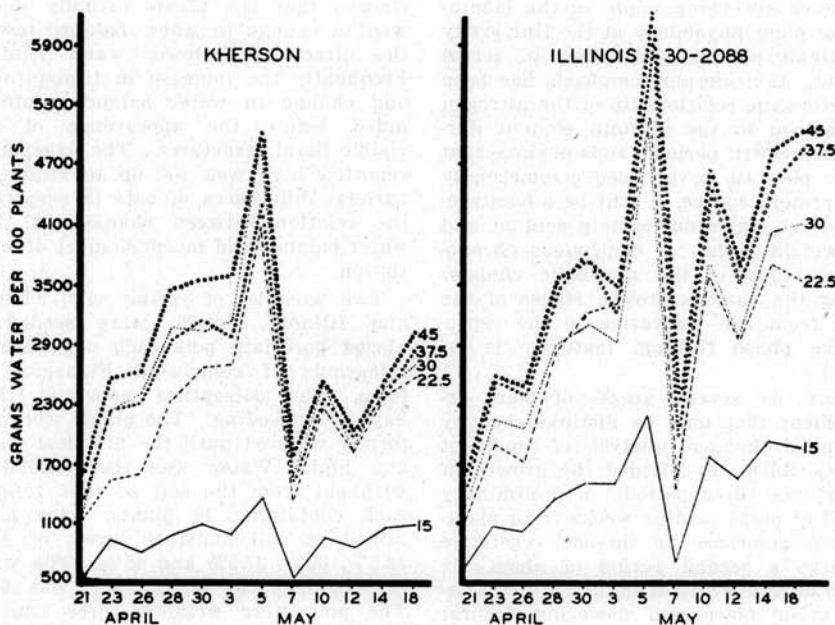


Fig. 1.

TABLE 1.—TOTAL GRAMS OF WATER LOST (100 PLANTS)

	15%	22.5%	30%	37.5%	45%
Illinois 30-2088.....	17117	34504	35184	41785	43493
Kherson.....	11428	26182	30922	30004	33661

reproductive phase, then the Illinois 30-2088 was developing through the reproductive at a more rapid rate than Kherson. This interpretation is further

borne out by the fact that the inflorescences of the Illinois 30-2088 immersed 4-5 days before those of the Kherson.

#### REFERENCES

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