EVAPOTRANSPIRATION OF THE IRRIGATED SUNFLOWER

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Experimental results obtained in different climatic and soil conditions have shown the positive influence of irrigation on the quantity and quality of sunflower yield.

Seasonal and monthly consumptive use data have been obtained by water soil depletion method.

However the evapotranspiration for short periods or on a daily basis are necesary for scheduling irrigation needs.

Lysimetry have proven to be suitable for these purposes. Lysimetry studies on sunflower crop started in Romania at the Irrigation Laboratory of the Research Institute for Cereals and Industrial Crops Fundulea in 1969.

METHODS

Sunflower evapotranspiration was determined in the field by water soil depletion method.

Potential evapotranspiration was determined by Penman and Thornthwaite formulas.

Sunflower variety Record was grown in 1969 and 1970 and the single-cross Romsun 53 in 1971 and 1973. Plant population was 50,000 per hectar. Two lysimeters having 2.2 m^2 each and a depth of one meter, were surrounded by 50 m^2 of sunflower crop. A constant water table level was maintained in lysimeter at 60 cm from the soil surface.

Water came from a basin, above the ground, where dayly evapotranspiration could be red on a glass tube and a scale.

Soil in lysimeter was wetted weekly with 5 to 10 mm of water in order to prevent heavy dryness of the soil surface. A complete water balance was maintained throughout the growing season.

RESULTS

Daily evapotranspiration measurements by lysimetry method (figure 1) have shown differences from year to year. The years 1969, 1970 and 1971 were rich in precipitation but 1973 was dryer than the long term average. However the mean curve can be approximated by an exponential function with a maximum of 5 mm per day in the period from June 20 to July 10.

The total evapotranspiration for the growing season is 512 mm which is not different from that obtained by soil water depletion method.

Daily evapotranspiration data and the total evapotranspiration per growing stages along with plant height measurements are shown in figures 2, 3, 4, 5. One can say that the daily evapotranspiration increases up to mid July folowing the increase of plant height. Head formation period recorded the maximum total evapotranspiration, beeing folowed by the physiological maturity period. These two periods are the longest periods in the growing season. However the maximum evapotranspiration is recorded from head formation to physiological maturity periods and irrigation is necesary in almost all the years.

Cumulative evapotranspiration data are closely correlated with the height of sunflower plant (figure 6).

Lysimetry measurements of daily evapotranspiration (figure 7) show a close correlation with air temperature, wind speed and relative humidity of the air. The high air temperature associated with strong wind and low relative humidity determined a high evapotranspiration value.

Evapotranspiration measurements obtained by lysimetry and soil water depletion methods, were compared with the potential evapotranspiration data obtained by Penman and Thornthwaite methods (figure 8).

There is a close relationship between lysimetry and soil water depletion methods.

The potential evapotranspiration calculated for Fundulea conditions using Penman formula shows a good correlation with lysimetry and soil water depletion methods.

The potential evapotranspiration obtained by Thornthwaite formula and coefficients shows a good correlation only up to July 10. For scheduling the irrigation needs daily evapotranspiration data are necesary and lysimetry measurements or potential evapotranspiration by Penman are suitable.

Correction coefficients from Thornthwaite, Penman and soil water depletion method to lysimetry method are presented in figures 9, 10, 11.

They can be used for scheduling irrigation needs in a computer program available in our Institute. Thornthwaite data can not be used for this purposes because they are long term averages.

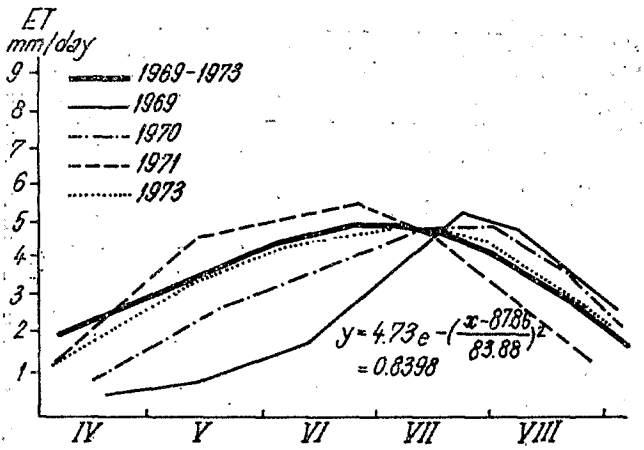

Fig. 1 — Evapotranspiration of a sunflower crop at Fundulea (1969—1973).

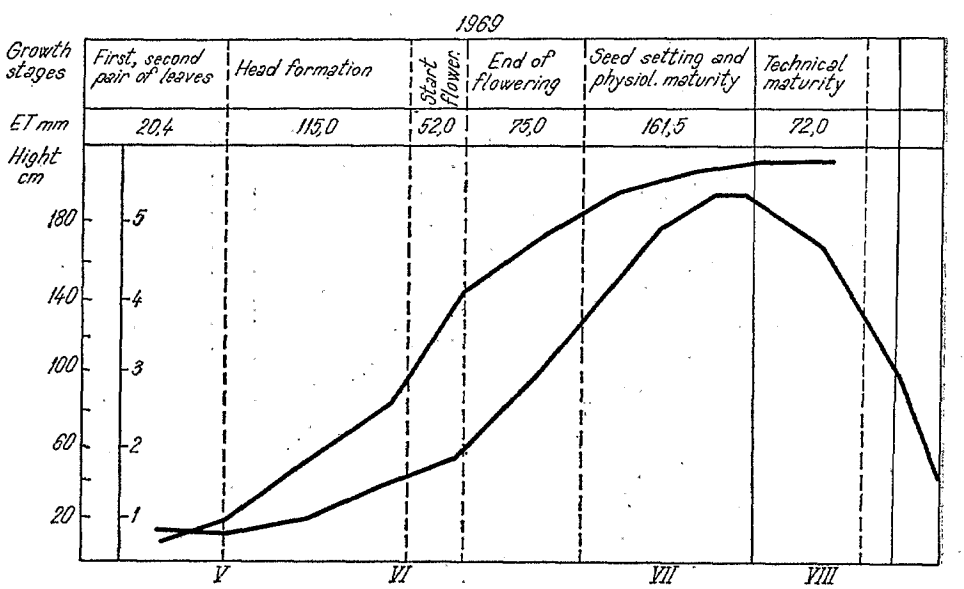

Fig. 2 — Evapotranspiration of sunflower plants in different growth stages (1969).

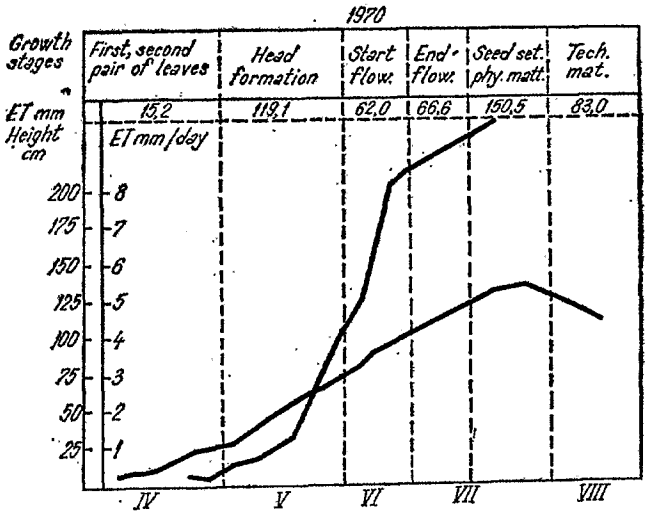

Fig. 3 — Evapotranspiration of sunflower plants in different growth stages (1970).

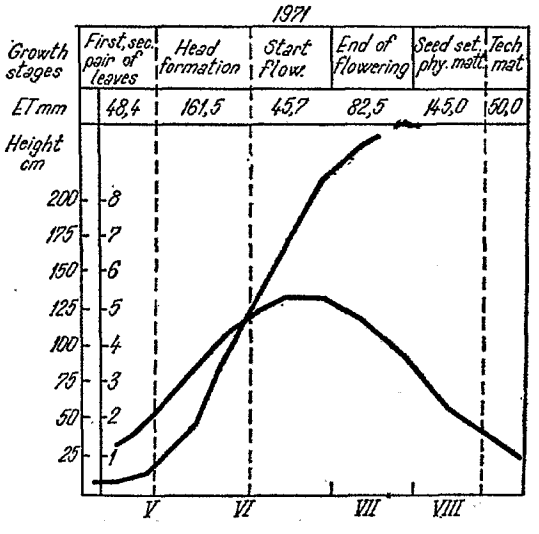

Fig. 4 — Evapotranspiration of sunflower plants in different growth stages (1971).

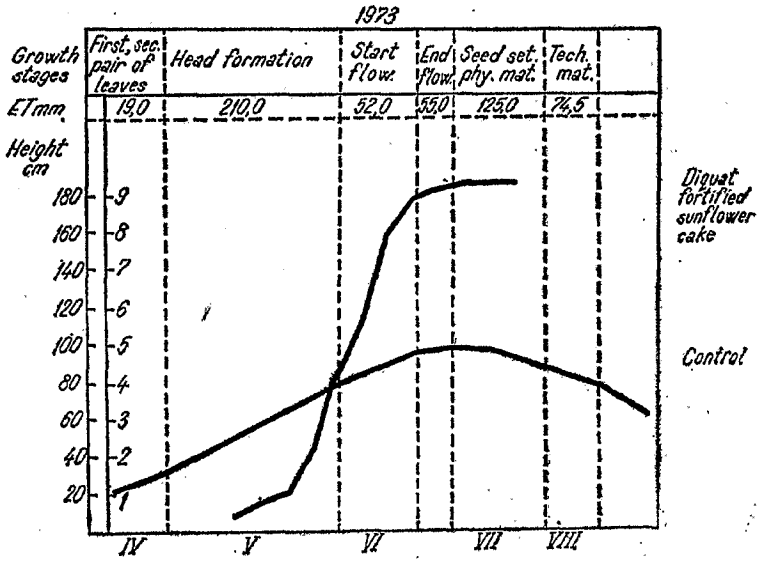

Fig. 5 — Evapotranspiration of sunflower plants in different growth stages (1973).

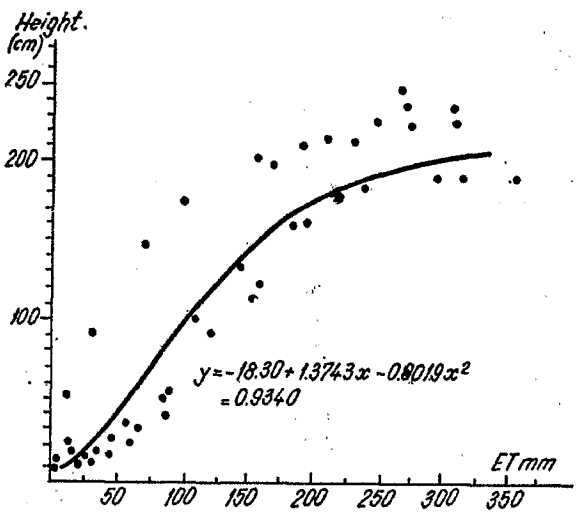

Fig. 6 — Relationship between evapotranspiration and height growth of sunflower plants.

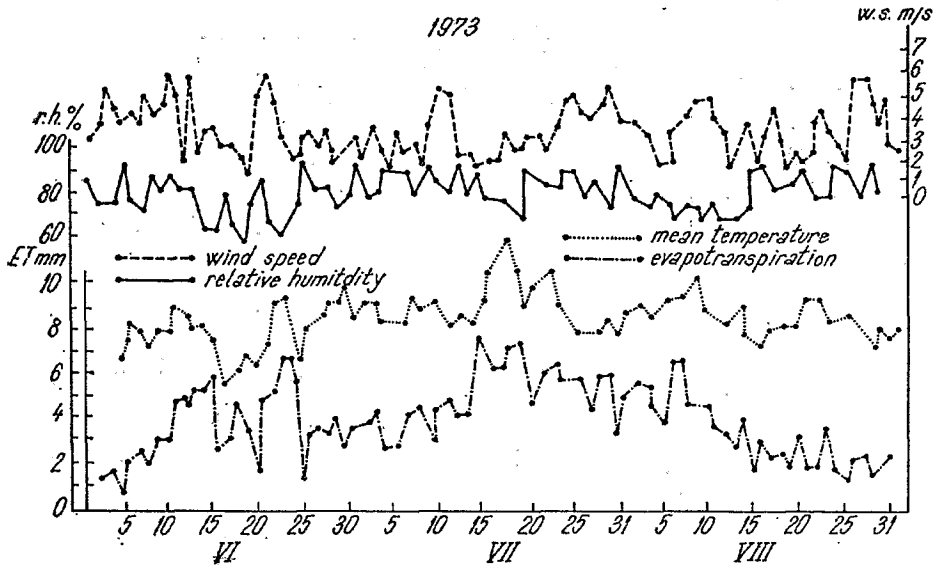

Fig. 7 — The influence of the climatic conditions on sunflower evapotranspiration (1973).

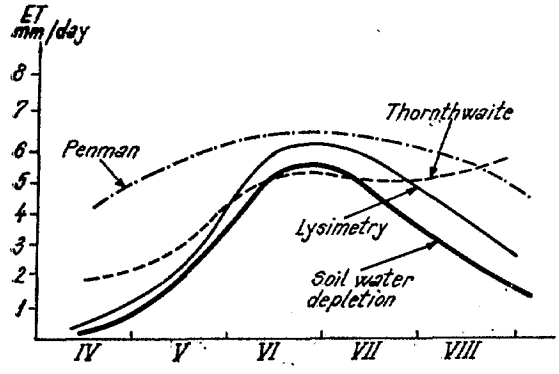

Fig. 8 — Determination of sunflower evapotranspiration by different methods.

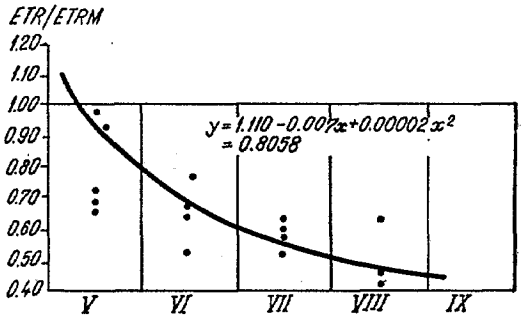

Fig. 9 — Correction coefficients from soil water depletion to lysimeter method.

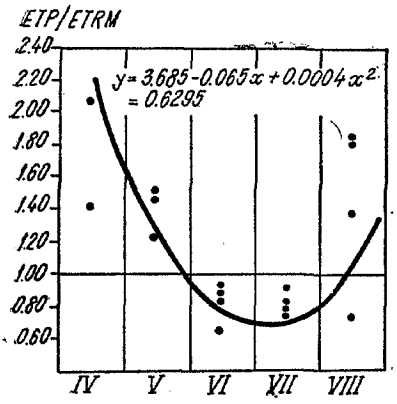

Fig. 10 — Correction coefficients from Thornthwaite to lysimeter method.

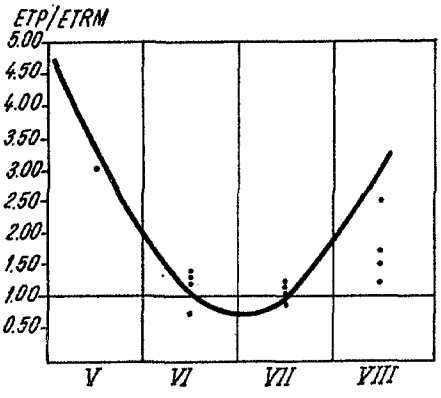

Fig. 11 — Correction coefficients from Penman to lysimeter method.

CONCLUSIONS

1. Evapotranspiration measurements by lysimetry method for the growing season is not different from that obtained by soil water depletion method.

2. Head formation and physiological maturity stages recorded the maximum total evapotranspiration.

3. Evapotranspiration data are closely correlated with the height of sunflower plants, with the air temperature, wind speed and relative humidity of the air.

4. Potential evapotranspiration calculated by Penman formula shows a good correlation with lysimetry and soil water depletion method.

5. The lysimetry measurements or potential evapotranspiration by Penman method can be used for scheduling the irrigation needs.