WATER REQUIREMENT AND YIELD RESPONSE OF CATCH SUNFLOWER (Helianthus annuus L.) CROP IN SOUTHERN ITALY

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SUMMARY

Sunflower was grown as a catch crop on a shallow soil (0.6 m) in 1989 and 1990 in Southern Italy, characterized by high temperature, radiation, evaporative demand and frequent soil water shortage in summer. Water consumptive use and yields were analysed.

Two hybrids (Cerflor and Romsun HS 90), two dates of sowing (25th June and 9th July) and three irrigation treatments (75, 100 and 125% of estimated maximum evapotranspiration) were compared. ETc was calculated from ETo following the evaporation pan method.

Weather conditions were greatly different in the two trial years and the effects of irrigation regimes showed the yield increase from the lowest to the highest water supply.

INTRODUCTION

In Southern Italy, where summer is characterized by high temperature and radiation, the main limiting factor to catch crops is the limited water supply.

The introduction of sunflower as a catch crop in rotations, where possible, would allow a higher farm income and a more complete and beneficial use of agricultural land and of farm resources.

Contrary to other species, sunflower can also uptake water from the deeper soil layers (Ruggiero et al., 1982; Quaglietta Chiarandà et al., 1990) and resist to short stress periods (Losavio et al., 1981) providing acceptable yields even under sub-optimal conditions.

The aim of the present research was to check the yield potentiality of two sunflower hybrids, sown at two different times and grown as catch crops under different watering regimes.

(*) The setting of research and the drawing of the script are due to the 4 authors; the three last ones were concerned with the execution of field trials and the statistical analysis.

MATERIALS AND METHODS

The test was carried on in the 1989-90 period in a typical Mediterranean area (Rutigliano - Bari) in a shallow soil (0.6 m), laying over a fissured limestone, classified as silty-clay (Rhodoxeralf Litic Ruptic following the Soil Taxonomy or Luvisol Cromic - following the FAO), of good fertility with the major chemico-physical and hydrologic properties reported in Table 1.

Twelve treatments resulting from the factorial combination of two dates of sowing (25th June and 9th July), two sunflower hybrids (Cerflor and Romsun HS 90) and three irrigation regimes were compared. In the irrigation regimes frequency was kept constant, the watering volume was changed and three experimental coefficients (0.75, 1.0 and 1.25) were used respectively for the irrigation treatments providing 75, 100 and 125% of ETc calculated by the evaporation pan method (Doorenbos and Pruitt, 1977). A split plot experimental design with 3 replicates was applied, with the dates of sowing in large plots, the irrigation regimes in plots and the two cultivars in 6 x 6.6 m^2 subplots.

Sowings were carried after the harvest of an autumn-winter cereal (oats), after rotary tillage and fertilization with 150 kg ha^{-1} of P_2O_5 and 75 kg ha^{-1} of nitrogen; rows were 0.7 m apart and the amount of seeds used was calculated to obtain a theoretical population density of 6 plants per m^{-2}. Low pressure trickle irrigation was applied by PVC perforated pipes.

Both in 1989 and in 1990 harvest was carried in the first decade of October and at end October respectively for the first and second date of sowing.

The parameters, tested in a 12 m^2 area, included the plant height, the head diameter, its central sterility and the seed yield per unit area on which the weight of 1000 seeds and the seed moisture at harvest were determined.

RESULTS

Figure 1 shows the mean decadal values of maximum and minimum temperature and cumulative rainfall and evaporation rate from class A evaporation pan for the test period.

Rainfall was nearly zero in 1990 (significant rainfall events took place in the second decade of September and in the third decade of October when the crop was close to harvest) and quite im-

portant in 1989 (mostly from sowing till the appearance of the flower bud). As a result of this rainfall pattern, in the test period the evaporative demand of the atmosphere was higher in 1990 (960.5 mm compared with 856.2 mm in 1989).

Maximum and minimum temperatures showed the same trend in the two years except in the second decade of September 1990, when they suddenly dropped and then took higher values than the multi-year average till the second decade of October.

The different weather evolution in the two years did not have any effect on the dates of the main growth stages both in the first and in the second date of sowing (Table 2).

The seasonal irrigation volumes increased, on the average, from 2267 to 3485 m^3 ha^{-1} and from 2861 to 4514 m^3 ha^{-1} respectively in 1989 and in 1990 from the lowest irrigation regime (75% of ETc) to the highest (125% of ETc) (Table 3).

As the seasonal irrigation volume was increased it was observed that: the seed yields per unit area at 10% moisture increased from 2.49 to 2.88 t ha^{-1} (although 2.8 t ha^{-1} was observed at 100% ETc); the plant height increased from 143.4 to 154.8 cm (Table 4). No significant differences were observed between the irrigation treatments compared in terms of head diameter, its sterile area and the weight of 1000 seeds.

The two tested hybrids provided statistically different yields which were although parallel to each other with the increase of the seasonal irrigation volume (Fig. 2); a higher plant height was observed in the Cerflor hybrid (156.4 against 142.2 cm in the Romsun HS 90) and whereas a higher 1000 seeds weight was observed in the Romsun HS 90 (51.7 against 42.3 g of Cerflor).

For the two dates of sowing, except the 1000 seeds weight (49.7 and 44.3 g respectively for the first and second times) no significant difference was found for the height nor for the yield and its other components.

The favourable weather pattern in 1990 (higher evaporative demand, associated to higher temperatures, which occurred during the crop reproductive stage resulting in a higher seasonal watering volume), on the contrary, affected the plant height (164.2 against 134.5 cm), the yield (2.99 against 2.45 t ha^{-1}) and its major components (head diameter, sterile area and 1000 seed weight).

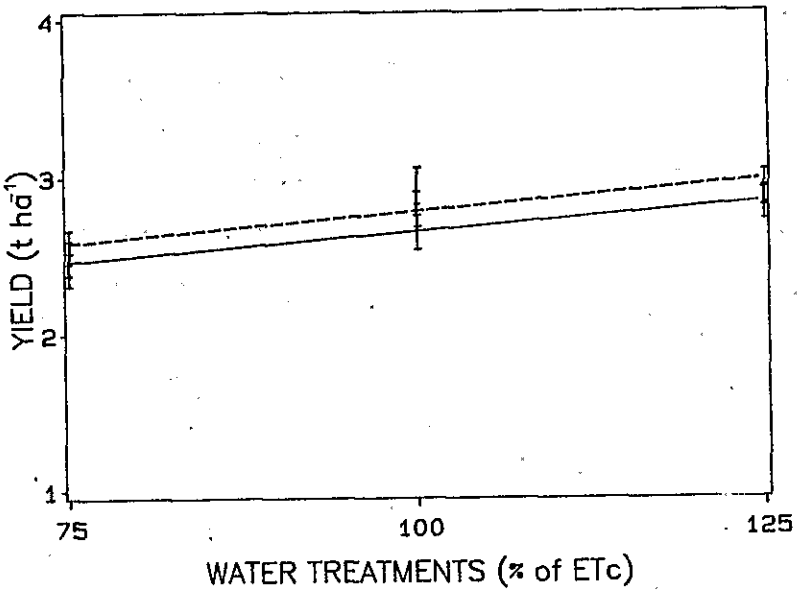

Figure 2 - Linear yield component of two hybrids (——— Cerflor and ------- Romsun HS 90) as a function of the three irrigation treatments.

CONCLUSIONS

Based on the above, the best yield results of sunflower, sown as a catch crop, (after an autumn-winter crop) were obtained applying a seasonal watering volume of 100% ETc, i.e. 3,500 to 3,800 m^3 ha^{-1}.

The delay in sowing (from 25th June to 9th July) did not affect the yield nor its components.

Out of the two hybrids tested, the Romsun HS 90 proved to be more yielding than Cerflor, as observed in other investigations (Losavio and Mastrorilli, 1988).

Moreover, the different weather pattern of the two trial years greatly affected the yield and its components. In fact the high temperatures, occurred in 1990 during the crop reproductive stage, positively affected the seed yield (2.99 t ha^{-1} in 1990 against 2.45 t ha^{-1} in 1989).

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