

IS SUNFLOWER SUITED FOR ZERO TILLAGE DRY FARMING?
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RESUMEN

El interés por proteger mejor el suelo de la erosión y reducir los costos de producción han impulsado el establecimiento de ensayos para reducir el laboreo en las tierras de secano en Andalucía (Sur de la España peninsular).

La experiencia recogida en siembra directa desde los primeros ensayos en 1981 revela que existe una ventaja adicional sobre los sistemas de laboreo tradicional: se produce un considerable incremento en el ahorro de agua, del cual se benefician las plantas. Suceso especialmente patente durante los años secos en los suelos arcillosos de carácter vértico

La siembra directa del girasol sobre rastrojo de trigo produce normalmente mayores cosechas en los suelos de textura arcillosa que los girasoles con las labores tradicionales. Existen, no obstante, algunos aspectos que precisan más estudios y que pueden ser causa de una reducción en la nascencia, posterior desarrollo y producción de los girasoles; tales como la creación, al sembrar en suelo demasiado húmedo, de una suela compactada en el lecho de la semilla que dificulta la penetración radicular en profundidad.

SUMMARY

The increased concern against soil erosion as well as the lowering of production costs have prompted reduced tillage experiments in dryland farming in Andalucía (Southern Spain). The acquired experience so far reveals one additional advantage over conventional tillage systems: there is a considerable increase in water conservation from which the plant benefits, specially in clay soils during dry years.

Direct drilling of sunflower on wheat stubble resulted in higher yields in clay-textured soils than under conventional tillage. There are, nevertheless, several points which deserve further attention such as the avoidance of possible shallow pans which hinder tap root elongation under zero tillage.

INTRODUCTION

Wheat-sunflower is the most popular crop rotation among dryland farmers of Southern Spain. The sunflower cropped area in several provinces represents more than 60% of the total cereal surface.

Until now, sunflower farmers had as a main goal maximizing yield per unit area. However market changes have forced the farmers to modify their objective, tending currently to minimize production costs in order to maximize net profits. One option to reduce costs is to avoid mouldboard ploughing and successive disk-harrowing after the cereal straw has been packed and the stubble burnt. The introduction of new herbicides for weed control and the reduction of tillage to minimum levels has led to new management practices which appear very promising. If the observed trend keeps its actual pace, it is possible that the minimum tillage surface will cover in the near future most of the sunflower area. Nevertheless the experience acquired so far is not enough in view of the highly variable meteorology of the region. At this point it is relevant to examine the current experience to draw several conclusions, in order to respond to the question posed in the title.

MATERIALS AND METHODS

The results from 1983 and 1985 are part of a long-term tillage experiment located near Carmona (Southern Spain $37^{\circ}26'N$; $5^{\circ}38'W$) (Giraldez et al. 1986). The experimental soil is classified as a typic chromoxerent (cracking soil) with high clay content. The trial was established in 1982 following wheat harvest, and three tillage treatments were applied to four replicate plots, each 15 x 180 m long. Treatments were conventional and minimum tillage and direct drilling.

Sunflower crops (hybrid 'Florasol') were sowed on February-10th 1983 and March-24th 1985 in rows 70 cm apart with about 55,000 plants/Ha. Rainfall was 263 mm for the 82-83 season (Sept-July), and 464 mm for the 85-86 season, respectively. Average annual rainfall in the area is 459 mm, mostly distributed between October and March (Fig. n^o 1).

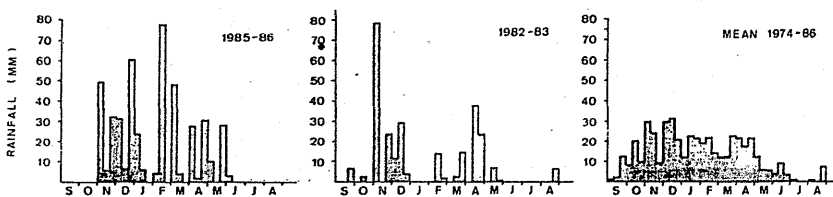


Figure 1. Ten days rainfall (1982-1983, 1985-1986 and mean from 1974-1986) at Tomejil Experiment Station ($37^{\circ}26'N$, $5^{\circ}38'W$).

In 1986 and 1987 a cooperative effort with Monsanto Chemical Co. was launched on 22 farm plots of about 2 to 18 Ha, where the two extreme treatments, zero versus conventionally tilled sunflowers were evaluated.

Usually two herbicide treatments were applied; one during autumn to eliminate weed growth and another one just prior to planting in spring.

RESULTS AND DISCUSSION

The above mentioned meteorological variability affected the results. Therefore it is convenient to present separately the trials on a dry and on a wet year. In 1983 in a long dry spell of several years the sowing was made early in the season when the soil surface moisture was between 16 and 18% on weight basis. Thereafter the scarce rainfall was unable to either recharge the soil profile or to maintain the sunflower water requirements in both tillage treatments. Nevertheless, the higher water recharge in the nontilled soil, and the better water conservation after sowing resulted on a greater biomass in the plants growing in this treatment, as compared to those in the conventionally tilled plots. The annual evolution of soil surface moisture is shown in figure 2. Crop yields are presented in Table 1. Reduced tillage produced the highest biomass as well as the highest harvest index.

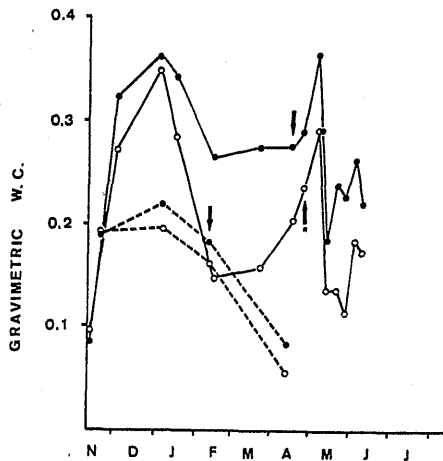


Figure 2. Mean Annual evolution of soil surface (6 cm) moisture during 1982-1983 (dashed lines) and 1985-1986 (solid lines). The data from direct-drilling plots are shown by "circles" and from conventionally tilled by "open circles".

In general, farmers had little or no problems with stand establishment or reduced root growth under no tillage even though 1986 and 1987 were not dry years. Thus our results in 1985 may be due to the long-term effects of lack of tillage since 1982. The favorable responses to no tillage in the majority of the field trials suggest that no-tillage in sunflower following wheat is a viable alternative to conventional tillage practices in the dryland cropping systems of Andalucia. In addition to higher yields and lower production costs, the control of soil erosion via no tillage (Allmaras and Unger, 1985) is perhaps as important under the hilly topography and relatively high seasonal rainfall of South Western Spain.

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