

PRODUCTIVITY OF WINTER SOWING SUNFLOWER (*Helianthus annuus* L.) IN A MEDITERRANEAN CLIMATE WITH COLD WINTER.

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ABSTRACT

The productivity of winter sowing (W.S.) sunflower is studied as an alternative to the conventional spring sowing (S.S.), in a semi-arid cold winter area, in the Central sub-meseta of the Iberian Peninsula.

It was verified a good adaptation of the tested hybrids to the winter conditions, with standing without damage frost at a  $-7^{\circ}$  C, at the beginning of the growth.

The winter sowing had a high capacity of production, its means, an increment of 177% , over the spring sowing. The capacity of adaptation of the TOLEDO-2, the hybrid with a high yield, is highlighted, with  $93,8 \text{ g.plant}^{-4}$  in winter sowing and  $29,6 \text{ g.plant}^{-4}$  in spring sowing. The yield components incremented in the same aspect.

It is very important that the increase in production, it is a consequence of flowering 31 days before in winter sowing, allowing to the sunflower plants make better use of the rainfall and reduce the transpiration.

Based on the scanty profit of spring sowing, in semi-arid areas, this method, is expected to prove interesting compared with the conventional grain production.

## INTRODUCTION

Despite the important farming area which sunflower production has obtained in Spain, and the noteworthy efforts in several national Breeding Programs, have carried out to find new genotypes, with better characteristics for drought resistance, the mean yields are clearly below the potential production of this crop. However, there are marked differences between Spanish Communities. In certain provinces, such as Toledo, mean yields are below the threshold of any kind of productivity; and in the last ten years, sunflower production has undergone a recession in these areas, coinciding with the decreasing of rainfall.

This fallback in mean yield is due mainly to the limited rainfall, that is characteristic of the Mediterranean region, and also it is related with the high evapo-transpiration which it supports for the sunflower crops.

Within the strategies which plants have in their fight against drought, adapting their life cycle to periods, when hydric resources are available, is a good possibility. This is the system which we suggest using in areas where there are cold winter temperatures combined, with a semi-arid conditions. Sunflower is traditionally grown in spring-summertime, coinciding with the plant's natural cycle, and make it coincide better with the rainy periods, and also achieve better efficiency in using available water.

The present survey is aimed at studying in further detail the possibilities of adapting seed production of winter sowing sunflower, in cold winter zones (absolute minimum temperature between 5 and 9°C). This study is based on the calculation of the productivity, yield components, physiological parameters and also the extracted water from the soil.

## MATERIAL AND METHODS

The experiment was developed in Cecosa Breeding Station in Malpica de Tajo (Toledo), with two sowing times in December, as winter sowing and in April as a reference.

The trial was carried out in a random block and four replications, using 6 hybrid genotypes, part of them

commercial and other experimentals.

The productivity, yield components and various physiological development parameters on these genotypes were studied using periodic and systematic registers in the four repeats. Variance analysis and Duncan test were performed using an IBM P5-2, M-50 computer, with SYSTAT program. The water content of the soil was also assessed, at the time of germination, and at harvesting, from 0 to 300 cm, every 30 cm, using a penetration probe and making gravimetric determination. At the same time, the rainfall from September to October, during the agricultural year, was determined.

#### RESULTS AND DISCUSSION

When assessing the productivity of winter sowing sunflower as an alternative to the spring sowing, under experiments performed in Malpica de Tajo, plants were at all times observed that showed normal physiological and morphological growth, which shows that the assayed hybrids adapt correctly to the low temperatures found in the winter months and beginning of spring.

The plant material that was assayed, withstood intermittent frost, without damage, of 7°C, for three days, and continuous night frosts of 3°C. The plants tolerates these kind of temperatures in very juvenile stages, in "pseudorroseta" phase, which we define as an atypical vegetative status of sunflower, where joints are noticeably shortened, and the leaves that have formed are small and medium in size. This is caused as a result of the low temperatures, and constitutes an adaptative response to same.

#### HYDRIC USE

Under both farming systems, the maximum extraction was made at 120 cm. depth, which coincides with what was shown by BERENGENA et HENDERSON (1980), for sunflower on dryland, whereas on irrigated land, the maximum extraction is located at superior levels. In the winter system, water extraction is higher, merely considering the difference between the initial and final hydric curves, but which prove noticeably higher, if we considered the rain contributions during the

are marked differences between the different genotypes; the hybrid TOLEDO-2 this produced a capitulum of a double magnitude, but in other cases, the increase was around 20% only.

#### NUMBER OF ACHENES PER CAPITULUM

As consequence of the higher productive diametre, the number of achenes per capitulum is also higher in the winter system, and there are cases where the differences are particularly marked, the TOLEDO-2 produced 1973 achenes/plant with this method produced 657 achenes/plant in the traditional system.

#### YIELD

According with the yields, when its refer to the biomass aerea, this yields are higher in the winter sowing, although the differences are not so marked as in the achenes production, and its found significantly marked. For that the hybrid TOLEDO-2 turned out to be the more productive in comparison with the hybrids that were tested, obtaining a production of 93.g.plant<sup>-1</sup> as contrasted with a 29,6 g.plant<sup>-1</sup> in the traditional sowing, its mean, an increase in the production of the 320%, this difference is raised, but it is in the same order that Sobrino et al. (1987) indicated in the trials realized in the province of Toledo in 1986/87.

These production levels can be imply a remarkable renovation in the sunflower crop interest, in semi-arid zones with cold winter, that in nowadays these zones, the yield is reduced.

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