

THE NATIONAL EVALUATION OF OIL-TYPE SUNFLOWER CULTIVARS IN SOUTH AFRICA

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INTRODUCTION

The evaluation of oil-type sunflower (*Helianthus annuus* var. *macrocarpus* (D.C.) CkII) cultivars on a national scale in South Africa has contributed markedly to the rapid change within 2 years from mainly open-pollinated varieties to over 90% high performance hybrids in 1979/1980. This programme was initiated in 1974/75 in order to obtain reliable information on the relative performance of oil-type cultivars in the main production areas. The main objective is to supply sunflower growers, extension officers and seed organizations with reliable, technically correct, impartial information on cultivar performance thereby facilitating sound cultivar decisions.

A second and equally important objective is to assist sunflower breeders to rapidly and thoroughly test the performance of new cultivars. This rapid testing of new cultivars is essential to enable seed companies to speed up the introduction of outstanding cultivars with a resultant benefit to the industry. The importance of this is accentuated by cultivars usually having a rather limited life of only 5 to 6 years and the very strong competition between seed companies.

In 1978 sunflower cultivars commercially available were registered on the Variety List under the Seeds Act. All new cultivars must be submitted for registration on the Variety List with the Division of Plant and Seed Control before seed may be sold. New cultivars must be distinct from existing cultivars, uniform, stable and have an acceptable name in order to qualify for placing on the Variety List. Information on agronomic performance obtained from the national cultivar trials, seed quality and grading requirements also play

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major roles in determining whether a cultivar should be placed on the Variety List.

RESEARCH PROCEDURE

The national cultivar trials are planned by the co-ordinators in association with the many co-operators. The seed required is made up at a central point and is supplied to each co-operator together with a 20 page guide on how the trial should be conducted in addition to forms on which the data must be submitted. At the end of the season the data is processed and the report compiled by the co-ordinators. In order to ensure that the trials are correctly conducted and valid cultivar comparisons made, each trial is critically inspected at the post flowering stage by a person having a good understanding of sunflower production and research techniques. An inspection at a much earlier stage of growth is also advisable.

CULTIVARS

In the 1974/75 season 33 cultivars, of which 13 were hybrids, were tested in the national programme. The number increased to 42 in the following year but decreased to only 16 in 1976/77 as a result of fewer cultivars being submitted together with stricter qualifying requirements. The number increased to 25 the next year. Ensure that only high quality seed that is cultivar pure is used. As only 12% of the new cultivars submitted for testing reached noteworthy commercial production the evaluation procedure was modified by using two types of trials in order to minimize input loss on the testing of new cultivars.

The so-called standard cultivar trial is used to test top performance commercially available cultivars as well as certain commercially available standards. Considerable thought must be given to the choice of cultivars as this can markedly influence the success of the programme. As far as possible cultivar changes in the standard trial are kept to a minimum in order to facilitate better comparison over years. These trials contained only 16 cultivars in the past two seasons though this could be increased to a maximum of 25 cultivars. This limit has to be imposed as the persons conducting most of these trials are not equipped to run larger trials.

Enlarged trials are used to evaluate new cultivars on a limited

number of sites though still maintaining adequate sites to facilitate the reliable comparison of the new cultivars. This was done over the past 2 years by testing the 20 "new" cultivars together with the 16 of the standard trial. This system makes it possible to compare the new cultivars with all the important commercial cultivars.

A number of supporting trials are also conducted. New cultivars imported from overseas are usually first tested in formal screening trials on approximately five sites. Additional cultivar trials containing only a few representative cultivars are planted in areas where the crop is not grown but where it is considered to have potential. Cultivars are also compared at various planting densities and planting times while the response of cultivars to fertilizers such as boron, to weedkillers, etc is also investigated.

SITES

The trials were conducted on eight sites in the first year and increased to 13, 18, 36, 39 and 53 sites in subsequent years. The "small" standard cultivar trials are conducted on farms and some research stations by seed and other agricultural companies as well as by the Department of Agriculture in Southern African countries. In 1978/79 and 1979/80 the enlarged cultivar trials were conducted at 13 departmental research stations that were equipped to handle large sunflower trials. The sites chosen should be representative of the sunflower producing area and soils.

PRODUCTION PRACTICES

Modern production practices are used in order to achieve optimum production. Sunflower has been found to be exceptionally sensitive to soil fertility. In addition to nitrogen and phosphorus it was found necessary to apply the trace elements, boron and molybdenum, as a standard practice in order to prevent invalid comparisons. Liming is essential to reduce aluminium toxicity on acid soils (<4.5 Kcl).

Particular attention is given to achieving a uniform stand by planting thickly and thinning to the required uniform stand. Uniform final stands of from 30 000 to 50 000 plants per hectare in rows 80 to 100 cm apart are used depending upon the yield potential of the site. Where possible an occasional irrigation is applied to ensure a

good stand at planting or where necessary to save the trial from being severely damaged by drought. A few enlarged trials are irrigated to ensure that information is obtained on the yield potential of the new cultivars while other trials are planted in areas where moisture stress is likely to occur. Most of the trials are planted in the spring as higher seed yields and greater cultivar differences are usually achieved with earlier than with later planting and most of the crop is planted in the spring. Procedures are used that minimize seed loss.

Lattice designs are employed using three to five replicates depending upon the number of cultivars. Harvesting only the two centre rows of four row plots is essential in view of strong inter-cultivar competition. Data is recorded on production practices, soil and climate as well conventional agronomic criteria such as stand, length of growing season, disease resistance, head diameter, 1000 seed mass, seed yield as well as oil and protein composition of the seed and fatty acid composition of the oil. Full details are presented in the annual reports.

RESULTS

Over the years the national cultivar evaluation programme has become more sophisticated, better production practices employed and a higher percentage of the trials are very well conducted. The mean seed yield per hectare is usually slightly higher than that of the national cultivar trials conducted in the USA. The testing of cultivars in a large number of trials under different soil and climatic conditions in the main sunflower producing area of South Africa supplies a reliable indication of overall cultivar performance within one season. Greater reliability is achieved when information is available over more than one season. The results of these trials are presented in a comprehensive annual report that is made available to persons participating in this programme as well as others known to be keenly interested in sunflowers or on request. The results of the season's trials together with a critical appraisal of the way the trials were run are presented at a closed meeting of co-operators, sunflower breeders and other persons associated with sunflower production. A growers pamphlet on the performance of cultivars registered on the Variety List, including newly registered cultivars, is released at this meeting. Only information obtained from trials that were well conducted in all respects (50 to 75%) are used for this purpose.

Regression lines that illustrate the performance of cultivars relative to the mean of a number of standard cultivars over the yield range of the trials are used to supply two-dimensional differences in yielding ability. A number of talks on aspects related to sunflower production are included in the cultivar trial report back meeting in order to make the programme more interesting and to keep leaders in sunflower production informed of recent developments.

CONCLUSIONS

The impartial and thorough evaluation of sunflower cultivars in the national cultivar evaluation programme is a huge project requiring the support of a large number of sunflower workers in all sectors of the industry. This comprehensive programme is strongly supported by growers, seed producers and the industry and makes it possible to predict the performance of sunflower cultivars with a high degree of accuracy. The identification of outstanding new cultivars within one season has accelerated the introduction of improved cultivars. This programme has an extremely strong impact on the cultivars grown. This is reflected in the huge demand for high performance hybrids and the lack of interest in cultivars that yield poorly in these trials.