OIL CROPS: SESAME AND SUNFLOWER SUBNETWORKS

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PROCEEDINGS OF THE JOINT SECOND WORKSHOP HELD IN CAIRO, EGYPT, 9–12 SEPTEMBER 1989

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OIL CROPS: SESAME AND SUNFLOWER SUBNETWORKS

Proceedings of the Joint Second Workshop held in Cairo, Egypt, 9–12 September 1989

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FOREWORD

In September 1989, the Sunflower and Sesame subnetworks held their bi-annual meetings in Cairo, Egypt. The meetings were well attended and papers, presented in these proceedings, provide a very informative overview of some of the cropping systems, management practices, production constraints and research highlights for both crops in several countries.

Chronic edible oil deficit is a major problem facing many developing countries in Africa and Asia where most countries are forced to import large quantities to satisfy the requirements of their growing populations. With the present rates of population increase and the improvement of nutrition standards it is likely that the consumption of edible oil will rise over the years, increasingly drawing on scarce foreign exchange for the importation of this vital food staple. For this reason, several countries have opted to increase self-sufficiency in edible oil.

Production deficits are due to a number of factors, among which neglect in oilcrops research, in both developed and developing countries has been a major one. This is particularly true for minor crops such as sesame. In the context of the IDRC oilcrops network, initiated in 1981, the interchange of information and the sharing of results between scientists have proved to be very useful and beneficial for the generation of scientific knowledge and the stimulation of research in this important area. It is hoped that conclusions and recommendations of this meeting will stimulate further research and development in the future.

A second important reason for limited national production has been the exceptionally low levels of world prices for oils and fats in the 1980's and the comparative advantage of importation over production for developing countries. The description of a case study using a system's approach to analysis the Vegetable Oil/Protein System of Kenya has stirred much interest during the Cairo meetings and it is hoped that similar work can be carried out in other countries in the future.

The Cairo meetings will also unfortunately be remembered as the one which has witnessed the diagnosis of the fatal disease of late Dr. Hiruy Belayneh, Chairman of the Brassica Subnetwork. We will all regret his absence.

On behalf of IDRC and of all participants, I would like to thank the Government of Egypt for its hospitality, the organizers for the excellent arrangements and all those who contributed to the success of these meetings by their presentations and discussions.

Eglal Rached,
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SUNFLOWER ADAPTATION IN MOROCCO

S. Quattar, T.E. Ameziane and A.Baidada

In Morocco, oilcrops are important sources of humanfood and animal feed. The main oil crops that are currently cultivated on more than 160,000 ha, include sunflower, rape seed, safflower, groundnuts, cotton and soybean.

Soybean was introduced in 1981 and is grown under irrigation. The cotton seed, mainly grown for fibre, is also used in oil seed industry. The other crops are cultivated under rainfed conditions where annual rainfall ranges between 300 and 600 mm.

Sunflower is one of the main oil crops and is undergoing tremendous development. In 1988, 110,000 ha were planted to sunflower by small and large scale farmers, using both traditional and modern cultural practices. Yields obtained were generally low and variable, due to socio-economic, environmental and management constraints (5). Adequate research is also lacking. In the first and second parts of this paper, we will discuss some of these issues, taking sunflower as a case study, and ways of adjusting the crop to its environment, using simulation models.

Materials and Methods

In part one, the success of sunflower was analyzed using field data and statistics. In part two, as water deficit is the main limiting factor to sunflower crop production, we have used the modelling approach to address the problem of crop adaptation to drought prone environments.

The modelling approach was carried out based on the principles developed earlier by different scientists (8,9,2,7,4), also as described elsewhere (10,6). We have developed a model to simulate the effects of contrasting crop management strategies on the crop water deficit. Three sowing dates and three genotypes differing in maturity period were then tested. The Genotypes had 1300, 1600, and 1900 growing degree days (GDD) from sowing to physiological maturity. Date of sowing was 20 November for the autumn planting, 20 February and 20 March for spring plantings. The latter sowing date is most commonly used by farmers.

Results and Discussion

Part one : Success and limitations of sunflower production in Morocco

Sunflower is grown mostly in the North Western part of the country where it was introduced in the sixties. The development of the crop acreage shows two distinct periods, Fig. 1. From 1960 to 1980, the total area devoted to sunflower (2000-40,000 ha) remained fairly low and highly variable. After 1980, the acreage dramatically increased to reach the current level. It is projected that some 300,000 ha will be planted to sunflower in the next 10 years. Seed yields basically followed a similar pattern.

The recent success of sunflower is explained by a shift in the role and function it has in the cropping systems. The crop evolved from an insurance crop to a cash crop. Up to 1980, the observed erratic variability in acreage is related to the extent of failures in winter crop. The sunflower crop is then planted in spring to insure a minimum income. After 1980, sunflower became a cash crop, as a result of changes in government policies and farmer's attitude. Policy changes included loans to sunflower producers for input acquisition, reasonable prices and guaranted public market, Fig. 2. In spite of these progresses, environmental constraints and poor management practices still limit production.

Part two: Crop adaptation to environment

Sunflower is grown under rainfed conditions in the North Western region. The climatic conditions including rainfall (P), evapo-transpiration (ETP) and water deficit, (P-ETP) of this area are shown in Figures 3. The data in Figure 6 represent a typical Mediterranean climate having a rainy winter season with low ETP followed by a spring period with a rapid increase in ETP and a decrease in P. Since sunflower is traditionally planted in spring, most of its cycle is out of the rainy season. Therefore, sunflower usually suffers from severe water stress conditions as the season progresses towards crop maturity. The following simulations illustrate the environmental constraints to sunflower production and the possibilities that agronomists and breeders may have to adjust the crop to its environment.

1. Analysis of sowing date effects

The effects of early, intermediate and late plantings on crop water use are shown in Fig. 4. The results indicate that the severity of water deficit increased as the planting date was delayed. Actual water deficit reached a maximum of 10, 55 and 70 mm per decade for early, intermediate and late sowings, respectively, Fig. 4a. The corresponding cumulative water deficit followed a similar pattern and was 40, 200 and 240 mm, Fig. 4b. For the early sowing, the crop water deficit index never exceeded 40%, i.e. at least 60% of the crop water requirements were met at any given time during the growing season, Fig. 4c. By contrast, for the intermediate and late sowings, the crop water deficit indices were above 40% during most parts of the growing season. This severe water deficit could be detrimental to seed formation and yield.

This became evident by exploring the research work executed with 23 genotypes to compare autumn and spring plantings, Fig. 5. The results clearly indicated that matching the crop cycle with the rainy season by early planting increased yield by 33%. Further, comparing the four water regimes to a rainfed control, as means of correcting the effect of late water deficits, the seed yield was greatly increased by irrigating the crop at various growth stages, particularly at late flowering, Table 1. In addition, a single irrigation applied at flowering stage yielded as much as the fully irrigated crop which produced 2.8 against 1.4 tons/ha for the rainfed control.

Similarly, three genotypes of rapeseed were compared at five planting dates. As a result, early sowing yielded 3.2 against 0.4 tons/ha with delayed sowing, Fig. 6. Therefore, choosing the appropriate sowing date, is critical to fit as much as possible the crop to a favourable environment. This is also a key factor to improve crop yields without increasing the levels of inputs.

2. Analysis of genotype effects

The model was also used to test the effects of three genotypes differing in maturity, with autumn and spring plantings. For autumn sowing, early and intermediate genotypes were able to grow under favorable conditions. In contrast, the late genotypes experienced increasing water deficit as the season progressed. This is illustrated by the data in Fig. 7. For spring planting, all genotypes were exposed to water deficit, but early maturing cultivar was least affected, Fig. 8.

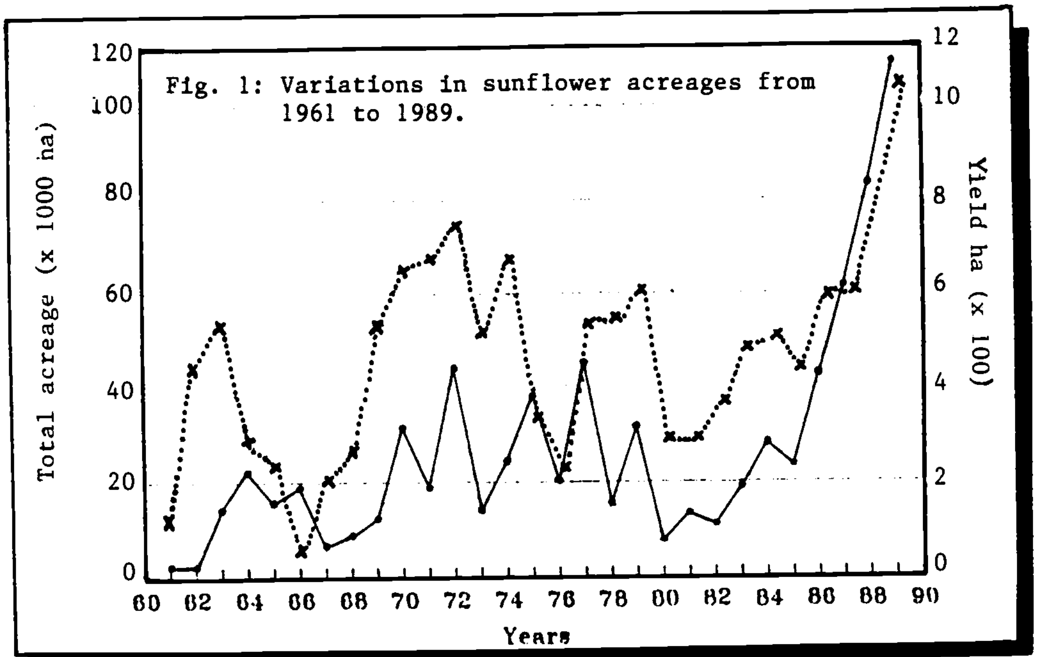
Fig. 1: Variations in sunflower acreages from 1961 to 1989.
Total acreage (x 1000 ha)
Yield ha (x 100)
Years
0
20
40
60
80
100
120
0
2
4
6
8
10
12
60
62
64
66
68
70
72
74
76
78
80
82
84
86
88
90

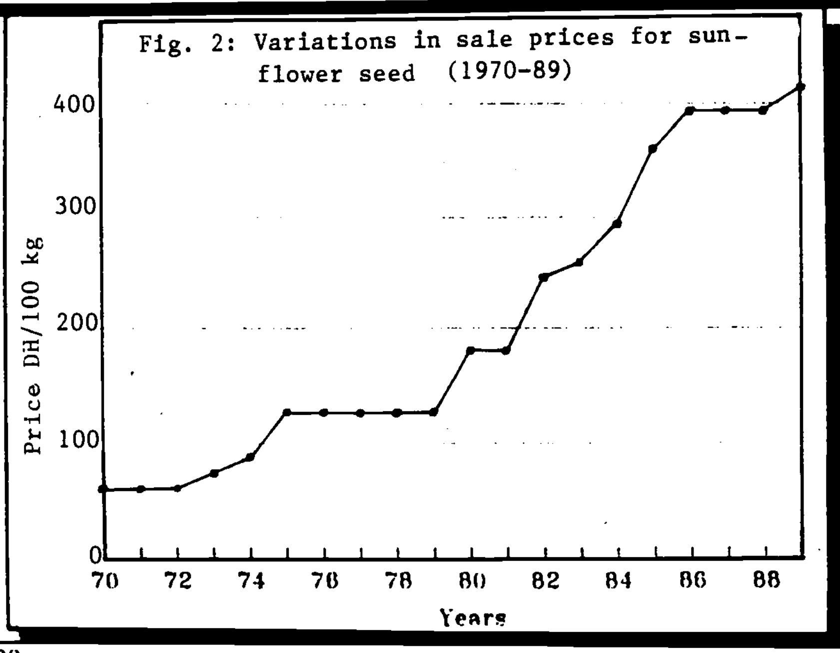
Fig. 2: Variations in sale prices for sunflower seed (1970-89)
Price DH/100 kg
Years
0
100
200
300
400
70
72
74
76
78
80
82
84
86
88

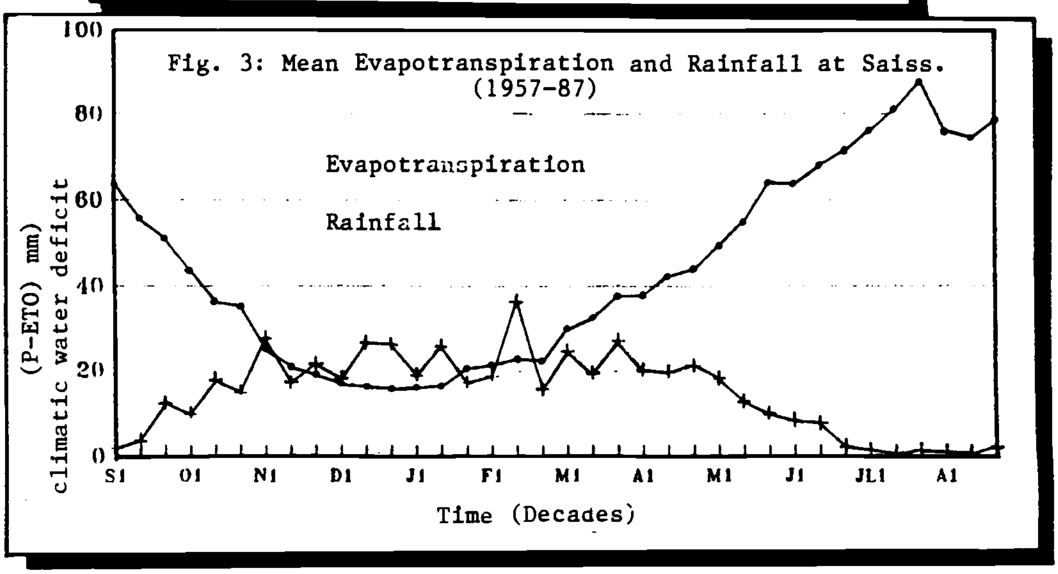
Fig. 3: Mean Evapotranspiration and Rainfall at Saiss. (1957-87)
Evapotranspiration
Rainfall
(P-ETO) mm) climatic water deficit
Time (Decades)
0
20
40
60
80
100
S1
O1
N1
D1
J1
F1
M1
A1
M1
J1
JL1
A1

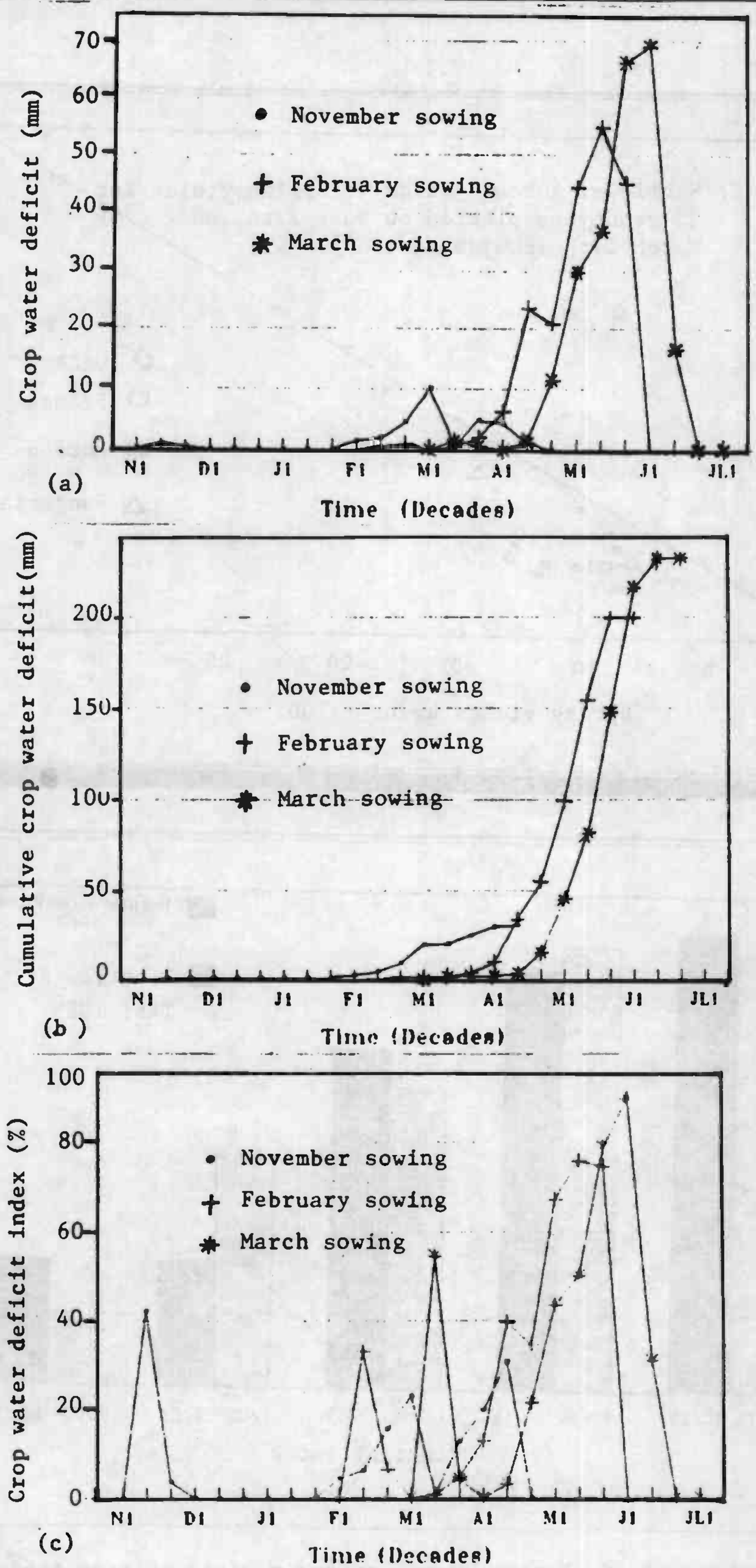

Fig. 4: Effect of three sowing dates on the simulated crop water deficit, cumulative and index during the growing season for three genotypes differing in maturity. Saiss(1957-87)

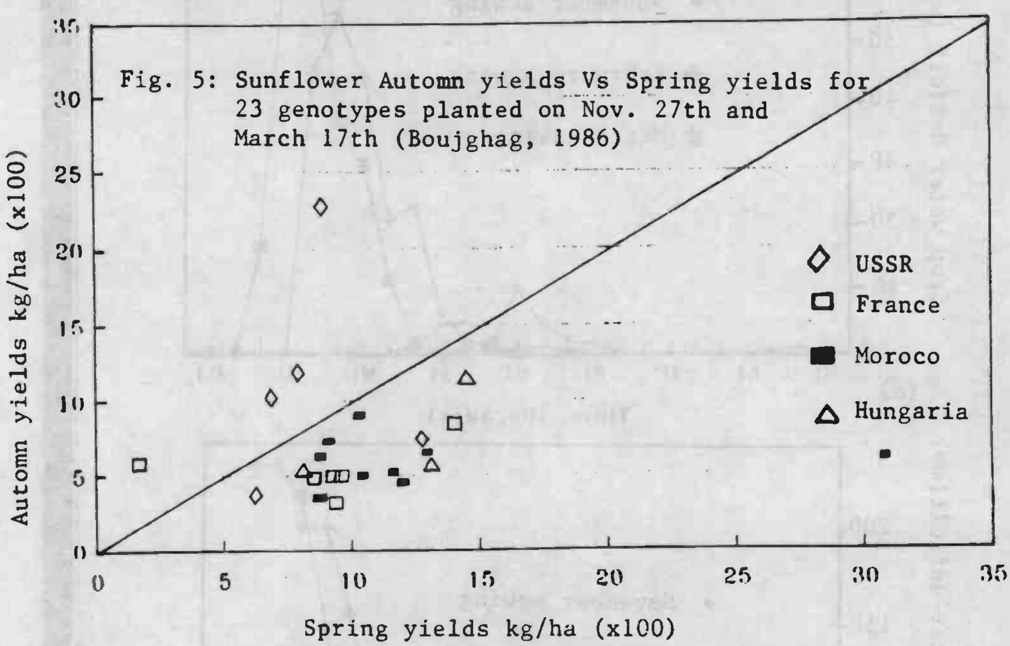

Fig. 5: Sunflower Automn yields Vs Spring yields for 23 genotypes planted on Nov. 27th and March 17th (Boujghag, 1986)

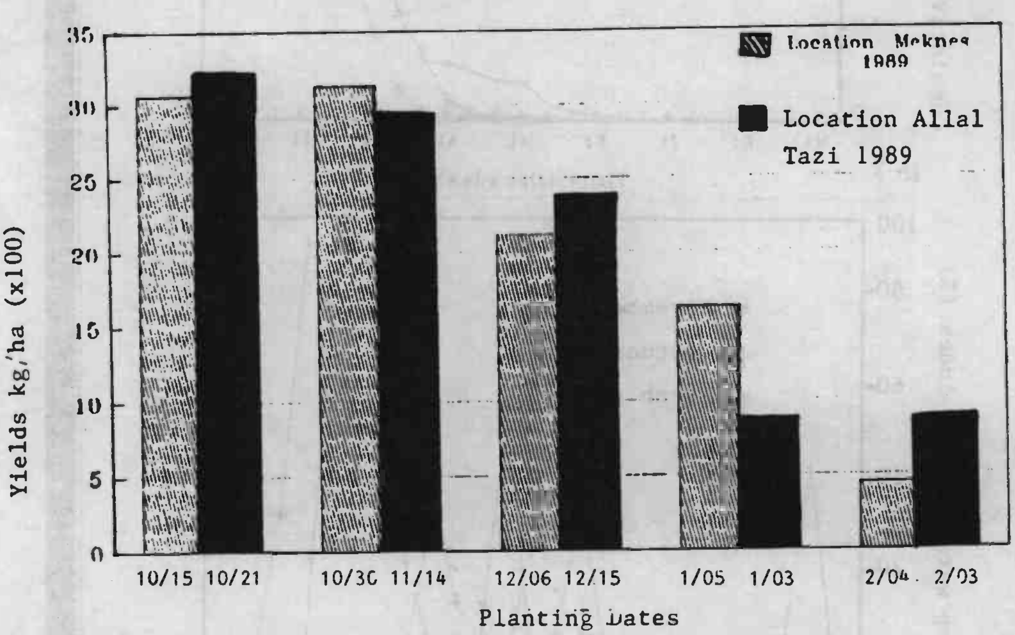

Fig. 6: Effects of planting dates on grain yield of rape seed (mean of 3 genotypes) planted at Meknes location. (Fezzaz, 1989)

Table 1. Effects of four water regimes on sunflower biomass production, seed yield and water use in the Gharb, 1989.

Water regimes	Crop yield (tons/ha) Biomass	Crop yield (tons/ha) Grain	Water use (mm)
1. Rainfed control	47.13c*	13.68b	237.00c
2. Fully irrigated (4 applications)	95.70a*	28.13a	440.90a
3. One irrigation at early bud	65.84b	17.88b	354.90b
4. One irrigation at early flowering	82.58a	29.40a	330.23b
5. One irrigation at late flowering	64.21b	20.05b	339.62bc

* Values in a column not followed by the same letter are significantly different at 5% level.

These results suggest that with an autumn planting, the intermediate genotype (1600 GDD) is preferable to the early and late ones. It offers higher yield potential (longer cycle) and experiences an acceptable level of water deficit. However, the early maturing cultivar should be preferred in the case of spring sowing.

Conclusion

Based on these preliminary results, it is important to match the crop to its environment through breeding and adequate crop management. Such strategy is more effective in improving crop production, while keeping inputs at reasonable levels. The modelling approach is useful to identify environmental constraints and to define ways of cropping with them. Further model testing using the experimental data is in progress.

Acknowledgement

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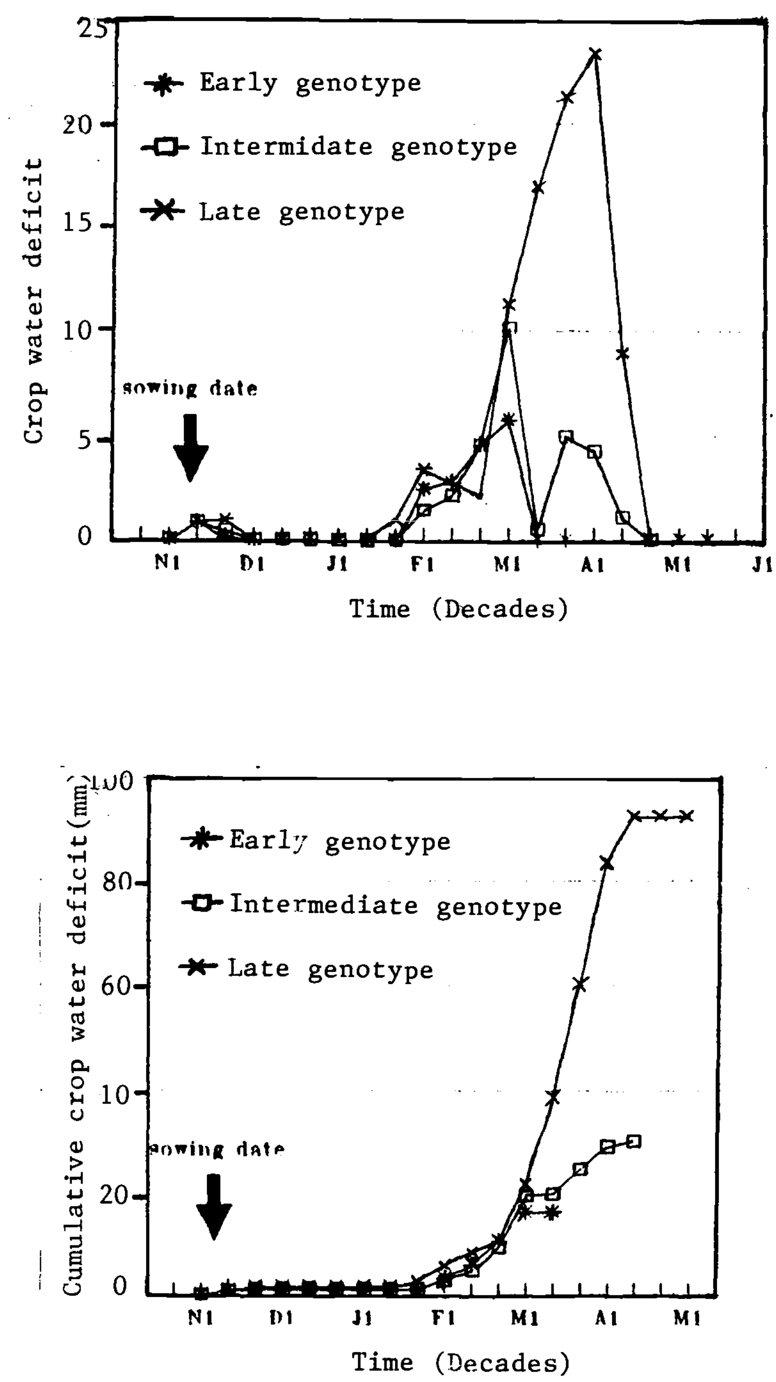

Fig. 7: Effect of Sunflower genotype on the variations of Simulated Crop Water Deficit during the growing season. November planting at Saiss. (1957-87)

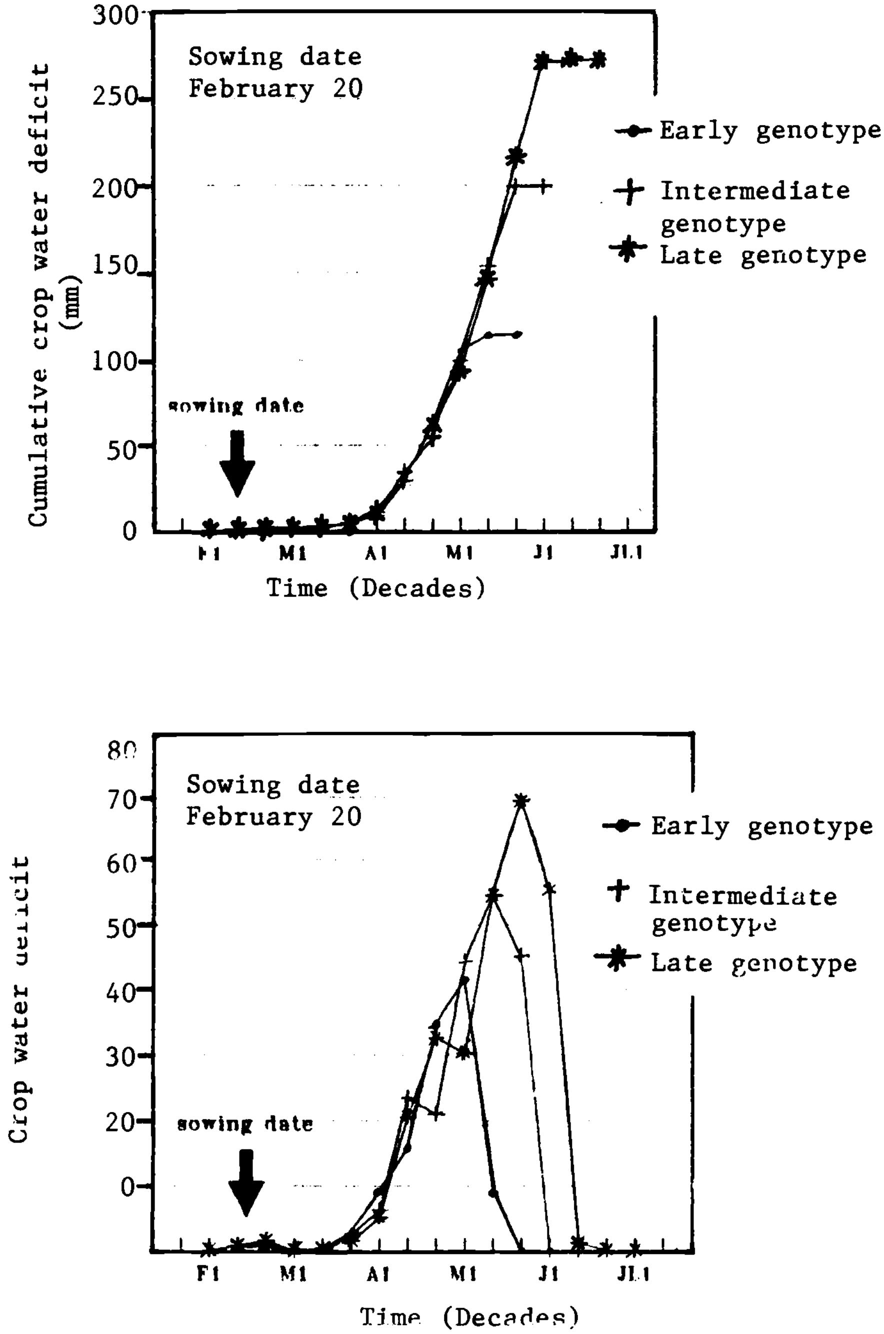

Fig. 8: Effect of Sunflower genotype on the variations of simulated crop water deficit during the growing season. February planting at Saiss. (1957-87)