SUNFLOWER CROP MANAGEMENT IN FRANCE : SOME TECHNICAL AND ECONOMIC ANSWERS

P. Leterme, Elisabeth Lancesseur, Dominique Wagner

C.E.T.I.O.M.
174 avenue Victor Hugo
75116 PARIS

Summary

Since 1986, CETIOM has been carrying out trials in various conditions of soil and climate to compare different crop management systems for sunflower.
The main tested factors were the cultivars (different earlinesses, various disease resistances), sowing dates and rates, nitrogen and water applications (quantities and periods). These factors were partially crossed in each trial. The experimental design was without replication, with a complete characterization of the environment of each plot. The output data were the yield, yield components, growth characteristics and pest and disease evaluation.
These data are useful in the framework of decision-making at the time of application of the new European agricultural policy. The communication presents some examples of technical analysis about the determination of seeding rate, the ways of irrigation and the choice of cultivar.

INTRODUCTION

Following the new european agricultural policy, the price of the crop is divided by two or three. So, the usefulness of some inputs involved in the sunflower crop management is now critical and must be studied precisely.
The aim of this paper is to present some references collected in France and their consequences on the agricultural advice.

MATERIAL AND METHODS

Two sets of data are used in this communication :

- the C.T.P.S. network which gives the information useful for the registration of the new cultivars . These trials allow us to estimate the genetic progress.

- Since 1986, CETIOM has been carrying out trials in various conditions of soil and climate to compare different crop management systems for sunflowers. The table 1 gives the location, the year and the size of these trials.

TABLE 1 : Location, year and size of the CETIOM trials

LOCATION	YEAR	NUMBER OF PLOTS
Charentes Maritime (CM)	1986	92
	1987	81
	1988	88
	1989	70
Lot et Garonne (LG)	1986	102
	1987	102
	1988	64
Indre (In)	1988	98
	1989	77
Marne	1987	78
Cher (Ch)	1986	92
	1987	92
Total 1986-1989		1036

In these trials, the main tested factors were the cultivars (different earlinesses, various disease resistances), sowing dates and rates, nitrogen and water applications (quantities and periods). These factors were partially crossed in each trial. The experimental design was without replication, with a complete characterization of the environment of each plot. The output data were the yield, yield components, growth characteristics and pest and disease evaluation.

From these data, we shall present only the analysis of two inputs :

- the seeding rate : the whole scale of density studied ranges from 40000 plants per ha to 150000 . We shall observe the yield variations following the decrease of stand density, from about 70-90000 plants to 40-60000.

- the irrigation : taking into account the cost of the irrigation, it appears necessary to maximize the water efficiency (yield variation per 100 mm of applied water). We shall observe the variability of efficiency of this irrigation.

irrigation rises with the drought. Moreover, in 87 and 88, following the irrigation, the plots exhibited heavy problems : lodging and *sclerotinia*. These problems explain the negative efficiencies.

- an aleatory effect of the sowing date which comes from the differences in the schedule of irrigation following these dates. In 86 and 89 when it was necessary to apply water and where there were no important limiting factors, the variation of efficiency related to the schedule of irrigation is shown in table 3 (F1 and F4 are respectively the beginning and the end of flowering).

TABLE 3 : Level of efficiency reached in 50 % of the plots related to the schedule of irrigation.

% before F1	% F1-F4	% after F4	Efficiency kg/mm
50	50	0	0
50	50	0	4
70	30	0	2
40	40	20	10
30	70	0	12
70	0	30	10
70	0	30	10
66	0	33	14

We can see that the higher efficiencies are observed when :

- there is no irrigation during the flowering : this fact is important mainly in the plots inoculated by sclerotinia
- there is an irrigation after the flowering period : the grain filling period appears to be very important to make the irrigation profitable.

In France, sunflowers are mainly grown without irrigation. Nevertheless, this specie can profit from the applied water but it is necessary to optimize its use (only in drought period) and the schedule of irrigation. This prevents heavy problems like sclerotinia and lodging.

3 - Seeding rate

The seeds are expensive. So, it is interesting to see if we can decrease the seeding rate without negative consequences on the yield. The table 4 shows the comparison between the yields of the high density (70-90000 plants per ha) plot and that of the low density plot (40-60000 plants per ha). There are no significant differences except in Charente-Maritime in 1988 where a dramatic attack of sclerotinia led to very low levels of density. In this case, the low seeding rate gave a lower yield.

TABLE 4 : Yield comparisons between high and low stand densities

Factors	Number of plots	YIELD (100 kg/ha) low density	high density	Cochran's test
Whole set	246	28.5	28.8	0.7139
Early sowing	151	28.6	29.2	0.4102
Late sowing	95	28.5	28.0	0.6189
With irrigation	107	31.6	31.5	0.8747
Without irrig.	139	26.2	26.7	0.5127
Flamme	27	32.5	31.9	0.7494
Frankasol	50	28.1	28.7	0.6299
Ibh166	27	24.6	23.9	0.6357
Mirasol	48	28.2	28.0	0.864
Pharaon	12	32.2	32.4	0.965
Viki	39	29.6	29.7	0.9795
CM 86	24	25.8	25.3	0.844
CM 87	33	22	21.4	0.61
CM 88	31	25.5	27.4	0.016 **
CM 89	13	25.3	25.8	0.781
LG 86	24	36	35.6	0.6
LG 87	26	32.3	30.3	0.185
LG 88	20	36.4	38.3	0.2045
Indre 89	16	30.9	30.3	0.8108
Marne 87	15	21.2	21.4	0.855
Cher 86	16	34.2	35.2	0.4105
Cher 87	28	27.4	28.7	0.06

So, it seems possible to decrease the seeding rate, but the farmer must be aware of the risk he takes. If the germination and/or emergence conditions are unfavourable (drought, pests), the stand density following the low seeding rate can be insufficient to give high yield. The farmer will meet the same probleme if a disease leads to a loss of plants during the growth period.

CONCLUSION

The technical references derived from the presented trials allow us to define sunflower crop management better fitted to the new european agricultural policy. This new policy indeed induces the necessity of reducing the costs of production if we want to keep up the gross margin. This saving can be done by optimizing the use of some inputs like the quantity of seeds or the irrigation. But, we think that it is not relevant to save money on the quality of seeds. On the one hand, we have seen that the yield evolution of new cultivars following their date of registration is an interesting factor of progress. On the other hand, the genetic resistances allow the farmer to manage the crop without fungicides and so to reduce the costs of production. More generally, the genetic progress leads to a higher ability of cultivar adaptation to different ways of production and to different environmental characteristics.