APPLICATIONS OF ETHEPHON ON SUNFLOWER TO PREVENT LODGING.

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Abstract :

Results obtained for the last years indicate that growth regulators used on sunflower enable us to get significant plant shortenings (- 20%) by applying 300 g/ha of ethephon at "5 leaves stage". This also leads to a better resistance towards lodging. Furthermore, the rooting system is stimulated and the biomass increased, which can bring about a better utilization of soil reserves (water, mineral elements...) The limits to the use of this technique will be discussed in the framework of new price prospects.

Key-words : Sunflower, growth regulator, root.

INTRODUCTION

With its geometry, sunflower has always been sensitive to lodging : at maturity, 30% of the biomass is located more than 1 meter above the soil. That is why breeders have endeavoured to apply genetics to find dwarf material. Concerning the plant size, the first results are certainly satisfactory, but unfortunately, the productivity of obtained material is still too low compared to the normal type. Moreover, this material is sometimes more sensitive to *Sclerotinia Scl.*

Lodging offers several disadvantages for sunflower (Merrien, 1987). That is an important factor of yield losses, it brings about difficulties at harvest and increases risks of pest attacks at the end of the cycle. Previous studies (Blanchet, 1988) showed that lodging became highly frequent beyond a plant height/collar diameter ratio higher than 60.

However, we will stress out here that the parameters of the technical methods play certainly an essential part : density (and still more the number of plants/linear metre) and nitrogen availability are 2 factors involving great risks. Besides, water exces during the vegetative period is also an aggravating factor. Therefore, if basic recommendations of sunflower crop management are taken into account, (CETIOM, 1992), it will be already possible to control lodging to a great extent.

The use of growth regulators on sunflower crops can also answer producers' permanent worry to take care against weather accidents (storms...)

MATERIAL AND METHODS

The results come from experimental networks in the open field, under normal cropping conditions without looking for extreme situations (like high densities or overfertilizations) more often related to the lodging risk.

Our studies dealt mainly with applications of ethephon at 200 or 300 g by hectare. These applications were tested at the stage 2.8/2.10 (8 to 10 leaves), and in all cases, before the apparition of the floral bud. We checked the plant height, the shoot and root biomass (easily extractible part), observed lodging when present on a scale between 0 (= no lodging) to 9 (= 100% lodging), and recorded yields.

RESULTS

1 - Shortening effect.

It appears quite clearly as shown on Fig. 1. In our trial's network, the size reduction of the plant was around 17 %.

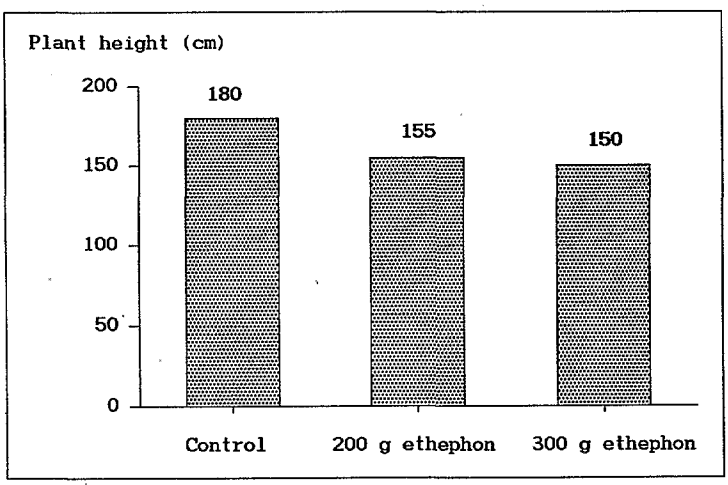

Fig.1 : Effect of an application of 2 doses of ethephon at "10 leaves stage" on the plant height

This effect is proportional to the ethephon dosis applied (Table 1). However, we note that the maximal effect of resistance to lodging was reached from the dosis of 300 g on a plot offering risks (cv. Frankasol, 108 p/m2 - deep loam).

Dosis (1)	% of reduction	Lodging (2)
Control	(184)	8
150	- 7,6 %	3
200	- 12 %	2,1
300	- 20 %	0
400	- 21 %	0

(1) in g of ethephon/ha. (2) see § Mat. & Meth.

Table 1. Effect of increasing doses of Ethephon on the reduction of the plant height (in % of the control and consequences on lodging.

2. - Effect on the root system.

For the last 3 years, results have been rather convergent to prove the effect of ethephon applications on sunflower rooting system (Table 2).

The stimulation of the rooting system can reach 10 % in average. Although few data are still available, we can note a trend to observe a positive effect on the protein content of seeds (without any change in the oil content) coming along with this increase in the root biomass. Besides, treated plots often show an increase in leaf area duration following flowering, which lets us think of a better water supply as a result of this effect on the root system.

Year	Place	Control	230 g of ethephon	300 g of ethephon
1988	Marne	1,1	1,28	1,31
	Charentes	,8	,79	,9
	Eure & loir	1,89	2,4	2,25
1989	Hte Garonne	,9	1	,97
	Marne	1,05	,97	1,05
	Hérault	,5	,75	,82
1990	Marne	0,71		0,76

Table 2. Effect of applications of Ethephon on the root biomass (inT/ha).

DISCUSSION AND CONCLUSION

Our results prove that it is possible to shorten a sunflower crop by applying ethephon. The dosis of 300 g/ha seems to be enough to obtain the anti-lodging effect awaited by this technique.

Concerning the stage of application, we observed that the growing 'inter-nodes' at the time of application are those which are particularly shortened (Merrien, 1987). Our results dealt with the growth phase of the 4th and 5th internodes and before the apparition of the floral bud.

Even if the effect on the plant height is spectacular, it is certainly more difficult to determine the effect on the root system. However, our 3 years of experiments allowed us to underline a slight stimulation of the root growth. This can be explained by our knowledge of carbon distribution before the development of the floral bud. Chenesseau (1984) showed that before the stage E1, the greatest part of carbon obtained following photosynthesis concerned roots. As soon as the bud appears, its apical dominance uses most of the available carbon. The application of ethephon, inhibitor of the auxin synthesis and therefore slowing down the effect of the apical dominance of the terminal bud, would extend a little the period when assimilates are essentially orientated towards roots. It would lead to a better water and nitrogen supply (which is mainly revealed by a slight increase in the protein content of seeds).

In our experiments in the field, we tried to estimate the quantities of nitrogen absorbed as well as water consumption rates. We could not stress out differences between treatments, because of great variations between samples. These measures could be possible under more controlled conditions. However, we will carry on studies of effects on the root system.

Presently, the utilization of a growth regulator on sunflower must be limited to its action as shortener. Thus, it will give the possibility of an insurance against lodging.

In the case of a normal crop management, this technique offers little interest today. Its conditions of application are linked to predict risks of lodging, which will be estimated essentially by density (if higher than 8 plants/m2) and according to nitrogen availabilities (in deep humus-bearing soils, risks will be increased). Up to now, it has not been possible to underline a way of intensification of the crop based on the use of a growth regulator.

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