Plant growth regulators and bolting in sugar beet *(Beta vulgaris L.)*

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Estación Experimental de Aula Dei. ZARAGOZA

Recibido el 14-V-76

A B S T R A C T

LASA, J. M. and M. C. PÉREZ-PEÑA, 1976. Plant growth regulators and bolting in sugar-beet (Beta vulgaris L.). *An. Aula Dei*, **13** (3/4): 357-361.

This work, based on the possibility to predict bolting in the field through an analysis of temperatures, studies the action of some plant growth regulators as inhibitors of bolting.

CCC and ETHREL present results with a significant inhibiting effect, which allows us to be hopeful about their usefulness.

MH with a very high inhibiting effect, causes a great depression in vegetative growth, which makes its use impossible.

INTRODUCTION

The possibility to predict bolting two or three months in advance, both in spring (CHRISTMANN, 1967) and autumn sowings (LASA, 1976), on the basis of the analysis of the temperatures which have surrounded the plant and have probably satisfied some vernalizing requirements, led us to carry out this work. Our purpose was to find some chemical compound capable of diminishing bolting occurrence in the years in which this phenomenon would normally occur in a high percentage, so as to mitigate the loses and problems bolting causes.

Acknowledgement. This work has been carried out with the help of a grant by the «Juan March» Foundation. We want to give here our most sincere thanks to this Organization.

Various plant growth regulators have been tested in sugar beet. The responses are variable, as the application conditions play a determinant role (LHOSTE, 1972).

MARGARA (1961), in his work about stem elongations, noticed an inhibiting effect in alil-trimethyl-ammonium bromide, while treatments with giberellic acid (GA) invalidated or reduced this inhibiting action. HUMPHRIES and FRENCH (1965) observed in the action of GA and 2-chloro-etyl-trimethyl ammonium chloride (CCC), that the former decreased the production of leaves, while the latter increased it. They justified this by the fact that GA elongated the vegetative point, while CCC flattened it out.

Maleic hydrazide (MH) presents depressing effects on the vegetation, which can amount to 66 % (WORT and SINGH, 1970), but on the other hand it increases sugar content, leading to results in sugar yields which are not significantly different from those in the controls (SCHREIBER and FERGUSON, 1967) (COHEN and AHARONOV, 1972).

ETHREL does not either show any significant variations in sugar yield, as the decrease it causes in sugar content is compensated by an increase in root yield (COHEN and AHARONOV, 1972).

MATERIAL AND METHODS

In order to avoid as much as possible environmental variations, this work was carried out in controlled environment.

Plants grown in paper-pot, in greenhouse at 20 °C, during 40 days, in a vegetative stage of about six true leaves, were vernalized during 100 days et 10 °C with 24 hours of light. The temperature of 10 °C was chosen, although the greatest vernalizing effect is usually achieved at 8 °C, because most of the days in which there is a vernalizing action on the root crop in the field, have temperatures betveen 10 and 13 °C.

At the end of vernalization the plants were transplanted into a greenhouse with continous day and a temperature of 20-25 °C. Five days later the treatment with plant growth regulators was carried out, using 125 cc of the following compounds and concentrations, per elemental plot:

Code	*Chemical name*	*Concentration*
CCC	2-chloro-etyl trimethyl ammonium chloride	1.60 °/₀₀
HM	1,2 Dihydro 3,6-pyradazimide	0.30 °/₀₀
ETHREL	2 chloroethane phosphonic acid	0.45 °/₀₀
GA	Giberellic acid	0.10 °/₀₀

As for the statistical design we used random blocks with four replications, with a set of controls. The number of plants per elemental plot ranged between 70 and 81; covering an area of 3 m^2.

Readings of bolting were done 30, 45 and 60 days after planting. When the last one was done, data were collected about the average weight of roots and tops in the plants that were not bolted.

RESULTS AND DISCUSSION

Tables 1 and 2 show the results of the statistical analysis on the studied characters.

We can notice that both CCC and ETHREL cause a significant reduction on the final bolting. However, the data collected in 30 and 45 days are rather similar to those of the control. This seems to indicate that the action of these compounds as bolting inhibitors was effective on plants that had hardly satisfied their cold requirements and were very slow in bolting, while they had virtually

TABLE 1. — *Bolting %. Statistical analysis.*

	30 d.	*45 d.*	*60 d.*
CCC	23.6	49.1	68.1
MH	15.1	21.2	41.6
ETHREL	20.0	45.8	65.2
GA	21.7	48.0	77.0
CONTROL	28.7	52.7	82.4
Sig. level	NO	1 %	0.1 %
s.s.d. 0.1 %	—	—	23.7
1 %	—	22.5	16.8
5 %	—	16.1	12.0
10 %	—	13.1	9.8
20 %	—	9.9	7.5
V.C.	47.0	24.0	11.7

TABLE 2. — *Root and top. Statistical analysis.*

	Root	*Top*
CCC	6.63	58.8
MH	2.31	12.2
ETHREL	4.64	51.5
GA	4.90	49.8
CONTROL	6.01	61.8
Sig. level	10 %	5 %
s.s.d. 5 %	—	25.3
20 %	2.36	20.4
10 %	1.77	15.3
V.C.	31.7	28.7

no action on those plants that had widely covered these requirements, as they did not even modify their speed of bolting. As for other kind of actions on the vegetation, no significant differences, from the control, were noticed in either case.

MH caused a very clear inhibition on bolting, but it was accompanied by a nearly total paralyzation of growth, as we can see in the data concerning root and top. This important depression on the vegetation is not totally in accordance with the results presented by SCHREIBER and FERGUSON (1967) and COHEN and AHARONOV (1972), and it is closer to those presented by WORT and SINGH (1970). This could only be explained by the possible different conditions of application, as the dosis we used were smaller.

GA did not cause any difference from the control, except for a greater development of stems.

CONCLUSIONS

It seems possible to conclude from the results obtained that CCC and ETHREL offer some posibilities as regulators of bolting, but now it is necessary to test these compounds in normal growing conditions.

Although the best inhibiting action is that of MH, its depressing effects on the crop makes us reject it for field use.

RESUMEN

Basado en la posibilidad de predicción de espigado en campo, por análisis de temperaturas, se examina la acción de algunos reguladores de crecimiento como inhibidores de espigado.

El CCC y el ETHREL presentan resultados con efecto inhibidor significativo, que hace concebir ciertas esperanzas sobre su utilidad.

La hidrazida maleica con un efecto inhibidor muy elevado, causa una gran depresión en el desarrollo vegetativo, que imposibilita su utilidad práctica.

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