EFFECT OF GIBBERELLIC ACID ON SPROUTING OF POTATOES [1]

J. DOORENBOS

Publication 184, Laboratorium voor Tuinbouwplantenteelt, Landbouwhogeschool, Wageningen, The Netherlands

SUMMARY

Dormant potato tubers were treated with gibberellic acid (GA_3). The ensuing promotion of sprouting was the result of a more rapid elongation. In 'Rode Star' the endogenous dormant period was reduced, but in the other 8 cultivars studied it was not affected.

1 INTRODUCTION

A few years ago, spectacular effects on stem elongation from applications of gibberellic acid (GA_3) and related compounds were reported (1). This led to an investigation of the effect of these substances on winter dormancy. During the autumn of 1956 and again in 1957 dormant buds of various species were treated with GA_3. The results obtained with *Solanum tuberosum* will be briefly reported.

It is well known that potatoes will not sprout immediately after harvest. This state of dormancy disappears after a period of cold, but also, although more slowly, at high temperature. The time required for the disappearance of dormancy at room temperature varies from a few weeks to several months, depending on the cultivar. The primary object of the experiments was to establish whether this period could be reduced by application of GA_3.

2 MATERIAL AND METHODS

In the first series of experiments dormant tubers of the cultivar 'Meerlander' were used, which were kept in the dark at a temperature of 15–20° C. During a 4 week period, viz. from 14 November to 12 December 1956 the apical eyes were treated daily with one drop of a solution containing 0, 25, 50 or 100 mg GA_3 per liter water.

A second series was started on 8 April 1957. Tubers of the cultivars 'Gineke' and 'Eigenheimer' had been freshly harvested in a greenhouse. The following treatments were given:

a all eyes covered with lanolin containing 1% GA_3,

b only the apical eye covered with lanoline with 1% GA_3,

c all eyes except the apical one covered with lanolin with 1% GA_3,

d all eyes covered with lanolin containing no GA_3,

e control.

---

[1]) Received for publication September 19, 1958.

The tubers were maintained at a constant temperature of 15° C in the darkness.

The third series began on 28 August 1957 with tubers of the following cultivars: 'Alpha', 'Bintje', 'Eersteling', 'Eigenheimer', 'Libertas', 'Meerlander', 'Noorderling', 'Rode Star' and 'Voran'. Lanolin paste containing 1% GA_3 was applied to the apical buds. The apical buds of the control tubers were treated with pure lanolin only. There were 10 tubers per group. They were kept in the dark at 15° C. Terminal shoots were measured twice a week in the case of early sprouting cultivars and at weekly intervals in the case of late ones.

3 Results and discussion

In the first series it was established that GA_3 hastened sprouting. Ten days after applications ceased, sprouts about 3 cm long were evident on treated tubers (regardless whether the concentration of the GA_3 solution had been 25, 50 or 100 mg/l) while the controls still appeared to be dormant. Three weeks later the apical buds of the controls also began to grow, but at a much slower rate than those of the treated tubers. By this time the treated tubers, especially those treated with 100 mg/l GA_3, were sprouting from lateral eyes also.

In the second series, all 'Gineke' tubers sprouted, but the shoots from treated tubers elongated much more rapidly than those of the controls. In 'Eigenheimer' shoots from treated tubers reached a length of 3–4 cm before initial signs of sprouting was evident in the controls. In both cultivars the apical buds sprouted first. This was also the case when GA_3 had been applied to the lateral eyes only. This shows the strength of apical dominance, and also indicates that GA_3 may be transported rapidly from a lateral eye

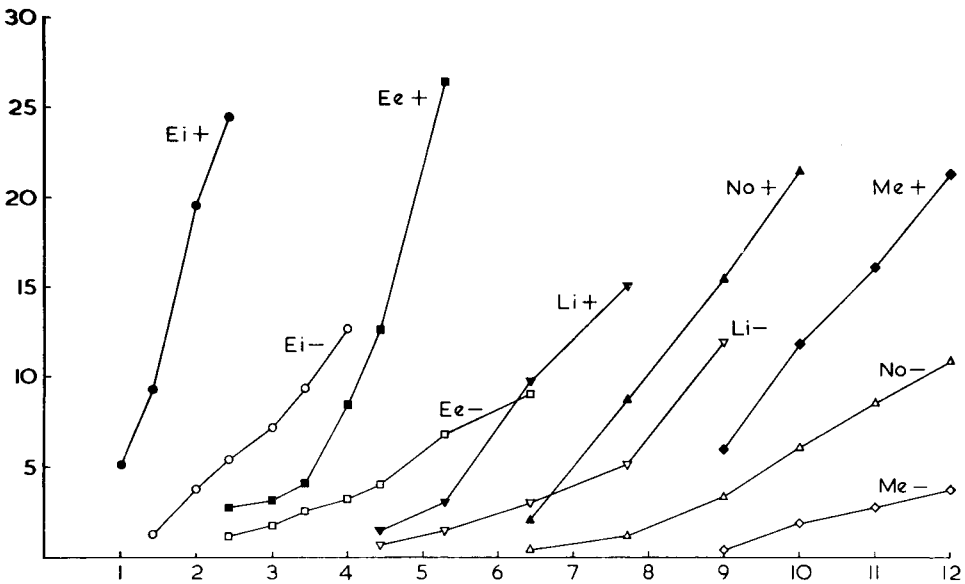

Fig. 1 Effect of gibberellic acid (GA_3) on potato sprouting. Ordinate: length of apical shoot in mm. Abscissa: time in weeks. Black dots: + GA_3; white dots: − GA_3. Cultivars used: 'Eigenheimer' (Ei), 'Eersteling' (Ee), 'Libertas' (Li), 'Noorderling' (No) and 'Meerlander' (Me).

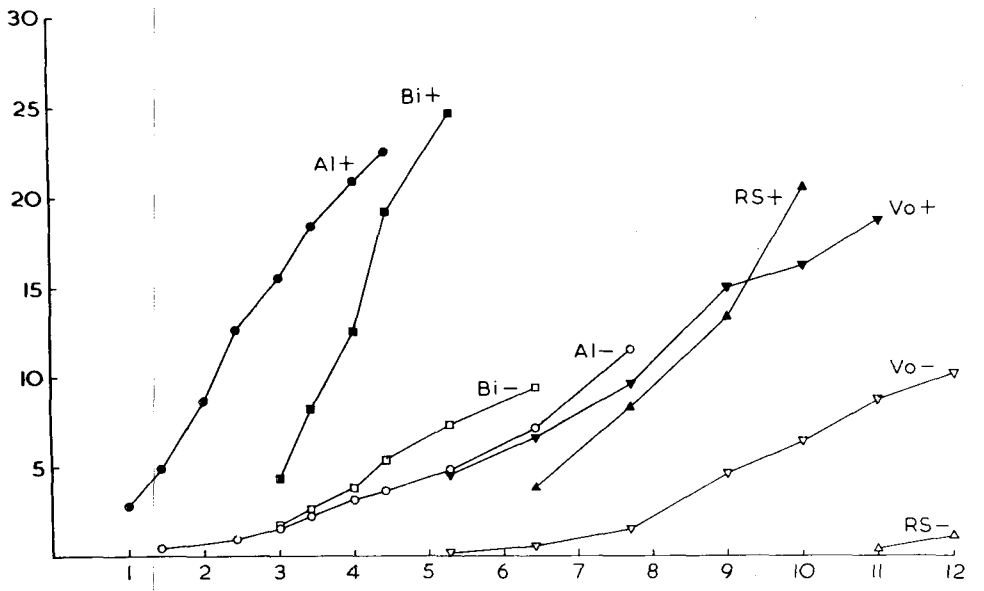

FIG. 2 SIMILAR TO FIG. 1, BUT OTHER CULTIVARS: 'ALPHA' (Al), 'BINTJE' (Bi), 'RODE STAR' (RS) AND 'VORAN' (Vo).

to the apical one. However, eventually lateral buds sprouted also and again in greater number in the treated tubers than in the controls.

The third series yielded more comprehensive data. The elongation of the apical shoots of the various cultivars is given in Figs. 1 and 2. One may observe that the slope of the curves connecting the black dots is much steeper than the slope of those connecting the corresponding white dots. This means that the elongation of apical shoots of treated tubers proceeds at a much faster rate than in the controls. Some of the 'black' curves begin to the left of the corresponding 'white' ones, showing that in these cases visible sprouting started earlier in the treated tubers. This is in accordance with the results of the previous series, and would seem to indicate that dormancy is curtailed. However, the distance between the 'black' curves and those between the corresponding 'white' ones is the same. This means that, for example, in both 'Eigenheimer' and 'Meerlander' sprouting is accelerated by GA_3 but the difference in time of sprouting between the two cultivars is maintained at about two months. These observations permit the conclusion that the effect of GA_3 consists of an acceleration of elongation, but not of a reduction of the length of the dormant period characteristic for each cultivar. There is, however, one exception to this rule among the cultivars studied, viz. 'Rode Star', in which the treated tubers sprouted more than 4 weeks ahead of the controls (Fig. 2). The experiment was repeated on this cultivar and it was found that the results were essentially the same.

In conclusion, something may be said about the practical significance of these results. In the light of the data reported it appears probable that application of GA_3 to tubers before planting will result in more rapid sprouting and possibly also in a greater number of shoots per tuber. A practical method to apply GA_3 is likely to be immersion in a dilute aqueous solution. This method appears to be applied already in Japan (2).

ACKNOWLEDGEMENT

Most of the tubers used in these experiments were obtained from the Institute for Biological and Chemical Research on Field Crops (I.B.S.) at Wageningen (Director: IR. J. WIND) through the kind offices of MR. K. B. A. BODLAENDER, biol. drs.

LITERATURE CITED

1 STOWED, B. B. and T. YAMAKI: The history and physiological action of the gibberellins. *Ann. Rev. Plant Physiol.* 8 (1957) 181–216.

2 TSUKAMOTO, Y.: Present state of gibberellin studies in Japan. Proc. XVth Int. Horticultural Congress, Nice (France) 1958. In press.