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Carry-over effects of SADH and CCC on shoot growth and berry set of Kyoho grapes

by

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Spätwirkung von SADH und CCC auf das Triebwachstum und den Beerenansatz bei der Rebsorte Kyoho

Zusammenfassung: Starkwüchsige Kyoho-Reben neigen oft zur Ausbildung lockerbeeriger Trauben. Durch Anwendung der Wachstumshemmer SADH oder CCC wurde der Beerenansatz verbessert. Die Spätwirkungen der Hemmstoffe wurden mit Hilfe des Trieblängenwachstums und der Anzahl entwickelter Beeren ermittelt.

SADH-Behandlung verzögerte das Triebwachstum und steigerte den Ansatz kernhaltiger Beeren. Der Einfluß von SADH beschränkte sich auf das Jahr der Anwendung. Im darauffolgenden Jahr wurden keine Nachwirkungen festgestellt.

CCC-Behandlung hemmte ebenfalls das Triebwachstum und erhöhte den Beerenansatz, wobei der Anteil kernloser Beeren erhöht war. Der Einfluß von CCC war auch noch im 2. Jahr wirksam, jedoch im 3. Jahr nicht mehr nachzuweisen.

Key words: growth regulator, SADH, CCC, table grape, shoot, berry, growth, fruit set.

Introduction

Kyoho is a leading table grape variety in Japan. It is characterized by shattering of berries shortly after flowering as well as by development of small and seedless 'shot' berries. These disorders often occur in vigorous vines. Spraying of a growth retardant, succinic acid-2,2-dimethyl hydrazine (SADH), results in retarded shoot growth, increased berry set and decreased number of shot berries (13, 14, 15, 16). 2-Chloroethyl trimethylammonium chloride (CCC) has shown almost the same results as SADH (1, 2, 3, 8, 11, 12). However, little is known how long carry-over effects due to these retardants may last, though they depend on concentration, application time, plant parts treated, etc. The objective of this study was to ascertain the duration of such effects by determining the shoot growth and berry set as indices.

Materials and methods

The experiment was conducted over 3 years (1982—1984) in the vineyard of Hiroshima Agricultural College, using 11-year-old Kyoho grapes which showed vigorous growth. The vines were trained in longer horizontal bilateral cordon system. All the shoots which developed from branches were cut back to one bud every winter during 3 years from the beginning of this experiment.

In 1982, treatments consisted of plots of control, SADH and CCC as shown in Table 1. On May 15, about 2 weeks before flowering, 0.2 % SADH or 0.1 % CCC to which a surface active agent was added were sprayed to newly growing shoots. The shoots elongated without pinching or topping during the growing season. Lateral shoots arising from their axils were removed, 1 node from the base being left intact. The clusters borne on these shoots were thinned to 1 cluster/shoot about 2 weeks after flowering. Each plot consisted of 20 shoots which were selected from 2 or 3 vines during the experimental period.

The experiment evaluated in 1983, consisted of plots of control, spraying in 1982 and spraying in 1983 as shown in Table 2. The former two treatments used the spurs of the shoots which had been examined in the previous year. Growth retardants were not applied to both plots in 1983. In the latter plot, the retardants were applied only in 1983 in the same way as in 1982.

In a further experiment completed in 1984, treatments consisted of plots of CCC series as shown in Table 3. In 1984, CCC was not applied to the plots of control, spraying in 1982 and spraying in 1983. Only one newly sprayed plot received CCC in 1984.

The seasonal changes in shoot growth were measured in every experimental year as shown in Figs. 1, 2 and 3. All the fruits were harvested on September 10. Length and weight of clusters, total number of berries, number of seeded and of seedless berries and berry weight were determined.

Results

In the treatment conducted in 1982, the shoot growth was directly retarded by application of SADH and stopped at the end of June as shown in Fig. 1. SADH caused also a marked increase in berry set, the rate of seeded berries being especially increased. The plot treated with SADH was also superior in cluster length, cluster weight and weight of seeded berries compared with the control (Table 1).

In 1983, the carry-over effect of SADH applied in 1982 on the shoot growth and berry set was examined (Fig. 2 and Table 2). Although application of SADH in the cur-

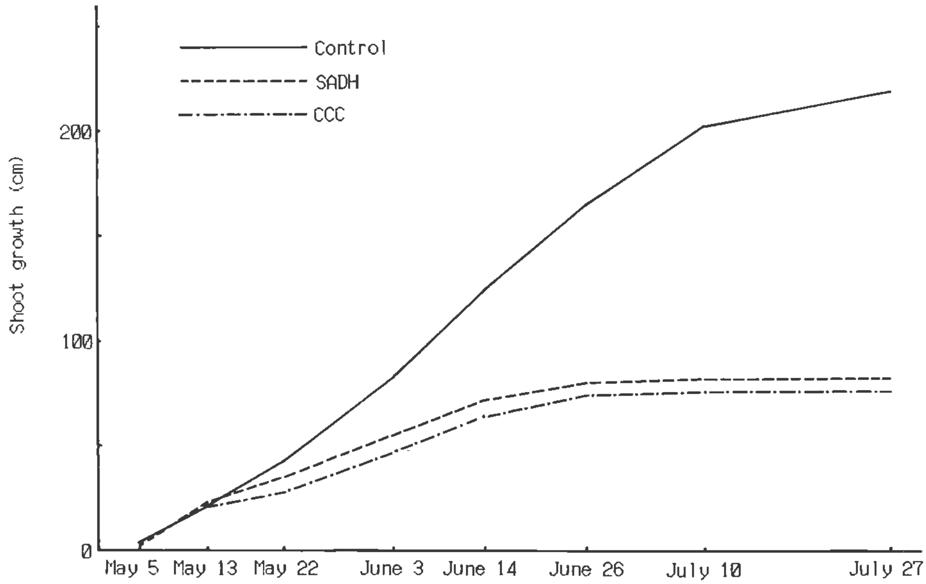

Fig. 1: Effects of SADH and CCC on the shoot growth of vines in 1982.

Einfluß von SADH und CCC auf das Triebwachstum der Reben im Jahr 1982.

Table 1

Effects of SADH and CCC on the berry development of grapes in 1982

Einfluß von SADH und CCC auf die Beerenentwicklung der Reben im Jahr 1982

Treatments[1])	Cluster		Number of berries			Weight of seeded berry (g)
	Length (cm)	Weight (g)	Total	Seeded	Seedless	
Control	11.4 b[2])	103.9 b	24.2 c	3.8 c	20.4 b	10.7 a
SADH	18.7 a	389.7 a	40.4 b	37.7 a	2.7 c	11.3 a
CCC	17.9 a	308.2 a	80.8 a	13.1 b	67.7 a	10.4 a

[1]) 20 shoots in each treatment.
[2]) Mean separation within columns by Duncan's multiple range test, 5 % level.

rent year (1983) retarded the shoot growth, SADH sprays in the previous year (1982) did not affect shoot length. Plot of SADH applied in 1982 showed almost the same results as the control as to setting of seeded, but not of seedless berries. Application in the current year (1983) caused a marked increase in cluster weight and number of seeded berries.

In the treatment conducted in 1982, application of CCC also retarded the shoot growth; its extent was almost the same as by SADH (Fig. 1). As shown in Table 1, CCC caused a marked increase in berry set, being increased in both seeded and seedless

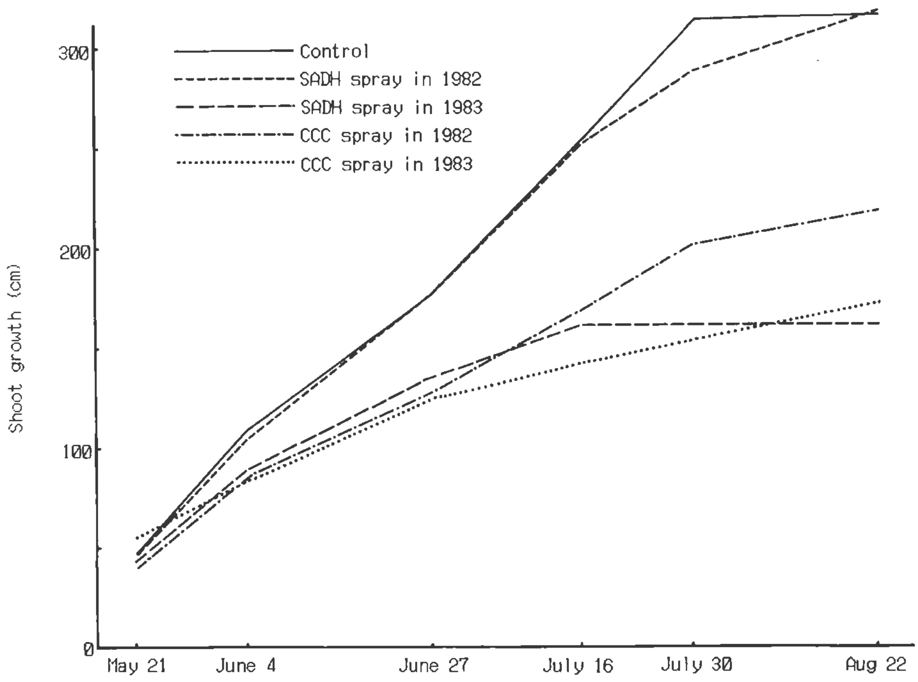

Fig. 2: Effects of SADH and CCC on the shoot growth of vines in 1983.

Einfluß von SADH und CCC auf das Triebwachstum der Reben im Jahr 1983.

Table 2

Effects of SADH and CCC applied from 1982 on the berry development of grapes in 1983

Einfluß von SADH und CCC — erste Anwendung 1982 — auf die Beerenentwicklung der Reben im Jahr 1983

Treatments[1])	Cluster		Number of berries			Weight of seeded berry (g)
	Length (cm)	Weight (g)	Total	Seeded	Seedless	
Control	14.6 b[2])	147.9 b	25.9 b	9.4 b	16.5 b	10.2 a
SADH spray in 1982	14.0 b	226.0 a	47.0 a	4.0 b	43.0 a	—
SADH spray in 1983	13.6 b	249.1 a	40.5 a	20.9 a	19.6 b	10.1 a
CCC spray in 1982	16.5 a	245.8 a	41.0 a	18.4 a	22.6 b	10.7 a
CCC spray in 1983	16.2 a	251.8 a	49.5 a	21.4 a	28.4 b	10.4 a

[1]) 20 shoots in each treatment.
[2]) Mean separation within columns by Duncan's multiple range test, 5 % level.

berries. The CCC plot showed a marked increase in cluster weight, resulting from increased berry numbers.

In 1983, CCC applied in 1982 also retarded the shoot growth similarly to the inhibition in the previous year (1982). The effect of CCC on the growth retardation continued to the following year (Fig. 2). CCC applied in 1982 showed an increased berry set in the experiment of 1983 (Table 2). There was nearly no difference from the plot treated in the current year (1983). In 1983, the cluster weight in the CCC plots showed almost the same values, when treated in 1982 or in the current year. The increase of berry set due to CCC application was also found in the following year (Table 2).

Table 3

Effects of CCC applied from 1982 on the berry development of grapes in 1984

Einfluß von CCC — erste Anwendung 1982 — auf die Beerenentwicklung der Reben im Jahr 1984

Treatments[1])	Cluster		Number of berries			Weight of seeded berry (g)
	Length (cm)	Weight (g)	Total	Seeded	Seedless	
Control	10.5 b[2])	79.9 b	18.5 c	0.6 c	17.9 b	9.2 a
CCC spray in 1982	11.2 b	93.2 b	28.2 bc	7.6 a	20.6 b	6.3 b
CCC spray in 1983	13.4 a	141.3 a	33.7 ab	4.2 b	29.5 ab	8.4 a
CCC spray in 1984	15.9 a	186.0 a	40.8 a	2.8 bc	38.0 a	9.4 a

[1]) 20 shoots in each treatment.
[2]) Mean separation within columns by Duncan's multiple range test, 5 % level.

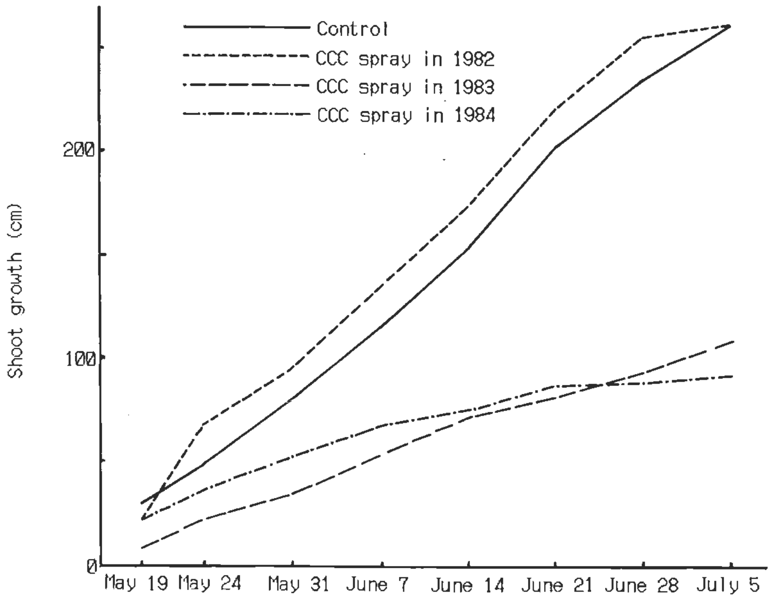

Fig. 3: Effects of CCC on the shoot growth of vines in 1984.
Einfluß von CCC auf das Triebwachstum der Reben im Jahr 1984.

In 1984, the shoot growth of the plot treated with CCC in 1982 was similar as in the control. However, CCC application in 1983 resulted in retarded shoot growth similar to that of the current year treatment (1984). The growth inhibiting action of CCC disappeared in the 3rd year (Fig. 3), differing from that of SADH, which had no effect in the next year. The plot of CCC applied in 1982 was inferior in berry set and cluster weight to those of CCC applied in 1983 and 1984. The promotion of berry set by CCC almost disappeared in the 3rd year after application (Table 3).

Discussion

The growth retardants SADH and CCC have been repeatedly reported to increase the berry set of grapes (1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 16, 17). At present, SADH is commercially used in Kyoho grapes to enhance the poor berry set of this variety, while, for commercial use, CCC is still under consideration. If, however, the effects of these growth retardants are maintained during the following year or thereafter, their use may involve unexpected physiological disorders of the grapevines. Tukey and Fleming (18) reported that the application of N-dimethyl aminosuccinamic acid (DMAS) to Concord grapes resulted in an increase of berry set and yield, but its effect did not continue in the next season. SADH belongs to the same chemical group as DMAS, and this may explain why application of SADH showed no response in the following year. On the other hand, Lazić *et al.* (10) and Isoda (8) have reported for Italian Riesling and Muscat of Alexandria grapes, respectively, a carry-over effect of CCC on shoot growth and berry development in the 2nd year, but its persistence over 2 years was not examined.

In the present experiments, a carry-over effect, exceeding the year of application was not found in SADH, too. CCC, on the other hand, maintained such an effect for 2 years. However, combined treatments with pinching and CCC application in Muscat of Alexandria grapes induced a marked growth inhibition in the following year, and it is assumed that several years may be needed to restore vigour in the vines (8). Obviously, the inhibiting effects of CCC vary greatly due to the growing conditions of vines. Therefore, the duration of the carry-over effect of growth retardants may differ considerably depending on their concentration, the growth stage of vines, variety, vine vigour, parts of plant treated and other conditions.

Summary

Vigorous Kyoho grapes often tend to develop straggly clusters. The application of growth retardants, SADH or CCC, enhanced berries to set. The carry-over effects of these growth retardants were ascertained by determining the retardation of shoot growth and the increase of berry set as indices.

Application of SADH retarded the shoot growth and increased the setting of seeded berries. Its effects were confined to the current year. No carry-over effects were found in the 2nd year.

Application of CCC also retarded the shoot growth and increased the setting of berries including seedless berries. The effects of the retardant were also visible in the 2nd year, but disappeared in the 3rd year.

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