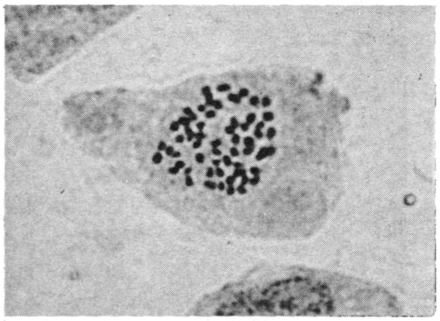

Fig. 2. Mitotic figure with 57 chromosomes in a young leaf tip cell of induced mutant of a tetraploid grape ($2n=76$) treated with PFP.

ones, resulting in a bushy growth habit (Fig. 1). This characteristic was maintained in all axillary shoots. The mutant had 57 chromosomes, which was counted in 32 mitotic figures of young leaf tips and in 16 of roots (Fig. 2). These observations suggested that the shoot was a triploid mutant; however, it is not known which chromosomes were actually eliminated from the original tetraploid.

Cytological observation of chromosome reducing procedures by PFP was not reported in plant cells, but mitotic abnormalities including subdivision of spindle poles which was observed in PFP treated HeLa cell (6) might result in somatically reduced chromosome number of the cells. Thus, the nature of somatic reduction and mutant shoot formation remain unresolved, but the method of direct induction of chromosome-reduced plants will be available for triploid and aneuploid breeding and genetic analysis of grape.

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Yield and Growth Response of 'Heritage' Raspberry to Daminozide and Ethephon[1]

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Additional index words. Rubus idaeus, flower initiation, growth regulators, butanedioic acid mono-(2,2-dimethylhydroxide), (2-chlorethyl)phosphoric acid

Abstract. **Butanedioic acid mono-(2,2-dimethylhydroxide) (daminozide) at concentrations ranging from 2000–8000 ppm applied when primocanes were 45 cm tall (12–16 nodes) greatly increased the early yield of 'Heritage' raspberries (*Rubus idaeus* L.). The addition of (2-chlorethyl)phosphoric acid (ethephon) at 300 ppm tended to further increase the effectiveness of the daminozide treatments. None of the treatments significantly affected the total primocane height. Microscopic examination of the axillary buds of untreated primocanes revealed that first signs of floral development occurred soon after the growth regulators were applied.**

The 'Heritage' raspberry grows well under western Washington conditions and produces good late season crops. The purpose of this research was to investigate the control of vegetative growth and earlier fruiting.

Mature 'Heritage' plants were mowed off during the dormant season to limit the production to primocane fruiting. Individual plants were sprayed to the dripping point when they reached a height of 45 cm. At this stage of development, there were about 12–16 nodes above the soil surface. Treatments included daminozide at 2000, 4000, 6000, and 8000 ppm alone and in combination with 300 ppm ethephon. These were compared with a control and with ethephon alone. Regulaid spreader-activator at 250 ppm was added to all treatments except ethephon alone and the control.

Individual primocanes were tagged and their height measured weekly until July 23. Beginning in early September, fruits were harvested every 5 days for a total of 4 harvests.

Axillary buds for microscopic examination of flower bud initiation were collected weekly from untreated primocanes beginning when the shoots were 50 cm tall. No buds from treated canes were examined. Excised buds taken from 5 primocanes in each sampling date were grouped according to location on the shoot beginning just below the terminal bud; buds 1–3, 4–6, 7–9, 10–12. Buds were embedded in paraffin, sectioned, and evaluated for stage of floral development according to the classification system used by Mather (1).

None of the treatments significantly affected total primocane growth (Table 1). Although the daminozide treatments tended to reduce the final height, the maximum difference, when compared to the control, was only 20 cm.

The growth regulators did not alter the onset of ripening. Only the 2000 and 8000 ppm daminozide with ethephon treatments

Table 1. Effect of daminozide and ethephon on growth and yield of 'Heritage' raspberries.

Treatment (ppm)[z]		Height[y]	Yield (MT/ha)[x]					
			Sept.			Sept.		
Daminozide	Ethephon	(cm)	2	8	Total	12	17	Total
0	0	89 abc	0.2	0.4	0.6 cd	0.4	0.8	1.8 c
2000	0	87 abc	0.7	1.3	2.0 bcd	1.2	1.6	4.8 b
4000	0	85 abc	0.9	1.7	2.6 abcd	2.0	2.1	6.7 b
6000	0	96 ab	1.0	2.2	3.2 abc	1.9	2.4	7.5 ab
8000	0	69 c	0.9	2.0	2.9 abcd	2.0	2.1	7.0 ab
0	300	103 a	0.2	0.3	0.5 d	0.5	0.9	1.9 c
2000	300	81 abc	1.2	2.3	3.5 ab	2.1	1.9	7.5 ab
4000	300	83 abc	1.1	1.9	3.0 abcd	1.7	2.3	7.0 ab
6000	300	87 abc	0.7	1.4	2.1 abcd	1.8	2.6	6.5 b
8000	300	75 bc	1.6	3.1	4.7 a	2.4	2.9	10.0 a

[z]Regulaid spreader-activator at 250 ppm was added to all growth regulator sprays except the ethephon treatment.
[y]Height measurements made July 23.
[x]Mean separation by Duncan's multiple range test, 5% level.

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significantly increased total yields for the first 2 harvests, however, by September 17 all daminozide treatments had greatly increased the total amount of fruit harvested. High daminozide concentrations tended to further increase yields. Ethephon alone had no effect but, when applied with daminozide, tended to increase the effectiveness of the daminozide. These increases in yield resulted entirely from greater numbers of fruits. After the first harvest date, fruit size was decreased by daminozide. On September 2, control fruits and daminozide-treated fruits weighed 4.0 g and 4.5 g respectively but, by September 17, the comparable fruit weights were 3.5 g and 2.9 g.

First signs of flower bud formation were seen in the buds from the 10–12 node section. This occurred when the primocanes were about 50 cm tall. At that time the 10–12 bud section was only 7–18 cm above the soil surface. About 50% of the buds in the section were showing initial flattening of the apical meristem. All buds closer to the shoot tip were vegetative. Within 3 weeks all buds, 1–12, were showing some floral development. By then the primocanes were about 75 cm tall. From that time on development of the upper buds was rapid and at the end of the fourth week the stage of development of the upper buds was at least as advanced as lower buds.

Other workers found a similar relation between position of the axillary buds on the cane and the time of flower initiation (1, 4). They observed that axillary buds in the region 5–15 below the terminal buds were the first to develop flower initials in both floricane — and primocane — fruiting cultivars. Flower initials develop in the terminal bud just prior to axillary flower bud formation (2, 4).

The stage of primocane growth when we applied the growth regulators (12–16 nodes) corresponds closely with the time when cold treatment has the greatest effect on early flowering (3). It appears, therefore, that treatments must be applied during the beginning stages of flower initiation to be most effective. Similar growth regulator treatments applied last year at a later stage of primocane growth did not significantly increase yields.

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Ericoid Mycorrhizas Stimulate Fruit Yield of Blueberry[1]

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Additional index words. inoculation, field trial, *Vaccinium corymbosum*

Abstract. **Two-year-old blueberry plants (*Vaccinium corymbosum* L.) of 6 cultivars were planted into a peat soil with or without ericoid mycorrhizal fungi inoculation. At the first fruit season, inoculation increased fruit yield by 11 to 92% among the six cultivars.**

The roots of heath plants in natural ecosystems are normally infected with ericoid mycorrhizal fungi (1, 3, 5) which stimulate N and P uptake (4, 6) and plant growth (4, 7). Blueberries are a new horticultural crop for New Zealand. Farmers are now planting 2-year-old nursery-grown stock onto former grass and clover paddocks which have never been vegetated by heath plants. As there are no reports on the incidence and effect of ericoid mycorrhizas on the growth and fruiting of highbush blueberry, we decided to root sample plants from nurseries and growers' plantations to see whether blueberries were becoming mycorrhizal under New Zealand conditions.

Root samples (5g) were taken at 0-100 mm soil depth underneath randomly chosen blueberry bushes in 12 nurseries and plantations. A total of 289 samples were taken from the cultivars 'Jersey', 'Dixi' and 'Atlantic'.

The root samples (1 per plant) were washed, cleared in 10% KOH for 40 min. (at 9°C), 20 volume H_2O_2 for 10 min. (at 20°), 1.0 N HCl for 2 min. (20°) and stained in 0.05% trypan blue in lactoglycerol. Infection level was determined as the percentage of randomly chosen root segments (0.5 mm long) which were mycorrhizal. Nursery plants sampled (3 to 24 months old), were growing in mixtures of pumice sand and unsterilised (U) or partially sterilised (S) peat cut from bogs vegetated by native heath plants. Field grown plants sampled were 3 to 15 years old.

None of the 61 blueberry plants sampled had become mycorrhizal within the first year of growth in potting mix, whether or not partially sterilised peat was used (Table 1). For the 2-year-old plants raised in partially sterilised peat (S), mycorrhizal infection levels were very low (3%) and only present in a third of the sampled roots. Where unsterilised peat (U) was used the incidence and degree of mycorrhizal infection were higher (Table 1). The data suggest that the potting mixes used are low in ericoid mycorrhizal fungi capable of infecting *V. corymbosum*, and that mycorrhizal infectivity is further reduced in the heat sterilising process.

After 3–7 years growth in the field, 28–42% of blueberry plants sampled were still nonmycorrhizal, and only after 15 years growth were all the sampled bushes infected (Table 1). A field trial was laid down on a peat soil under pasture in September 1977 to see whether artifical inoculation could stimulate

Table. 1. Mycorrhizal infection levels in roots of nursery and field grown blueberry plants.[z]

Age of plants	No. of plants sampled	Plants mycorrhizal (%)	Roots infected in mycorrhizal plants (%)
Nursery grown			
3 months S & U[y]	5	0	-
6 month S & U	43	0	-
12 month S & U	13	0	-
24 month S	64	34	3
U	23	56	15
Field grown			
3 year	32	72	52
5 year	47	60	34
7 year	19	58	27
15 year	43	100	36

[z]Cultivars samples were Jersey, Dixi and Atlantic.
[y]Nursery plants grown in sterilised (S) or unsterilised (U) peat.

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