flesh is orange-yellow in color, with moderate amounts of pinkish-red adjacent to the pit area. The flesh is above average in firmness, and of relatively smooth texture. The flavor is mild, and noticeably less sharp and astringent than that of Rio Oso Gem. The quality has been rated well above that of other varieties ripening in its season.

Tyler has not shown problems of particular susceptibility to brown rot, mildew or bacteriosis. Bacteriosis seldom occurs in the mountain sections of Virginia and the reaction of Tyler to this disease has not been reported from areas in which it does occur. Trees have been distributed to Experiment Stations in twenty states, two Canadian provinces, Mexico, Italy and France. Reports on its response to diseases and other pests in the various regions should soon be forthcoming.

Trees of Tyler were propagated by several commercial nurseries for delivery in the winter of 1970-1971 and will be available from additional nurseries in subsequent winters.

Seed Germination in the Red Raspberry

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Raspberry breeding programs are often hampered by poor seed germination. Germination may be improved by seed treatments. Jennings and Tulloch (1) reported on several of these, but even with the best (20 minutes in concentrated sulphuric acid followed by six days in 1.0 per cent calcium hypochlorite and a six-week period of moist chilling) germination seldom

Table 1. Germination per cent for raspberry cultivars, means of counts 30 and 90 days after overwintering.

	Cultivars				
Treatments[2]	Creston	Trent	Ottawa Latham	Boyne	Mean[1]
Dry seed, 50 min. conc. H_2SO_4	72.5	37.8	35.5	12.3	39.5 a
Dry seed, 20 min. conc. H_2SO_4	55.0	30.8	25.8	34.3	36.4 b
Dry seed, sandpaper scharified	50.3	22.5	2.0	1.5	19.1 cd
Wet seed, 6 months –2°C peat moss	54.8	19.5	0.5	1.0	18.9 cd
Fruit 6 months –5°C freezer bag	41.5	14.8	11.5	4.5	18.1 cd
Fruit (fresh seed sown) overwintered in cold frames	32.0	19.8	10.4	18.6	20.2 cd
Control	29.0	10.0	1.0	1.0	10.3 d
Mean[1]	47.9 a	22.2 b	12.4 cd	10.5 d	

[1]Means followed by the same letter are not significantly different at the 5% level.

[2]All treatments were followed by a four months' period of overwintering, outdoors, in a covered frame. The first five treatments listed were duplicated by overwintering for four months in a cold room at 0°C, but the data were bulked with the closely similar data from outdoors.

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exceeded 50%, although in an earlier and little known work, Williams (3) reported 20-95% germination after 50 minutes in concentrated sulphuric acid. In genetic experiments such as conducted at this Station, involving large-scale diallel crosses where the number of seeds is limited and any missing item may upset the whole project, most existing methods seemed to be unsatisfactory and it was thought that longer H_2SO_4 treatments (3) may be too risky by causing seed damage.

In an attempt to improve on existing methods, several treatments were given to four red raspberry cultivars in four replications. The treatments and the mean results from the four cultivars for two largely similar germination counts are given in Table 1. These percentage data were analysed after an arcsin transformation (Table 2).

As reported by others, there were large differences between cultivars in germination capacity. Highest per cent germination was shown by Creston, ranging from 72.5% in the 50 min. H_2SO_4 treatment to 29.0% in the untreated control, followed by Trent. Ottawa Latham and Boyne were the lowest in germination per cent, ranging from about 35% after H_2SO_4 treatments to 1% in the control; but Boyne was the only cultivar showing more germination after the shorter treatment. It was suggested recently (2) that poor germination of Boyne and related cultivars is caused by a sex-linked and gametophytically expressed sterility factor, tracing back to the cultivar Chief. Chief is a selfing of the original Latham cultivar, so that the present results support this hypothesis.

Williams' (3) treatment of dry seed (50 min. H_2SO_4) was the best in the average of two germination counts (Table 1), but in the later count the shorter 20 min. H_2SO_4 treatment gave equally good results. Both were superior to the routine previously used at this Station – seeds sown immediately after harvest and overwintered outdoors in cold frames. The latter had a slight advantage over the remaining three threatments at the first count, but there was little difference between them on the average (Table 1). Similar time differences contributed in a combined analysis to high significant interactions due to speed of germination, but these are not shown in Table 2.

In conclusion, seed treatment with concentrated sulphuric acid for 50 minutes can be used with confidence, in most cases, for improving germination in certain raspberry materials; but in some cases, shorter treatment may be better especially if slower germination is acceptable. With the best material, over 70% germination was achieved; but with poorer seed, further improvements in germination methods would be welcome.

Table 2. Analysis of variance of arcsin transformed data of Table 1.

Source of variation	d.f.	Mean square
Cultivars	3	4992.0**
Treatments	6	3355.1**
Cultivars x treatments	18	159.6**
Error	196	44.6

*Significant at the 1% level.

Literature Cited

1. D. L. Jennings and B. M. M. Tulloch. Studies on factors which promote germination of raspberry seeds. J. Exp. Bot. 47, 329-340, 1965.
2. S. H. Nelson and R. R. Skinner. Raspberry breeding trials. Can. Hort. Counc. Rep. 1969, 141, 1970.
3. D. D. Williams, Sulphuric acid treatment of raspberry seed. Can. Hort. Counc. Rep. 1955, 60, 1956.