to viruses than Hood, it is not tolerant enough to be grown in the northern part of the production area, where viruses are usually more severe.

The development of increased fresh market outlets for Pacific Northwest strawberries emphasizes the need for cultivars with differing seasons of maturity. At present, there is interest in Rainier, released from the WSU program in 1973, because it produces late-season, high quality fruit. Rainier seems to have virus tolerance comparable to that of Totem. This also makes it a promising prospect for the future. A selection (70-22-82) from the BC program produces fruit which ripens 10-14 days earlier than that of the mid-season Totem. This, together with virus tolerance, has justified placing the selection in commercial propagation in 1978 so that it can be extensively tested over the next few years.

Selecting for adaptation to mechanical harvesting has received major emphasis in the OSU-USDA program. One cultivar, Linn, has been released because of its mechanical harvesting adaptation. This cultivar and selections from all three Pacific Northwest breeding programs will continue to be evaluated for adaptation to this method of harvesting. It is inevitable that much of the acreage grown for processing will be harvested mechanically. High fruit quality traditional to the area and cultivars for fresh market consumption will continue to be emphasized in the three ongoing breeding programs.

California Strawberry Cultivars—Past, Present and Prospects

R. S. BRINGHURST AND VICTOR VOTH[1]

Average yield of strawberries in California has increased dramatically since the mid 1960's, and during the past five years the state average has exceeded 20 tons per acre (over 45 metric tons per hectare) with top yields of more than 50 tons/ acre (> 112 MT/H) reported.

The Tioga cultivar released in 1964 has dominated production in California during the 1970's, accounting for about 60% of the acreage. The once popular central coast variety Shasta has now disappeared and Fresno, useful in southern California since its release in 1961, is also on its way out. Tufts, released in 1972, has become the second ranking variety. Aiko, released in 1975, is gaining rapidly in the central coast area and partially accounts for some of the reduction in the Tioga percentage of the total acreage in the 1978 plantings, although most of it is due to the substantial increase in Tufts (Figure 1). Heidi, an excellent private variety (Driscoll Associates), very important as a summer cropping variety in the central coast including Santa Maria, accounts for a substantial portion of the "other" acreage.

Most California strawberries are marketed fresh (66% in 1977), most of the rest is processed. "Pick-your-own" operations are rare or non-existent in most areas.

All California strawberries are grown under "hill" culture under two planting systems:

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[2]Note: Tufts, Aiko, and Heidi are U.S. patented varieties and U.S. patents are pending for CN7, CN8, C38, C45, C51 and C55.

Table 1. The most important California strawberry cultivars, their period and area of usefulness (university varieties only).

Cultivar	Release	Use Period	Years	Area
Lassen	1945	45-64	19	So. California
Shasta	1945	45-74	29	Central Coast
Fresno	1961	61-78	17	So. California
Tioga	1964	64-	?	Statewide
Tufts	1972	72-	?	Statewide
Aiko	1975	75-	?	Central Coast

Table 2. Comparing performance of promising new selections with standard cultivars in winter plantings at Santa Ana during 1976-77.

Item	G/P1 Early	Yield Total	Total T/A*	Size	Firm
Tioga	166	640	37	15.6	5.2
Tufts	129	577	33	18.2	5.3
C38	142	778	45	21.1	5.4
C45	101	558	32	20.9	5.8
C51	188	721	42	25.2	4.9
C55	142	743	43	22.7	5.0

*52,269 plants/acre

Table 3. Winter (November-January) and total production of summer planted, day-neutral selections at Santa Ana during 1976-77.

Item	Fruit Production: Winter G/P1	Winter T/A*	Total		Size G/Fr
CN6	76	4	394	23	10.6
CN7	623	36	860	49	12.4
CN8	403	23	558	32	15.1
CN15	327	19	586	34	13.2

*52,269 plants/acre

1. **Winter planting**—This system, predominating in southern California and used to a lesser extent in the central coast, involves the use of high elevation nursery plants dug in October and planted by about the first week of November. The principal advantage in southern California is early, high-quality fruit.

2. **Summer planting**—Important to a greater or lesser extent in most strawberry areas, involves winter harvested, stored plants set in the fruiting beds from early August to about September 1 depending upon the variety. The principal advantage is high production.

Improvements in general culture designed specifically to exploit the new varieties have contributed greatly to the success of the new varieties. Three of the most important recent innovations should be noted here. They are:

1. **Planting slot fertilization**—This has been particularly important in contributing to the success of winter planted Tufts in southern California.

2. **New wide beds**—The use of 52 and 60 inch (130 and 150 cm respectively) in place of the standard 40 inch (100 cm) bed has increased the plant density without reducing yield per plant.

3. **Drip irrigation.**—Bed top delivery of irrigation water through drip tubes has decreased fruit losses substantially. Here, careful installation, good filtration, and pressure control are mandatory.

The strawberry cultivar situation in California can best be described as transitional, and all cultivars, in a sense, are interim only (Table 1). Given the existing cultivars, it is likely that Tufts in southern California and largely Aiko in central coastal California will continue to gain in popularity at the expense of Tioga. Ease (= cost) of harvest, difference in production patterns and maintenance of size throughout the harvest season have contributed to this change. Tioga was affected very adversely by the exceptionally warm and wet winter of 1977-78 and the 1978 harvest on

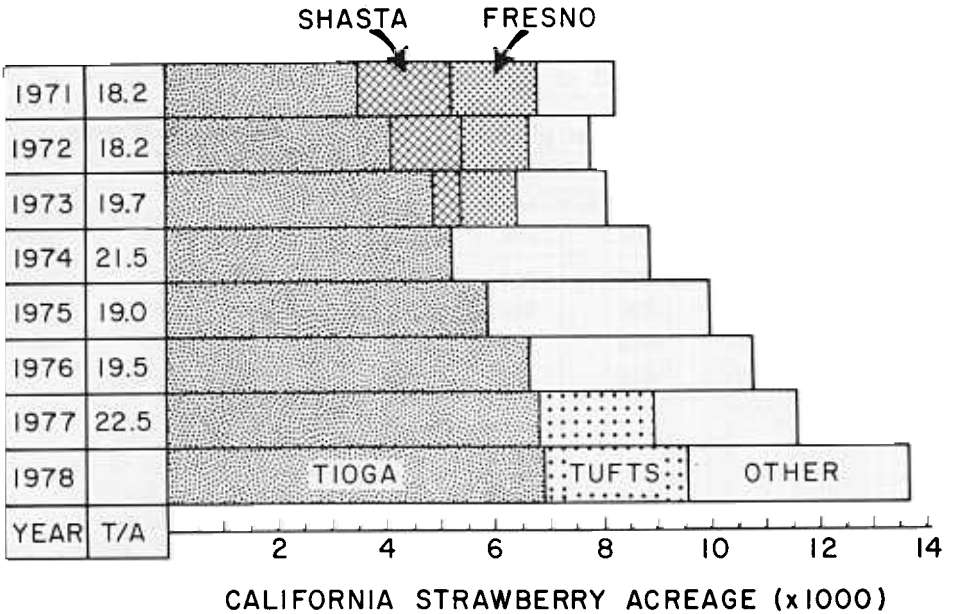

Fig. 1. Trend in California strawberry acreage by cultivars by year and average yield by tons per acre (20 T/A = 45 metric tons per hectare).

Tioga has been disappointing. In contrast, Tufts and Aiko both performed quite well despite the warm wet winter with the Aiko harvest continuing strong through the summer similar to previous years. This has influenced planting decisions for 1978 already and Tioga acreage will decrease.

There is a need for earlier, high quality winter planting varieties for southern California and advanced selections C38 and C51 are particularly promising in this regard (Table 2). Summer-planted day-neutrals such as CN7 and CN8 may also prove useful in producing very early fruit (Table 3).

There is also a need for improved summer cropping varieties for the central coast, particularly those suitable for winter planting. C55, C51 and possibly C45 (C45 may be better for summer planting) show promise (Table 4). Winter planted day-neutrals

Table 4. Comparing performance of promising new selections with standard cultivars in winter plantings at Watsonville during 1976-77.

Item	G/P1 Yield by Periods Ending				Total		Size
	3/31	5/17	6/29	8/16	G/P1	T/A*	G/Fr
Tioga	59	194	372	150	775	30	17.9
Tufts	47	169	572	328	1115	43	20.6
Aiko	48	143	302	247	740	28	16.7
C38	45	168	585	181	979	37	20.0
C45	51	159	445	215	870	33	23.2
C51	80	257	447	305	1089	42	21.8
C55	48	126	594	501	1268	49	22.5

such as CN7, CN8, CN15 and possibly CN6 are of interest (Table 5).

In summary, the prospect of the strong strawberry industry of California continuing to flourish is very bright.

Table 5. Performance of winter planted day-neutral selections at Watsonville during 1976-77.

Item	G/P1 Yield by Periods Ending				Total		Size
	5/20	6/30	8/10	9/6	G/P1	T/A*	G/Fr
CN6	88	270	514	172	1043	40	17.7
CN7	78	590	619	113	1400	54	17.3
CN8	158	452	750	176	1535	59	22.4
CN15	56	414	512	159	1141	44	18.8

*34,848 plants/acre

Highbush Blueberry Cultivars

A. D. DRAPER[1]

About 1911, Dr. F. V. Coville of USDA began a series of crosses among six native selections of three *Vaccinium* species (*V. australe, V. corymbosum,* and *V. angustifolium*) that led to the release of the first highbush blueberry cultivar, Pioneer, in 1920. One wild selection, Rubel, and at least 55 cultivars from U. S. Department of Agriculture, State Agricultural Experiment Stations, and private breeders have since been propagated and distributed to growers. Highbush blueberry cultivars released by public agencies since 1960 are shown in Table 1. Some of the older blueberry cultivars (Greenfield, Redskin, and Catawba) were not distributed widely and disappeared soon after being introduced. Others (Jersey, Weymouth, Rubel, and Rancocas), because of disease resistance, plant vigor and habit, high production, and suitability for machine harvesting have remained in production. Other factors in determining popularity of cultivars are fruit quality, season of ripening, and resistance of fruit to breakdown. Cultivars also differ in areas of adaptation; some, such as Bluecrop, are much more widely adapted than others. Winter hardiness, number of chilling hours required for bud growth, heat tolerance, and soil requirements of cultivars are important in determining areas of adaptation.

In northern Florida and areas along the Gulfcoast low-chilling cultivars (less than 800 hours below 7°C) are required for consistent yearly production, three highbush varieties, Flordablue, Sharpblue, and Avonblue are grown.

In North Carolina, cane canker is a serious fungal pest of blueberry and in order for a planting to persist, it must be resistant or be vigorous enough to quickly replace canes that

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