that progress in highbush blueberry cultivar improvement is still being made, since some of the newer cultivars shows considerable promise in comparisons with the older, established ones.

Literature Cited

1. Eck, Paul and N. F. Childers (ed.) 1966. Blueberry Culture. Rutgers University Press, New Brunswick, New Jersey. 378 pp.
2. Zych, C. C., A. G. Otterbacher, and A. L. Shawkat. 1971. Effect of soil treatments at planting on newly set blueberry plants. Trans. Ill. State Hort. Soc. 104 167-170.

Fall-Bearing Red Raspberries

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Autumn-fruiting or fall-bearing raspberries have been known for nearly 200 years. Rapid advances have been made in breeding, so that it is now possible to have ripe fruit on summer and fall clones from June 20th until frost at Geneva, New York. With the advent of mechanical harvesting, a new approach to culture and production may be on the horizon. Fall-bearing raspberries produce two crops of fruit in one season. The summer crop ripens in late June or early July and is borne on canes which grew the previous year. The fall crop is produced on the upper portion of the current season's growth.

Mawe and Abercrombie described a "twice-bearing" red raspberry in 1778. Several American horticulturists referred to them in 1806 and 1832. The Ohio Everbearing black raspberry was discovered in 1832 and grown to some extent. Hedrick (1925), in the *Small Fruits of New York* described 48 autumn-fruiting red and hybrid varieties and 17 black varieties. Over 40 years ago, several polyploid fall-bearing varieties such as 'Erskine Park', 'La France' and 'Hailsham' were grown. These varieties produced very soft, low quality, dark, dull, coarse, crumbly fruits and lacked hardiness. They were used in breeding but failed to be of any value.

One of the most widely grown English varieties, 'Lloyd George', produces a small fall-crop which ripens very late in a favorable season. This variety has been used extensively in many breding programs. In New York, 'Taylor', 'Marcy', 'Milton' and 'Indian Summer' were selected from 'Lloyd George' parentage.

'Indian Summer' originated from the breeding program where breeding for earliness was the objective, howover, it was noted to produce a fall crop very late in October. The fall crop ripened too late in northern areas but 'Indian Summer' was grown extensively on Long Island and southward where the growing season was longer than at Geneva.

'Ranere', or 'St. Regis', (Fig. 1) is a selection from the American red raspberry. It was grown to some extent 70 years ago but is nearly non-existent today. The berries are very small, poor in quality and only a few were borne at the tips of the canes in late August.

'Marcy', a late ripening large fruited variety, crossed with 'Ranere' produced 'September'. 'September ripens its fall crop 2-3 weeks earlier than

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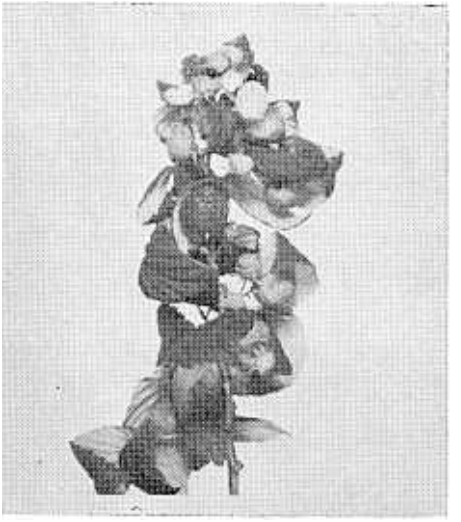

Figure 1. Fruiting habit in fall-bearing red raspberries. Type of fruiting habit exhibited by 'Ranere'.

'Indian Summer'. The summer crop is also very early, often ripening in late June at Geneva. Therefore, 'September' gradually replaced 'Indian Summer'.

The breeding of fall-bearing raspberries began in Geneva in 1934. Since then many thousands of seedlings have been grown and many selections evaluated. In 1938, a fall-bearing raspberry was discovered in the wild near Oswego, N.Y. From this source, several hundred seedlings were grown and several early ripening, well-branched selections were made. The berries were small, but the fruit was produced on many more laterals than that of 'Ranere'. The selections were hardy, early ripening and played a very important part in the early phase of the breeding work.

The first promising progress occurred when these *Rubus strigosus* selections were crossed with 'September' and other varieties. The resulting progeny exhibited larger fruit, an increase in number of fruiting laterals and earlier ripening. One of these, 'New York 359', was released for trial. It ripened 3 weeks earlier than 'September' but the fruit size did not interest many growers. In several northern areas ripe fruit was easily obtained before frost with this selection. The summer crop of 'N.Y. 359' ripens very early, often around the 20th of June at Geneva, N.Y. Since this selection was used extensively in breeding, the small fruit characteristic is dominant in most populations.

'Durham' was released in 1947 from the University of New Hampshire breeding program. The major assets of this variety were that of earliness and erect cane habit. The fruit is dark, soft, coarse, and of poor quality. In 1958, it was crossed at Geneva with 'N.Y. 463' (Milton x Cuthbert). From this cross 'Heritage' was selected (Fig. 2). To date, 'Heritage' is the most widely adapted promising fall-bearing variety. The plants are vigorous, very erect, with a fruiting surface extending down ⅓ the length of the cane. The fruits are average size, very firm, coherent and of good quality. In Maryland, Arkansas and other south central areas, the fruits tend to be a little smaller and the plant exhibits a more open growth habit, while in northern areas the fruiting laterals are more compact.

The very sturdy, erect canes need no support as contrasted with 'September' and 'Fallred'. Plants set in very early spring, if well grown, will produce a small crop the first fall.

'Fallred' (N.H. 7 x N.Y. 287) was released in 1964 by the Univ. of New Hampshire and is very early ripening. The canes branch profusely but the fruit is small, very soft, coarse and poor quality. The arching canes make picking difficult and require support.

A new approach to raspberry culture may be possible with the fall-bearing fruiting habit. Since fruit is borne on current season's growth, there is no hand topping and after frost all canes may be mowed or brush-hogged to ground level, thus eliminating hand removal of the old canes. The width of the row is easily

controlled by a light disc or rotovator. Current season's growth can be easily manipulated without severe cane breakage as exhibited with a woody biennial. There is no problem of positioning such canes for mechanical pruning.

The breeding program at Geneva is being continued. Great progress has been made but there is room for unlimited improvement. The principal objectives include:

1. Increased fruit size.
2. Increased number of fruiting laterals.
3. Earliness, erect cane habit, high quality and firmness.
4. Aphid resistance.

With the fall-bearing characteristic, winter hardiness is not a factor, unless there is a demand for a two crop variety where the wood would have to be hardy in order to fruit the following summer.

Selections have been made with all of these characteristics, however, no single selection has all of them. Several selections ripen in late July or early August. This would be a more desirable season, as fruit which ripens late is subject to fruit rot or the entire crop will not ripen before frost. Small fruit size is dominant over large size. The fruits of 'Heritage' average 3.5 grams per berry while two other fall-bearing selections average 8.8 grams per fruit. Even larger fruit size is available in summer fruiting clones. Berry size is important for the commercial or home gardener who hand picks the fruit.

For mechanical harvesting, total production is important or number of berries. A number of selections produce lateral fruiting branches the full length of the primocane, forming a canopy of fruit (Fig. 3). Such selections have little wood for production of a crop the following summer.

If fall-bearing raspberries are mowed to ground level, no support should be used, therefore a sturdy erect cane is essential. Most primocanes are slender and with the terminal weight of fruiting laterals they arch over, often touching the ground making picking difficult. Such canes are susceptible to severe damage in high winds or the fruit is bruised and dirty. Large canes produce larger crops than small ones.

The raspberry aphid is responsible for transmission of viruses. Aphid resistant varieties may escape virus in-

Figure 2. Fall-bearing crop on 'Heritage'.

Figure 3. Canopy of fruit on a fall-bearing selection.

fection. Varieties vary from being completely immune to highly susceptible. Screening techniques are being developed to eliminate susceptible progeny. Virus free plants are available and highly recommended. New plantings should not be established near existing or old plantings, nor should they be established near abandoned areas with large numbers of wild raspberries of unknown virus content.

The fall-bearing characteristic occurs in black raspberries and blackberries. Since black raspberries are propagated by tip-layers, fall-fruiting poses a problem.

Raspberries should be planted on a well drained, fertile soil free of perennial weeds. Soil fumigation before planting is desirable. Fall-bearing varieties are generally planted in the same row width as the summer fruiting varieties. Simazine is an effective herbicide. Excessive amounts of fertilizer or extremely fertile soils may produce more growth than desired for fall-bearers. Irrigation may be necessary in a dry season or on a sandy site, to produce good sized fruits and vigorous laterals.

A ten-acre planting of 'Heritage' near Syracuse, New York, is probably the first large scale fall-bearing planting in the U.S. The potential and promising breeding results may change the culture of red raspberries in the U.S., especially on a commercial scale. There is still an unlimited demand for U-pick, roadside and fancy market trade.

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I certify that the statements made by me above are correct and complete.

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