Effect of Temperature and Day Length on Varietal Adaptation of Strawberry

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STRAWBERRY varieties have been long known to be regionally adapted. Some varieties like the Massey, raised only in eastern North Carolina, and Klonmore, raised chiefly in southeastern Louisiana, are very restricted in adaptation. Others like Blakemore, grown throughout most of the Southern States, and Howard 17 (Premier), grown throughout most of the North, are more widely adapted. In other countries similar variation in range of adaptation of varieties is known. The map outlining the areas of the United States where certain varieties are best adapted shows clearly that some varieties are restricted and others have wide adaptation.**

The usefulness of strawberry varieties in any location, that is, their adaptation, is determined largely by their response to two conditions of the environment—length of day or photo-period, and temperature. These two conditions and their interrelations determine the varietal response not only at some particular stage of development, but throughout the entire life of the plant as well.

However, photoperiod may be the more important of the two at one stage and the less important at another. Likewise, temperature may be all important at one stage and of little importance at another. Thus the Ambato variety, which produces fruit the year through at Ambato, Equador does not make flower buds until late November at Beltsville, Md.; and in 1953 and 1954 it made none. Apparently it makes flower buds under short days at low temperatures, but only after the day length has been as short as $12^1/_2$ hours for a relatively long time. In contrast, the Missionary variety seems to respond quickly, in initiating flower buds, to a short day-length even at relatively high temperatures.

Day length and temperature affect other characteristics of the strawberry, such as flavor and firmness of the fruit. Although both factors have important effects on firmness, temperature apparently has much the greater effect on flavor.

Royal Sovereign, one of the highest flavored strawberries when grown in northern Europe, lacks flavor when grown in the much warmer climate of Maryland. Aberdeen, which is so delicious when grown where the days are cool and sunny and the nights cool, is also poor in flavor when grown in Maryland.

Like Royal Sovereign and Aberdeen, Marshall, long the standard of excellence when grown in the north and in the Pacific Northwest, is not at all well-flavored when grown in Maryland. In contrast, Suwannee develops fine flavor under a wide range of temperatures and hours of sunshine. However, in general, sunny days and cool nights are necessary for the best flavor, and cloudy humid days and warm nights for poorest flavor in strawberry varieties.

Howard 17, Catskill, and Robinson, are too soft to ship when grown in Maryland, but are much firmer and

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are the leading varieties under the cooler climate of New York and Michigan. Ambato, when grown under 12.5-hour days at low temperatures (mostly 40° to 60°F.) and with very low rainfall (probably about 20 inches) is perhaps the firmest of all strawberries; but when grown in Maryland it is too soft for commercial shipment.

Patterns in Fruit Production

Northern United States. The normal pattern of fruit development and production common to most strawberry-growing areas of northern United States, includes the following stages: (1) Initiation of flower buds and (2) development of flower buds when the days shorten to 12 hours and less and temperatures are relatively low through September, October, and November; (3) a winter rest period due in part to temperatures too low for plant growth and in part to chemical changes induced by the shortening days—a rest period which is usually broken by a period of chilling, but which also can be broken by long light periods and high temperatures; (4) spring flowering; (5) fruit development; and (6) fruit maturity over a period of two to three weeks.

The cultivated strawberry, an octoploid (with 8 sets of chromosomes), is a hybrid chiefly between two extremely heterozygous species with widely different adaptations. Hence, an infinite variety of genetic responses may occur at each stage of fruit development. Flower buds, for example, may develop as early as August or not until November, slowly or rapidly, and to a limited extent or extensively. Varieties like the Southland, Ettersburg 80 (Huxley), and Ettersburg 121 are nearly evergreen in Maryland and western Oregon, while most leaves of others like the Marshall and the Dunlap usually die by Christmas.

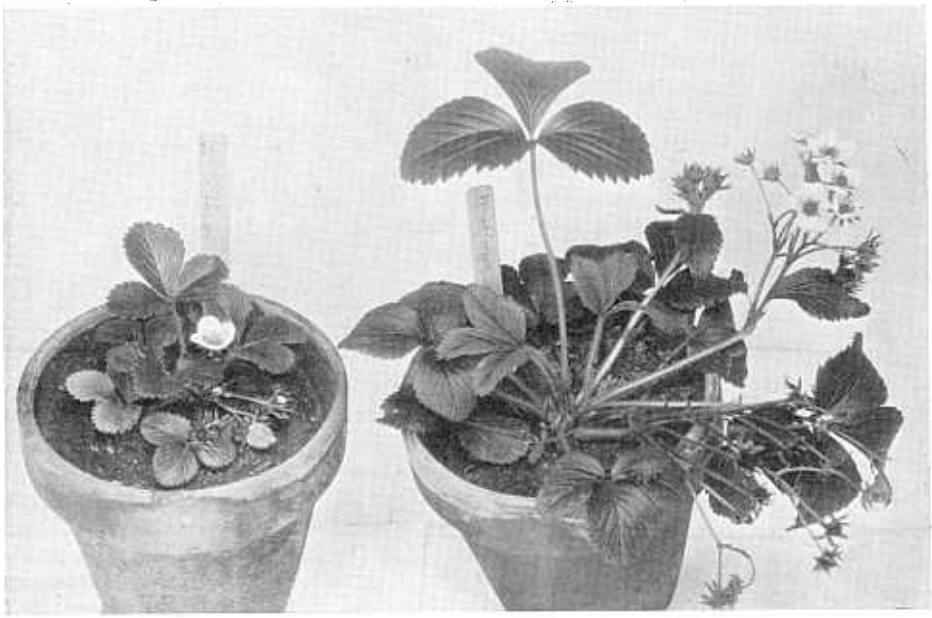

Fig. 1. **Left, Howard 17 (Premier), and Missionary on the right, showing varietal differences in response to a normal day length of 9 to 10 hours at Washington, D. C., from November 7 to March 10.**

The Missionary variety requires only a short rest period before it may start growth again, while Mastodon and Howard 17 require much longer rest periods (Fig. 1). However, in northern states the rest period of most varieties is not broken by the cool weather of October and November and thus renewed growth in the fall and subsequent injury by severe cold are prevented. Although a few flowers of some varieties develop so far that they may open in the fall, this is unusual. In the spring, flowers of some varieties open early and those of others much later. Most varieties are June-bearers and mature the bulk of their fruit within a two-week period, and some early varieties stop bearing before late varieties start ripening.

In contrast to ordinary varieties in pattern of fruit development, the so-called everbearing varieties initiate flower buds and develop flowers and fruit whenever growing temperatures occur (Fig. 2). They differ from ordinary varieties in that they have the inherited ability to initiate flowers in midsummer, when days are long. Each everbearing variety has a different pattern of fruiting and response to environment. Some make runners early in the season and then, as the days reach their maximum length, begin to make flower buds. Others make few runners but initiate flower buds and produce fruit throughout the growing season. However, actual yields of individual plants of a variety vary with soil fertility, moisture, and temperature. Thus, because of variable inheritance and environmental conditions, everbearing seedlings and varieties present infinitely variable patterns of fruit production during the growing season. When moisture is ample and temperatures are usually below 85°F., everbearing varieties will produce fruit for home gardens and local markets throughout the growing season.

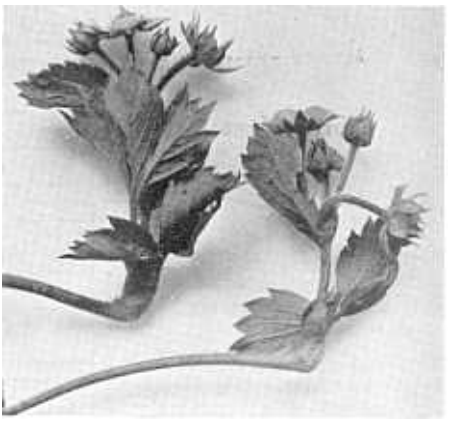

Fig. 2. **The terminal growing points of runners of an everbearing strawberry that developed into flower buds. Photographed on June 21.**

Southern United States. In southern states where the growing season starts when the day length is as short as 12 hours (Fig. 3), flower-bud initiation and development in ordinary varieties occur not only in the fall but also in February, March, and April. The fruit production period of a single variety is therefore lengthened to 6 to 8 weeks. Still farther south, in Florida, where growing temperatures continue all winter and the day length is as short as 10 hours, flower-bud initiation and development continue until April or sometimes until May when the days lengthen and the temperatures are high enough to slow down and finally to stop flower-bud initiation.

Each area in the South where strawberries are grown has different production periods: December to April in Central Florida, March through May in Southern Louisiana, and April through May in eastern North Carolina.

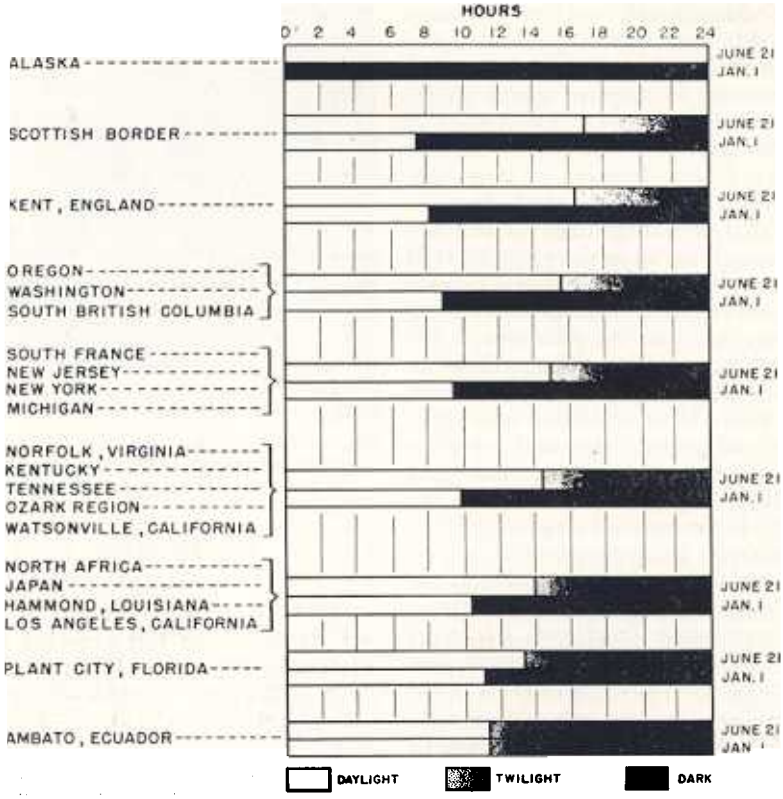

Fig. 3. **Length of the light and dark periods on June 21 and January 1 in various areas where strawberris are grown.**

(To be continued)

Edgar Apple

The Edgar apple is one of the newer Ottawa hybrids that follows the McIntosh picking season. It is a cross between McIntosh and Forest. The fruit is of good commercial size, good quality and texture. Its chief merit is that it has a longer season than McIntosh. The tree of Edgar is equal to McIntosh in hardiness, but is slower to come into bearing. We have noted in recent years that it is not as productive as McIntosh, and for that reason is not recommended to the commercial grower, although it is worth trying. *—D. S. Blair, Central Experimental Farm, Ottawa, Canada.*

If you have an interest in the French-American hybrid grapes, you will enjoy seeing the "Catalogue of Grape Vines for Wine and Tables", which you can obtain by writing to the Boordy Vineyard, Box 38, Riderwood, Maryland. In this catalogue you will find vine and fruit descriptions of some of the outstanding French-American grape varieties.