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Growth Stages in Fruit Trees— From Dormant to Fruit Set

P. J. Chapman and Gertrude A. Catlin



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Deciduous fruit trees pass through a series of fairly definite growth steps or stages in the spring. Fruit growers and those who serve the fruit industry in a research, regulatory, or advisory capacity or as suppliers of pesticides, fertilizers, etc., will often have occasion to refer to these stages. They perhaps find their greatest use, however, in the timing of chemical treatments for the control of plant diseases and of insect and mite pests.

What then are these stages and by what names are they known? Unfortunately, no common agreement has been reached on either of these points (1,2,4,5,6).

In the present publication we identify, illustrate, name, and define what we believe are the *key* growth stages for apple, pear, peach, plum and prune, tart cherry, and sweet cherry. The growth period covered extends from the dormant stage of the buds up to the initial setting of the fruit. It is hoped that these designations have sufficient merit, collectively, to win official acceptance beyond the confines of New York. For if this transpires, at least that part of the horticultural world would be using the same growth stage language.

The uses to which the proposed growth stage terminology plan may be applied lie in general beyond the scope of the present publication. However, some references are made here to its application in the timing of pesticidal spray treatments under New York conditions. More specific and timely information will be found on this usage and on other horticultural operations as well, in official recommendation publications like the one revised and issued annually in New York (2).

Several rules were followed in selecting names for the key growth stages. These were that the name be short, self-descriptive, non-technical, preferably not new, and non-fanciful. Reference is made in that last rule to some names used in the past such as mouse ear, popcorn, bowlegged stage, etc. Generally, we have also avoided giving names to growth stages falling between the key stages. To have done so would seem to have complicated the system unnecessarily. However, the generic nature of the terminology used does permit the use of qualifying prefixes, adjectives, and phrases for more precise timing. Thus, using the pink stage in apple as an example, one may wish to employ such terms as prepink, early pink, late pink, full pink, etc.

Our growth stage coverage is limited to the deciduous fruits which are widely grown commercially in New York. If desired, the plan readily could be extended to include other fruits such as apricot, nectarine, almond, quince, and Japanese plums. Nectarine is a hairless peach, so in areas where both nectarine and peach are grown commercially the two could be treated as we have plum and prune, i.e., as one fruit.

With the exception of apple, each of the fruits is represented here by a single cultivar (variety). This treatment raises the question of how much variation there is in the appearance of growth stages between the cultivars of a given fruit. Differences occur, of course, but these are more of degree than kind. Thus, we believe that among standard cultivars of a fruit, one should be able to identify the growth stages, readily, from illustrations given of that fruit's representative cultivar.

Pesticidal sprays applied at some time during the dormant period and up to the initial setting of the fruit are critically important. Generally, these treatments are applied when the trees reach specific developmental stages during this period. An additional timing consideration, in districts having climates like New York's, is the actual or anticipated occurrence of infection periods (wetting periods of sufficient duration) for various fungus diseases. This factor may determine when a treatment may be most advantageously applied during the range of a given key growth

PLATE 1

APPLE

1. Dormant
2. Silver tip
3. Green tip
4. Half-inch green
5. Tight cluster
6. Pink
7. Bloom
8. Petal fall
9. Fruit set

The photographs appearing in the following six plates were selected from a large number all of which were taken by the junior author. We are able to reproduce them here in color from a set of color separation plates kindly prepared for our use by E. I. duPont de Nemours and Co., Inc.





PLATE 2

PEAR

1. Dormant
2. Swollen bud
3. Bud burst
4. Green cluster
5. White bud
6. Bloom
7. Petal fall
8. Fruit set





PLATE 3
TART CHERRY

1. Dormant
2. Swollen bud
3. Bud burst
- 4a. Early white bud
- 4b. White bud
5. Bloom
6. Petal fall
7. Fruit set

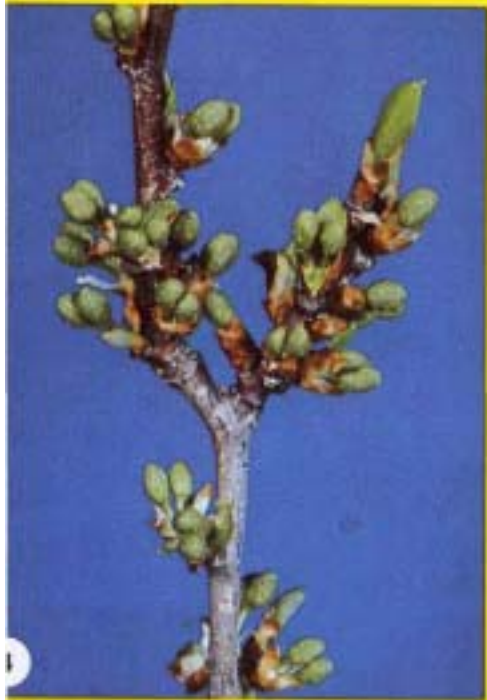


PLATE 4
PLUM AND PRUNE

1. Dormant
2. Swollen bud
3. Bud burst
4. Green cluster
5. White bud
6. Bloom
7. Petal fall
8. Fruit set





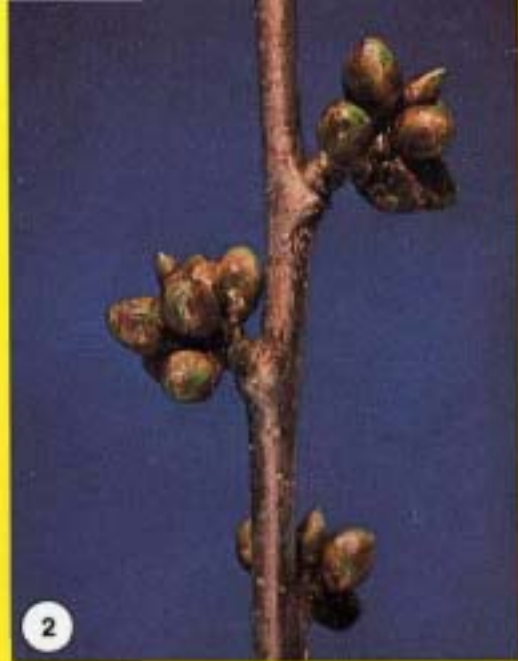
PLATE 5
PEACH

1. Dormant
2. Swollen bud
3. Half-inch green
4. Pink
5. Bloom
6. Petal fall
- 7a. Fruit set—shucks on
- 7b. Fruit set—shucks off

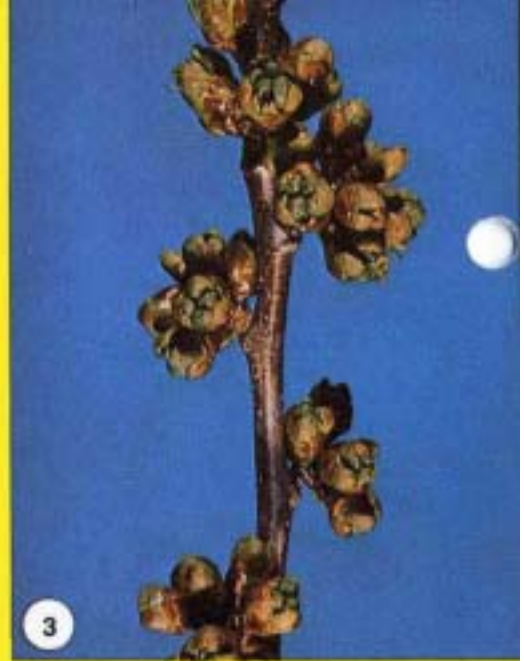




1



2



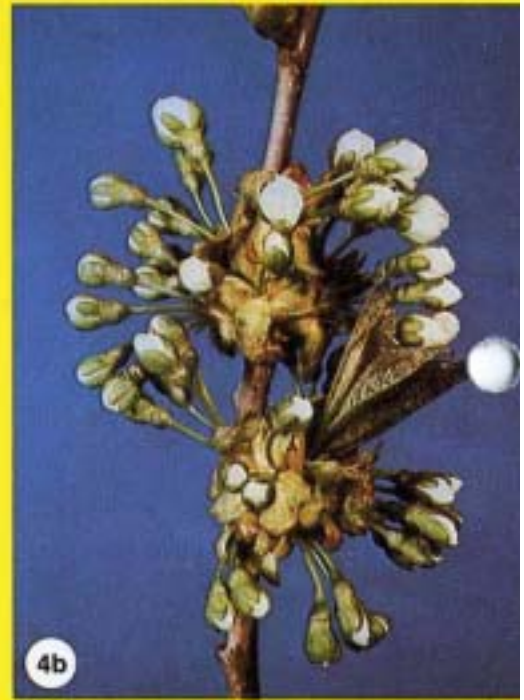
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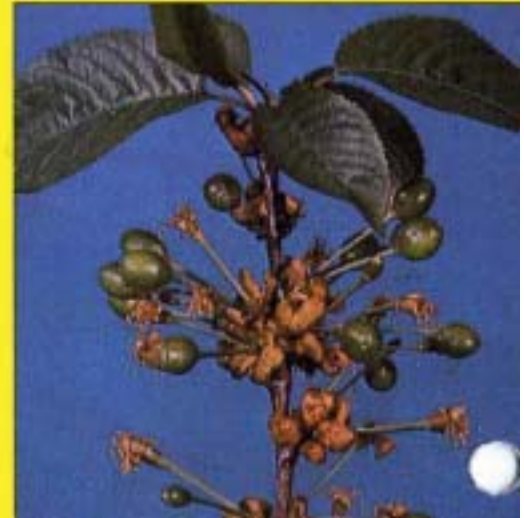
4a

PLATE 6
SWEET CHERRY

1. Dormant
2. Swollen bud
3. Bud burst
- 4a. Early white bud
- 4b. White bud
5. Bloom
6. Petal fall
7. Fruit set



4b



stage. Additionally, in cool wet springs, it may be necessary to apply one or more "extra" or "in-between-key growth stage" fungicide treatments. This action is most commonly taken in New York in coping with apple scab and brown rot. The number, timing, and composition of the pesticidal treatments applied between the dormant and the fruit set period varies widely between the fruit growing districts of the world. These differences are dictated by the pest complex present and by the amount of precipitation falling during the growing season. That latter factor will rather directly determine the prevalence and severity of fungus diseases in a given district and thereby the extent to which fungicides are needed in the spraying program.

In addition to the differences found between districts are those that have or may take place within a given district. Thus, just as present practices here differ from those of the past, so are future usages apt to differ from those of the present.

BUDS, FRUIT SET, AND SHUCKS

We make use of three common horticultural terms in our definitions and discussions of the growth stages. These are: buds, fruit set, and shucks. Since these terms are rather variously used, we are stating how we have employed them here, including the place they should have, if any, in growth stage terminology.

Buds: Early horticulturists called the overwintering buds which ultimately produce flowers and fruits, fruit buds (3). Most fruit growers continue to use this name for them. Modern horticulturists now advise that the proper name for these overwintering buds is flower or blossom buds. A problem is created for us if we accept this usage for we need to describe developments in two quite different kinds of buds w/z the overwintering ones, and those arising out of them which directly produce the blossoms. If we call the former blossom buds, what then do we call the latter? Between the two, the buds which produce blossoms directly would seem to have the better claim to being called *blossom* or *flower buds*. They are so called in this publication. As to the overwintering buds, we are using the time honored name of *fruit buds* for them.¹ This name is used for these buds up until the time when the flower bud(s) become visible.

The terminal and lateral buds which produce only leaves are called *leaf buds*. These usually can be distinguished from the fruit buds by their location and narrower width.

In the case of apple and pear, typical fruit buds will produce clusters of from five to eight blossom buds arising out of a whorl of leaves (See Plates 1 and 2). In the stone

fruits, the leaves and blossoms are produced in separate buds. The number of blossom buds arising out of a single fruit bud in stone fruits will range from one (peach) to four or five.

Fruit Set: In our usage, this stage is reached in apple, for example, 5 to 10 days after the end of bloom or when one can readily see which blossoms have at least temporarily set fruit and which ones have not. This stage is illustrated for all of the fruits in the plates. Actually this stage represents only the *initial* setting of the fruit. For some of these initially set fruit may drop a week or two later, and some will fall later still in the so-called June drop (3).

Shuck: The shuck is the dried floral remnant which in the stone fruits partially covers the newly-set fruit. As the fruit grows, the shuck splits and soon is sloughed off. The number of days intervening between the end of bloom and when most of the fruits are free of the shuck varies with temperature and kind of fruit. The period may be as short as 3-4 days in sweet cherries, or, if cool weather sets in, as long as 2 weeks in peach. The term shuck has long appeared in official spray recommendation literature, but the more basic consideration at this juncture is whether the fruit has set. If the term shuck is employed, we suggest it be used to qualify the key growth stage of fruit set. Some possible ways of so doing include: fruit set, 50 per cent shucks off; fruit set, shucks falling; fruit set, shucks off, etc.

KEY GROWTH STAGE NAMES

Thirteen different growth stage names are used for the six fruits. The same name is employed for all of the fruits at five comparable stages. Since one definition will serve all uses of a name, each will be defined before listing the growth stages for the individual fruits. These follow:

Dormant: Fruit buds relatively inactive. This is the overwintering stage, (applies to all fruits).

Silver Tip: Applies only to apple. Fruit bud scales separated at tip, showing light gray tissue.

Swollen Bud: Equivalent to silver tip stage in apple. Fruit buds swollen, scales separated to expose areas of lighter colored tissue. (Applies to all fruits except apple).

Green Tip: Applies only to apple. Fruit buds broken at tip, showing about 1/16 inch (1 -2 mm) green.

Bud Burst: Equivalent to green tip stage in apple. Fruit buds broken at tip, showing tips of blossom buds. (Applies to pear, sweet and tart cherry, plum and prune).

Half-inch Green: (*Centimeter green*): Applies only to apple and peach. In apple, when about 1/2 inch (1 cm) of leaf tissue is projecting from the fruit buds. In peach, when the leaf bud occurring between a pair of fruit buds has produced about 1/2 inch (1 cm) of new growth.

Tight Cluster: Applies only to apple. Blossom buds mostly exposed, tightly grouped, stems short.

¹ In Webster's New International Dictionary, Unabridged, 2nd Edition 1957 (G. and C. Merriam Co.) *fruit bud* is defined as: "a bud that produces flowers and fruit instead of foliage leaves; also a bud producing both leaves and flowers as in the apple. "*Flower bud* is defined as: "An unopened flower; (a bud) producing only a flower."

Green Cluster: Applies only to pear, plum and prune. Blossom buds green, mostly separated in the cluster, stems lengthened. **Pink:** Applies only to apple and peach. For apple, all blossom buds in cluster pink, stems fully extended. For peach, when the blossom bud shows a pink tip. **White Bud:** Applies to pear, sweet and tart cherry, plum and prune. Blossom buds white, separated in the cluster and stems lengthened. **Bloom:** Blossom buds open (applies to all fruits). **Petal Fall:** After about 75 per cent of the petals have fallen (applies to all fruits). **Fruit Set:** A stage ranging from about 4 (cherry) to 10 (peach) days after bloom when the blossoms that have or have not set fruit, initially, are clearly evident (applies to all fruits).

KEY GROWTH STAGES AND THEIR RELATIONSHIP TO PEST CONTROL

The growth stages identified here do not show when spray treatments are to be applied but when any combination of **needed** treatments can be applied. Rarely, if ever, will a grower need to apply treatments at all of the key growth stages shown for a given fruit. Furthermore, the number, distribution, and content of needed treatments will vary between the major fruit growing districts of the world and within any given district over the years. Against this changing scene, a generally accepted growth stage standard obviously would serve useful reference purposes.

APPLE (Plate 1)

The cultivars represented in the photographs are McIntosh (stages 2,6,8,9), R. I. Greening (stages 3,4), Gravenstein (stages 5,7), and Delicious (stage 1).

Growth Stages: (1) dormant, (2) silver tip, (3) green tip, (4) half-inch green, (5) tight cluster, (6) pink, (7) bloom, (8) petal fall, (9) fruit set.

Prevention of primary apple scab infections is a dominant concern of New York growers at this season. In a "normal" year fungicides may be applied at stages 3,4,5,6,8, and 9 to attain this objective. The most effective time to use an oil spray to control the European red mite is at the tight cluster stage. This is also the time to start control of powdery mildew.

In areas where the plum curculio is troublesome, the treatment applied at the fruit set stage has been called "the curculio spray." Treatments applied at the petal fall and fruit set stages are important in a program of control of this pest. Limited success has been obtained in the control of fire blight with a bactericide applied during the blossom period. Aside from the foregoing specific problems, a number of lesser insect pests may be controlled with sprays applied at stages 4,5,6,8, and 9.

PEAR (Plate 2)

Photographs and observations were based on the cultivar Bartlett.

Growth Stages: (1) dormant, (2) swollen bud, (3) bud burst, (4) green cluster, (5) white bud, (6) bloom, (7) petal fall, and (8) fruit set.

Pesticidal treatments are used primarily for the control of pear psylla and fire blight. One or two oil sprays applied in the swollen bud stage provides good initial control of the psylla and blister mite. Fire blight may be contained by good control of its vectors—psylla, plant bugs, aphids—in green cluster and petal fall sprays and by use of a bactericide in bloom.

TART CHERRY (Plate 3)

The photographs and observations are based on the cultivar Montmorency.

Growth Stages: (1) dormant, (2) swollen bud, (3) bud burst, (4) white bud, (5) bloom, (6) petal fall, and (7) fruit set.

New York tart cherry growers are concerned with the control of the cherry fruit flies, plum curculio, brown rot, leaf spot, and powdery mildew. While sprays needed to control some of these problems are applied as post fruit set treatments, growers commonly apply sprays at stages 4,6 and 7.

PLUM AND PRUNE (Plate 4)

The photographs illustrate the cultivar Stanley. It was derived from the European plum *Prunus domestica* L.

Growth Stages: (1) dormant, (2) swollen bud, (3) bud burst, (4) green cluster, (5) white bud, (6) bloom, (7) petal fall, and (8) fruit set.

Problems controllable by pesticidal sprays, in whole or in part, include: the European red mite with an oil spray applied at the bud burst stage; brown rot, at stages 5,7, and 8; and the plum curculio at fruit set and in one or two later stages.

PEACH (Plate 5)

The photographs illustrate the cultivar Red Haven.

Growth Stages: (1) dormant, (2) swollen bud, (3) half-inch green, (4) pink, (5) bloom, (6) petal fall, and (7) fruit set.

To control peach leaf curl a spray must be applied in the dormant period, either in the fall or before the swollen bud stage in the spring. Brown rot is a problem in peaches requiring the use of a fungicide in the pink and petal fall

stages. To control the plum curculio, a spray is advised at the fruit set stage when the shucks are falling and, where the pest is of major consequence, two later sprays are applied, about 7-10 days apart.

SWEET CHERRY

(Plate 6)

The photographs are of the cultivar Windsor.

Growth Stages: (1) dormant, (2) swollen bud, (3) bud burst, (4) white bud, (5) bloom, (6) petal fall, and (7) fruit set.

While sweet cherries are subject to the same disease and insect pest problems as tart cherries, brown rot is of special concern to the sweet cherry grower. This disease may be contained by use of a fungicide applied at stages 4 or 5,6, and 7 and by several post fruit set sprays. Such spraying is usually more than adequate to control leaf spot while by adding an insecticide to the fruit set spray and to one or more post fruit set treatments the plum curculio and fruit flies can be controlled.

LITERATURE CITED

1. Ballard, J. K., E. L. Proebsting, and R. B. Tukey. 1973. Critical temperatures for blossom buds. Cherries. Washington State Extension Circ. 371.
2. Brann, J. L., P. A. Arneson, and G. H. Oberly. 1975. Tree fruit production recommendations for commercial growers. N. Y. State Col. of Agr., Cornell Univ., publication.
3. Chandler, W. H. 1925. Fruit setting. *In* Fruit Growing. Houghton Mifflin Co., Cambridge, Mass. pp. 170-188.
4. Chapman, P. J. 1966. Key apple bud stages. New York Agr. Expt. Sta. (Geneva) Farm Research 32(1):6-7.
5. Dennis, F. G. and G. S. Howell. 1974. Cold hardiness of tart cherry bark and flower buds. Michigan Agr. Expt. Sta. Res. Rept. 220:1-5.
6. Fleckinger, J. Phenologie et arboriculture Fruitiere *in* Bon Jardinier, Tome 1 pp. 362-372. (Undated reprint only available; publication date about 1960).