

ALASKA PIONEER FRUIT GROWERS' NEWSLETTER

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President and Editor: **Dwight Bradley**, 22008 Voyles Blvd, Chugiak, AK 99567 Phone 688-1268.
Vice President: **Bob Boyer**, P.O. Box 9-1376, Anchorage, AK 99509. Phone 561-2885
Secretary and Treasurer: **Pam Warner**, 7000 Viburnum Dr., Anchorage, AK 99507. Phone 344-9749.

MEETING SCHEDULE

May 19, 1994, 7 to 8 P.M. at Dave Crusey's orchard in Wasilla. Dave has a very successful one-acre orchard overlooking Knik Arm. He grows prize-winning Norlands, as well as several other varieties. He has cordially invited us to see his orchard for our May meeting. Unfortunately, exact mileages to the Crusey's weren't available when this announcement went to press. From the traffic light on the Parks Highway in "downtown" Wasilla, take the Knik-Goose Bay Road south. The village of Knik is about 12 miles and the Crusey's driveway, which will be marked, is on the left about 1.5 miles later (these distances are read off a map so they aren't exact.) Call Dwight Bradley during the day at 786-7434 or at 688-1268 from 5 to 9:30 PM if you need more information.

June, July, August -- No meetings.

September 15, 1994-- Annual apple tasting. Tentatively, the tasting will be held at Bradley's orchard in Peters Creek, 7 PM. This is our best opportunity for publicity, so feel free to bring interested non-members.

CLUB BUSINESS

In February, Eric Simpson stepped down as club president after about five years of outstanding service. He replaced Bob Purvis in 1989. Eric is in the process of moving to Washington where he's already planted a lot of apple trees. Eric's last major chore as president was to see to it that the Alaska Pioneer Fruit Growers Association was incorporated as non-profit organization in Alaska. This was formalized on March 3, 1994. Pam Warner also stepped down as Editor of the Newsletter. Since Bob Purvis left, Pam has done an excellent job keeping the Newsletters coming. Thanks to both Eric and Pam.

NOTES FROM RECENT MEETINGS

Our January Meeting featured Susan Adams, who showed a video on her efforts to promote a wild blueberry industry near Aniak in southwestern Alaska. The project was funded by the Alaska Science and Technology Foundation. Susan brought in a blueberry specialist from the University of Maine, David Yarborough, as a consultant. Yarborough has published a number pamphlets on all aspects of low-bush blueberry cultivation which he can provide (for \$5, if I recall) if you contact him at Deering Hall, Rm. 114, University of Maine, Orono, ME 04469). In February, in addition to our regular meeting, the Cooperative Extension Service organized a statewide teleconference on fruit growing in Alaska. Participants from Fairbanks, Palmer, Juneau, Anchorage, and several other smaller communities kept up a lively discussion for two hours. In March, our planned speaker could not make it, so instead we showed two videos: one by Ed Fackler on apple grafting, and a second by Oregon State Univ. on growing apples in the home orchard. In April, our annual grafting workshop was held at Dimond Greenhouses. The workshop was well attended and it was clear that a growing number of people are planting large (for Alaska, at least) blocks of apple trees. Many local apple growers brought bundles of scionwood from their own trees, and Clair Lammers provided a huge box of surplus scionwood, mostly of extremely rare numbered varieties. Burt Gore and Dana Olsen are going to try quite a few of them.

CALL FOR CONTRIBUTIONS FROM YOUR NEW EDITOR

Although we're a much smaller group than NAFEX, the philosophy behind *Pomona* seems to be a good one for this Newsletter. *Pomona* is a pretty low-key publication and all NAFEX members, whether beginner or expert, are expected to contribute something every couple

of years. In putting together this, my first newsletter, I haven't gotten any contributions from other members, but you *can* expect to be pestered in the future. There are lots of suitable subjects, from your own experience, that will be of interest to the other club members:

- fruit production (what varieties ripened?, when?, how were the apples?)
- lists of varieties you have growing
- scionwood wish lists
- winter survival notes, especially of untested varieties or rootstocks
- grafting methods
- building fences
- soil fertility
- IPM
- bees, mice, moose
- failed experiments
- items of historical interest
- plant breeding experiments

Excerpts from published books, articles, catalogs, etc., may be suitable if permission has been obtained from the publisher and author. Although most of the club's most active members are from the Anchorage area and the main interest seems to be apples, the club serves the whole state and all fruits and nuts.

ANTIQUE COLD-HARDY APPLE VARIETIES IN NORTHERN NEW ENGLAND

by Dwight Bradley

The northern counties of Vermont, New Hampshire, and Maine have long been a proving ground for hardy apples. The growing season is about the same as in Anchorage (late May to early September), and the winters are about as cold (record low temperatures for most towns are -40° to -50°F). For apple growing, the three biggest differences are that the longest summer days are about 4 hours shorter than in Anchorage, mid-summer days average 10°F warmer, and there is usually a month of great apple-ripening weather between the first frost in September and the apple killing freeze in October. Over the past few years, my wife Lauren and I have visited several apple growers from northern New England. Here are some notes on apple varieties that are either already being grown in Alaska, are worthy of trial here, or might be good parents in a breeding program for Alaska.

The leading expert on Maine varieties is George Stilphen. He has a small orchard (about 40 varieties) in the foothills of the White Mountains in Oxford County, Maine. Most of the area is zone 4 but he lives in a zone 3 pocket. As far as I know, he has the largest collection of varieties that originated in Maine, including Dudley, Coles Quince, Moses Wood, Winthrop Greening, Thompson, Deane, Nutting, Brock, Striped Harvey, Cherry Pippin, Starkey, Major Small, Somerset, Winn's Russet, and Black Oxford. Except Brock, which was developed through a breeding program, all of these obscure varieties originated as chance seedlings in the 1700's or 1800's. Stilphen recently published a book on apple varieties of Maine that provides descriptions and historical information, with particular emphasis on the time before Red Delicious, Macintosh, and Cortland came to dominate. *The Apples of Maine* (hardbound, 378 pages) is available for \$40 from George Stilphen, R.R. 1, Box 1347, Bolster's Mills/Harrison, ME 04040.

Ken Parr, from East Burke in the Northeast Kingdom of Vermont, has 265 varieties growing in a favorable Zone 3 location. His orchard includes what is probably the only complete collection of varieties that originated in Vermont. He's an optimist — 84 years old and still planting about 20 new trees every year. Parr got interested in apples about 20 years ago when he retired to an old farm that had eight weather-beaten, 80- to 100-year-old trees that were still producing. He set out to identify them, and ended up prowling around the countless old and abandoned farms in the Northeast Kingdom, trying to rediscover the nearly forgotten varieties that once were found on most farms in the area. Eventually, Ken identified the trees in his original orchard as Duchess, Dudley, Wolf River, Fameuse, Tetovski, Wealthy, and Yellow Transparent. Other old varieties that he's come across in the Northeast Kingdom include Beacon, Bethel, Winter St. Lawrence, Montreal Peach, Golden Sweet, and two that he rediscovered: St. Johnsbury, and Magog. Ken's address is Kenneth Parr, Blue Wax Fruit Garden, RD 1, Box 63, East Burke, VT 05832. He is interested exchanging scionwood and in testing unusual varieties in his Zone 3 orchard.

All of these antique varieties on Stilphen's and Parr's lists are hardy enough to have survived a century in Zone 3, despite often total neglect. All, therefore, should be hardy in the Anchorage area. The big question is whether or

not they will ripen before the first apple-killing freeze. Some notes on varieties follow.

Coles Quince is a large, yellow summer apple from Maine. Cole (1849) described it as follows: "When first ripe, firm, juicy, pleasant, acid, and first-rate for cooking. When very mellow, remarkably tender of a mild, rich, high quince flavor and aroma. When in perfection we have never seen its equal. July to September (in Maine)." It is sold by Bear Creek and Southmeadow, but the last time I checked it was only available on non-hardy dwarfing rootstocks. It would be well worth trying in Anchorage on hardy rootstock. I suspect that hardiness might be a problem, because it was never grown in Aroostook County (in northernmost Maine, the coldest county in the state) during the late Nineteenth Century.

Duchess, also known as Duchess of Oldenburg, is found on many old farms in northern New England. In New Hampshire, the 40-year-old Duchess trees in my parents' yard ripens about August 25, a week or so after Yellow Transparent. Parr has found many minor variants on Duchess, which he thinks may be due to the fact that self-pollinated Duchess comes nearly true to seed. It may be that Duchess seedlings were sold as Duchess by one or more nurseries some time in the remote past. Duchess is hardy enough and ripens early enough to be grown in Anchorage. The Duchess I planted in 1992 is likely to bear a few apples in 1994. Duchess is sold by Bear Creek and St. Lawrence.

Dudley, also known as North Star, is an open-pollinated Duchess seedling from Aroostook County. The tree is very vigorous, spreading, hardy, and productive. The fruit is large, greenish yellow splashed with crimson. It is briskly sub-acid and very good. It resembles Duchess, but ripens a bit later (early September in northern New England), keeps longer, and is much better for fresh eating. Dudley's quality makes it worth trying in Anchorage, but I suspect it won't fully ripen every year. The Dudley I planted in 1992 is likely to bear a few apples in 1994. Parr thinks Dudley is self-fruitful, because, in his orchard, a 40-year-old seedling that is virtually identical to Dudley grew at the drip-line of his 100-year-old grafted Dudley. Dudley is sold by Bear Creek and St. Lawrence.

Nutting is an open-pollinated Duchess seedling from Aroostook County that was rediscovered only last year, after nearly a century of

obscurity. It probably never was sold outside Aroostook County. The tree is described in Stilphen's book as hardy, vigorous, and very productive. The fruit is large, yellowish green, with faint red on the sunny side. Nutting ripens in late August and September in Aroostook County, a few weeks after Yellow Transparent. Stilphen sent me a box of Nuttings last Fall that had been picked at least two weeks earlier. I concluded that it isn't a very good keeper, at least when in the hands of the US Postal Service. It should succeed in Anchorage, and is definitely worth trying. I am going to get scionwood from Stilphen in 1995.

Tetovsky is a Russian apple that is still found in old orchards throughout northern New England. An old-timer once told Parr that Tetovsky was "the best apple in the world — for fifteen seconds!" The Tetovsky I planted in 1992 should bear in 1994. It is sold by Bear Creek and St. Lawrence.

Wolf River. Although it never very popular, Wolf River is now the commonest survivor in the oldest orchards in New England, having withstood some fierce winters over the past century. Although generally regarded as a cooking apple, fresh-picked Wolf Rivers are excellent for fresh eating, and huge. I've heard of several people trying to grow Wolf River in the Anchorage area; I suspect it probably ripens too late. (The same probably goes for Wealthy and Fameuse — both good, hardy Fall apples.)

BOOK REVIEW

Up until a few years ago, there was not much published literature on apple growing that dealt specifically with the problems we face in Alaska. *La Culture de la Pomme dans le Nord* (Growing Apples in the North, 271 pages), published in 1992 by Eddy R. Dugas, is just the book we need, except it's in French. Dugas is a Canadian from northern New Brunswick, just across the border from Aroostook County, Maine. He has a large experimental orchard in Zone 2. Because I've never had a day of French class, the language barrier makes for pretty slow reading. Still, because so many French technical terms are essentially the same as in English, and because there are lots of well-labelled illustrations, I'm able to make headway at about fifteen minutes per paragraph, using a French-English dictionary. It is well worth the effort.

Chapter 1 is about the basics of apple trees. Chapter 2 is on orchard site selection. Chapter 3

is the best treatment of hardy rootstocks I've ever seen. It discusses the pros and cons of seedling rootstocks such as Antonovka, Beautiful Arcade, Borowinka, Baccata, Prunifolia, and Columbia Crab, and clonal rootstocks such as Ottawa 3, 3, and 5, Budagovski 490 and 491, P 2 and 22, Alnarp 2, Nertchinsk, and two dwarfing stocks that Dugas developed himself: D2 and D3. D2 looks promising for Alaska, because it induces early leaf drop and is hardy in Zone 2. Chapter 4 is on grafting and propagating rootstocks. Chapter 5 is on improving the soil. Chapter 6 is on laying out and planting an orchard. Chapter 7 contains a very helpful guide to recognizing and treating deficiencies in the major elements (nitrogen, potassium, phosphorus), minor elements (calcium, magnesium, sulfur), and trace elements (boron, copper, manganese, zinc, iron). There is also a section on ways to induce earlier fruiting. Chapters 8 and 9 are on control of weeds, insects, and diseases. Chapter 10 is a well-illustrated discussion of pruning and training apple trees. Chapter 11 is on controlling overproduction and premature fruit drop. Chapter 12 is on harvesting. Chapter 13 contains one-paragraph descriptions of about 50 varieties, including many that might be worth trying in Alaska. Ripening dates are given for northern New Brunswick, and it ought to be a fairly simple matter to convert these to Anchorage dates as discussed in a recent Newsletter by Bob Purvis. This chapter also contains a table of varieties that have not survived on specific rootstocks.

The book can be obtained from Eddy Dugas for \$24 US at PO Box 172, Van Buren, ME. (Dugas keeps a PO box in Van Buren, which is just across the river from his orchard in New Brunswick). If any club member is fluent in French and plans on having some spare time next winter, translating this book (or even just chapters 3 and 13) would be a great project.

APPLE NOTES FROM PRAIRIE CANADA

The Canadian prairie provinces have been the source of many of the most successful apple varieties in Alaska (for example, Norland, Parkland, Rescue, and Westland). *Apple Notes*, edited by Roger Vick, is a quarterly publication by the University of Alberta Devonian Botanic Garden dedicated to apple growing in the cold, windy, dry Canadian prairie. It costs \$8 for four issues and is well worth the money.

GRAFTING AND BUDDING OF FRUIT TREES

By Robert A. Purvis, Department of Horticulture/LA, WSU, Pullman WA 99164-6414

- I. Purpose of class: To describe the principles and practice of grafting and budding of fruit trees and to have the student practice the techniques of so doing.
- II. Definition and Purpose of Grafting
 - A. Grafting is defined as the art of connecting two pieces of living plant tissue together so they will unite, form a single plant, and grow.
 - B. The purposes of grafting include the following:
 1. To propagate or assist in propagating plant varieties not otherwise conveniently propagated.
 2. To substitute one part of a plant for another, as for example in topworking an apple tree to a different variety or putting an interstem between a scion and rootstock.
 3. To join plants selected for special purposes or properties, e.g., disease or pest resistance, size control, or adaptability to special conditions of soil or climate.
 4. To repair bark damage or girdling by rodents.
 5. To overcome stock/scion incompatibility.
 6. To invigorate weak-growing plants.
 7. To enable one root system to support more than a single variety.
 8. To do virus-indexing of plant material.
 9. To hasten the initiation of flowering and fruiting.
- III. Terminology
 - A. Scion - a part of a plant used for grafting upon an understock. In whip-and-tongue grafting, generally it is a piece of 1-year-old wood 3-5 inches long.
 - B. Rootstock (also, stock or understock) - The bottom part of a plant propagated by grafting or budding, consisting of a root system and stem or trunk.
 - C. Xylem - a network of tubes and vessels which conducts water and mineral nutrients from the roots to the rest of the plant.
 - D. Phloem - a network of tubes and vessels which conducts photosynthates from the leaves downward to the rest of the plant.
 - E. Meristem - tissue capable of cell division.
 - F. Cambium - a layer of meristematic tissue between the xylem and phloem from which new cells develop.
 - G. Callus - scar tissue arising from the cambium at wounds, which helps to form a graft union.
 - H. Polarity - tendency to develop from the poles, roots downward, stems upward. Polarity must be observed for successful grafts.
- IV. Preparation for Grafting
 - A. Preparation of Rootstocks

1. Order rootstocks in fall to early winter to be sure that what you want is available.
2. Order by caliper - typically 1/4 to 3/8 inch for grafting medium size to large scions, No. 1 to 1/4 inch for smaller scions. (Even 3/8 to 5/16 rootstocks will work well, but they will require large scions and may be difficult to cut.)
3. Arrange for delivery shortly before you want to graft.
4. Roots should be kept moist but not wet. Inspect rootstocks upon arrival and store at 32 to 40F.
5. If roots are very dry, soaking them for several hours before grafting may raise the water content of the cambium, leading to better callus formation and a higher number of "takes" (successful grafts).

B. Preparation of Scions

1. In September or October, decide which cultivars you want to propagate in the spring.
2. If freezing damage is likely to occur, gather some scions after the leaves drop but before severe winter temperatures occur. Otherwise, wait until late winter and cut scion when temperatures are above freezing.
3. Select new wood, preferably from the sunnier side of the tree, from a tree which has already come into fruiting. Ideally, there should be at least a foot of new growth on the branch selected, and 2 to 3 feet is much better.
4. The scions should be 5 to 12mm in diameter: the thicker the scion, the more vigorous is from it as a rule.
5. Select wood free of insect and disease problems and winter injury. Seal the cut ends with wax. Virus indexed wood is best.
6. Store in a plastic bag with a moist (not wet) paper towel. The idea is to keep the external moisture level the same as that inside the scion. Keep scions at 30 to 35F, and **do not** store them with sources of ethylene (e.g., ripe fruit), which promotes budbreak.
7. The ideal to strive for is to keep the wood fully dormant and neither to allow it to dry out nor to become moldy, until it is to be used.
8. Protect scions from rodents.

C. Other materials needed

1. Tree-Doc, wax, or other material to waterproof the graft union.
2. Masking or electrician's tape, or other tying material to hold the scion securely in place.
3. Labeling materials - tags, waterproof and fade-proof marking pens.
4. Sharp knives, preferably with wide, thin blades.
5. A good quality sharpening stone.
6. Pruning shears or loppers to cut lengths of scionwood or shorten rootstocks.
7. Wet burlap or other means of keeping the roots moist.

V. Physiology of Grafting

A. Stock/scion compatibility

1. Normally, one grafts apples to apple or crabapple rootstocks (**Malus** to **malus**, in other words).
2. Pears are grafted to pears - seedling **Pyrus communis**, Old Home X Farmingdale 40, 51, 333, 513), or to quince in areas with mild winters.
3. Cherries are normally grafted to **Prunus mazzard** or **Prunus mahaleb rootstocks, crosses** of the two, or to semidwarfing rootstocks such as GM 9, 61, or 79.
4. Plums may be grafted to plum, peach, apricot, or almond rootstocks. "Pixie" is a semidwarfing plum rootstock compatible with both European, Japanese, and American hybrid plums. **Prunus salicina mandshurica** is a very hardy, vigorous rootstock likewise compatible with all three types of plums. **Prunus americana**, the native American plum, is best used with Japanese or American hybrid plums, and Myrobalan plum rootstocks are best for European plums.
5. Peaches may be grafted to peach, apricot, or some plum rootstocks, e.g., St. Julian A.
6. Apricots are grafted to apricot, peach, or some plum rootstocks.
7. Viruses may cause incompatibility and graft failure.

B. Role of temperature, moisture, and oxygen

1. Production of callus tissue does not occur below 32F.
2. Formation is slow even at 38F but increases up to 90F.
3. Temperatures above 91F will kill callus tissue; that below 28F will injure it.
4. Callus tissue is very high in water content. The water needed to form it is drawn out of the limited reserves within the scion and the somewhat greater reserves of the rootstock.
 - a. For this reason, anything that causes or allows a loss of water from the scion will diminish the odds of getting a take.
 - b. Storing scions above 40F will result in needless callus formation and probable budbreak, both of which will deplete the water in the scion.
5. If no callus tissue forms, no graft union will form.
6. Avoid asphaltic preparations such as pruning sealant for use in coating graft unions.

C. Formation of the Graft Union

1. Soon after knife cuts are made, damaged surface cells brown and die.
2. Freshly exposed cambial surfaces and parenchymal cells adjacent to the cambium will begin to form callus tissue, which is made from thin-walled parenchymal cells, if
 - a. grafting cuts are well matched,
 - b. scions are bound snugly to the rootstock,
 - c. grafts are given proper aftercare.
3. Parenchyma cells slowly form a healing tissue over any exposed scion surface from the cambial area.
4. The first cell division in a fresh cut will occur after 24 hours.
5. Under perfect conditions, callus tissue will form a new cambial bridge within 5 days. After another 5 days, there will be some differentiation into xylem and phloem within the bridge.
6. Within 15-20 days after grafting, the vascular bundle should be well differentiated

- into xylem and phloem. After this, the scion's buds can safely begin growing.
7. With the passage of time, deposits will be laid down in the new cells to strengthen them and the union.
 8. The callus tissue cells cannot keep themselves from drying out. Hence, it is important to keep scion buds dormant and to keep the graft from drying out also.
 9. When preparing a scion, avoid using the top and bottom inch or two of a cutting.

VI. Making the Whip-and-Tongue Graft

A. Preparation of the scion

1. From a piece of first-year growth, cut a 3-5 inch long piece to serve as a scion. There should be a minimum of two, and preferably 3-4 buds on the scion. Also, make a label for the tree (listing the scion, rootstock, and date grafted, as for example, Red Delicious/Malling 26, 3-12-90) at this time.
2. Begin on the side opposite to the basal bud on the scion, to make a tapering downward cut 4-5 times as long as the scion diameter. (Note: the buds point toward the apical or upward end of the scion.)
3. The cut should be smooth, flat-surfaced to slightly concave. Note that longer cuts allow more area for matching the cambia.)
4. Begin the tongue cut about halfway from the basal tip of the scion to the center of the cut surface. Pull the knife so the tongue is almost parallel to the original cut. The tongue should be about $\frac{1}{3}$ as long as the first cut.
5. The tongue serves to provide a more secure union between scion and rootstock and also more area for intercambial contact.

B. Preparation of the rootstock

1. Keep rootstock roots moist.
2. Prune off suckers and lateral branches from the rootstock.
3. Look for a smooth, straight stretch of trunk that is the same diameter as the base of the scion. Cut off the top of the rootstock above that.
4. Next, make a smooth, slanting cut the same length as the cut on the scion, towards the apex of the rootstock.
5. To form the tongue, begin a cut at a point halfway from the tip of the rootstock to the center of the cut surface and cut semi-parallel to the first cut. This cut should be $\frac{1}{3}$ as long as the first cut.

C. Fit scion and rootstock together so that the tongues interleave.

1. Cut off any overlap of the tips of scion or rootstock beyond the cut surfaces.
2. Align the cambia (the bright green oval on each cut surface). Ideally, both sides should match. At worst, one side should be matched as well as possible. Remember, the more the cambial tissues are matched, the more likely it is you will get a take. Align the cambia, not the bark!
3. Wrap graft union spirally with $\frac{1}{2}$ -inch wide masking tape. The spirals should overlap only a little; the tape should be snug but not ultra-tight.

4. Apply Tree-Doc over cut tip of scion and over the union, or dip the newly grafted tree upside down very quickly into a wax bath so the union and scion are sealed. The wax temperature should not be over 185F; 160 to 185F is best.

VII. After-Care of Grafts

- A. The roots of the freshly grafted trees should be kept moist by burying them in a bin of moist wood shavings or potting soil. Before burying, any broken roots should be trimmed off. The tips of sparsely rooted laterals should be cut off to encourage new root growth.
- B. The trees should be kept at a temperature of 40-50F for apples and pears, 50-60F for stone fruits.
- C. Remove suckers from below the graft union.
- D. Once leaves begin to sprout from the buds (typically 10 to 20 days after grafting), the trees may be planted in pots or in the ground.
- E. Causes of graft failure:
 1. Drying out of the graft union owing to an imperfect seal (most common cause),
 2. Poor alignment of cambial layers of scion and rootstock,
 3. Scion breaking dormancy; insufficient amounts of water available to form callus tissue,
 4. Viruses,
 5. (Later in the spring) Bridge of cambial tissue is too narrow to support leaves or vigorous growth.

VIII. Chip Budding

A. Introduction

1. Chip budding is the substitution of a scion chip (consisting of the bud, bark, and a sliver of wood) for a matching area of rootstock tissue. It offers an advantage over whip and tongue grafting by economizing on scionwood.
2. Other advantages:
 - a. It offers better contact of cambial layers than T-budding,
 - b. It oftentimes gives 50 to 100% more takes on species with a low success rate using other techniques,
 - c. It does not require that the bark "slip" on the rootstock,
 - d. It offers greater resistance to cold temperatures for buds emplaced during the summer months.
3. Chip budding is normally done in the summer at the same time as T-budding or in the spring just as the sap begins to rise in the rootstock.
4. Scionwood selection is the same for spring chip budding as it is for whip and tongue grafting. For summer budding, choose new growth with plump buds, and cut off all but 1/4 to 1/3 inch of the leaf petioles after cutting the shoot.

B. Techniques

1. Choose an area of smooth, clean stem, 4 inches aboveground.
2. Make a downward cut, 1/8 inch long, at a 45 degree angle to the bark.
3. Make a second cut, 1 to 1-1/2 inches above the first and 1/8 inch below the surface, downwards to meet the first cut. Remove and discard the chip formed.
4. The top of the cut should be like an inverted U rather than a V.
5. The woody tissue should be exposed on the rootstock.
6. To prepare the bud chip,
 - a. Hold the budstick so its base points toward you.
 - b. Make a cut 1/8 inch long at a 45 degree angle to the bark in a downward direction, 3/4 inch below the bud chosen.
 - c. Begin 1 to 1-1/2 inches above the first cut and cut downward to the first, 1/8 inch below the surface. The object is to cut a chip that will be slightly shorter and narrower than the area exposed on the rootstock.
7. Insert the chip on the rootstock so that it sits on the ledge formed by removal of the rootstock chip.
8. Align the edges, or at least one edge, of the chip with the exposed cambium on the rootstock.
9. Wrap the area of the chip spirally with Parafilm, a grafting rubber, or thin polyethylene film.
10. Remove the wrapping material 4-6 weeks later. If the bud union has formed, the bud will not fall out when the wrapping is removed, and you should see the callus formation through the material.

C. Spring chip budding

1. Use the same criteria for scionwood selection as given in section IV.B.
2. After making the chip bud union, keep rootstocks at 60F to cause growth and a good flow of sap.
3. After 3 weeks, check to see if the chip has formed a union. If it has, the bud should be swelling, or at least firmly joined.
4. If the bud is joined, cut the rootstock off about 4-6 inches above the bud. This will eliminate the rootstock's apical dominance and suppression of the bud's growing. Once a few inches of shoot growth have emerged from the bud, cut the remaining snag off 1/4 inch above the bud union.
5. The roots should have a supply of moisture after the chip budding is done so that there will be ample amounts of sap flow and cambial activity.

D. Last thoughts

1. If after all effort, a whip-and-tongue or chip-bud graft fails to take, remember that the rootstock, especially if it is making healthy growth, can be re-used for another attempt, either of summer chip budding or of whip-and-tongue or chip budding the following spring. If the second attempt fails, it's probably best to discard the rootstock and begin afresh on a new one.
2. Scionwood is best cut as soon before use as possible to insure its freshness.