Fruit Varieties Journal 49(2):103-106 1995

Annual Grafting of Nashi Pear in Low Chill Areas of Taiwan

DAVID H. BYRNE,[1] SHYI-KUAN OU[2] AND J. BENTON STOREY[1]

Abstract

At present there are no high quality Nashi pear cultivars adapted to the subtropical (low chill) zone of Taiwan. A method to produce high chill Nashi pear cultivars in the lowland subtropical zone of Taiwan has been developed as a way to harvest Nashi pear 6 to 12 weeks before the harvest in the high chill regions. The procedure involves the annual grafting of already chilled budwood of high chill, high quality Nashi pears ('Hosui' and 'Kosui) onto the local low chill poor quality Nashi cultivar, hand pollination, the use of gibberellic acid (GA) to accelerate ripening, paper bags to protect the fruit, and the development of renewal wood for grafting the following year.

Taiwan is a subtropical island located south of China between the latitudes of 22° and 25°N. Due to the changes in altitude in the mountains within the country, its climates range from subtropical and frost free, where mangos and citrus are common crops, to temperate, where high chill cultivars of apple, Nashi pear, and peaches are grown very successfully.

Research is being conducted to develop low chill Nashi pear cultivars for cultivation in the mountain foothills and lowlands (less than 500 meters altitude). At present, the only low chill Nashi pear cultivars available are of poor quality with rough russetted skin and flesh with abundant stone cells. Consequently, other approaches to growing high chill, high quality Nashi pear cultivars in a low chill area have been developed to exploit the early market window for this fruit.

About fifteen years ago, Chang Jung-Son, a grower in the Tung-shin area (350 meters altitude) of Taiwan, devised a way to grow high chill Nashi

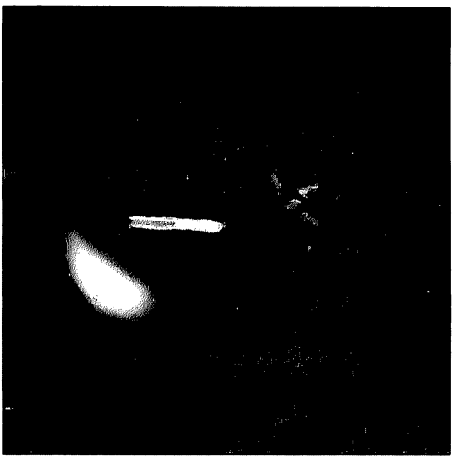

Figure 1. Single node scion used in the cleft or side grafting of Nashi pear in Taiwan.

in this low chill zone and consequently begin harvest of the fruit 6 to 12 weeks before the Nashi pear harvest in Japan or the highlands of Taiwan (1). As with many of the horticultural practices in Taiwan, it is very labor intensive but is economically feasible because land is very expensive and fruit can be sold for a high price. The procedure involves the annual grafting of high chill Nashi onto low chill 'Huang-Sang-Li' trees, hand pollination, removing new shoots of the high chill cultivar, thinning the fruit, bagging the fruit, and the use of gibberellic acid (GA) to further accelerate ripening. Nashi pear is produced on about 10,000 ha of which 5,000 ha are produced in this fashion (2). The economic value of this production is approximately $US 61 million ($NT 1.6 billion) per year.

[1]Texas A&M University, College Station, TX 77843-2133, USA.
[2]Taiwan Agricultural Research Institute, 189 Chung Cheng Rd., Wufeng Taichung, Taiwan 431, Republic of China

Figure 2. The grafts flower about 30 days after grafting.

Figure 3. Leaves derived from the high chill scion are removed after the fruit is set to allow bagging and then the fruit is thinned to 3-4 fruit per spur.

Production begins with the training of the local, well adapted Nashi ('Huang-Sang Li') on a overhead trellis to a flat surface covering the entire orchard surface at the height of about 1.7 meters This is possible because the equipment used in Taiwan is small as are the individual farms. Air blast sprayers are rarely used. Instead, orchards are plumbed with pipes through which spray materials are delivered to spigots located throughout the orchard. Hand operated spray nozzles and booms are attached to these.

Since 'Huang-Sang-Li' trees produce poor quality fruit, budwood of high quality Nashi pear cultivars is imported from Japan or the highlands of Taiwan for grafting at a cost of about $US 33 ($NT 850) per kilogram (450-500 buds

Table 1. Fruit size and yield of Nashi pear cultivars used for annual grafting production technique in Taiwan.

	Fruit size (g/fruit)		Yield (mt/ha)	
Cultivar	Medium	Maximum	Good	Excellent
Shinko	490-525	750-900	32-36	43-48
Hosui	490-525	750-900	24-27	32-36
Kosui	300-450	490-525	16-18	22-24
Sinseiki	300-375	450	12-14	16-18

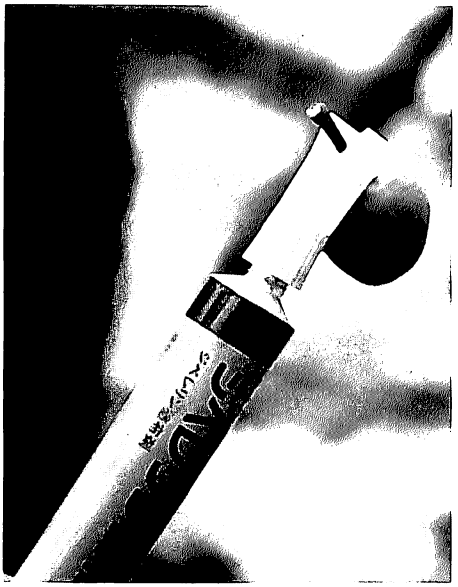

Figure 4. A lanolin-gibberellic acid cream, bought in tubes from Japan, is applied with double brushed applicator to the peduncle of each fruit to accelerate ripening.

for 'Hosui' and 500-530 buds for 'Kosui'). This is done in late December or January after the budwood of the high chill cultivar has received sufficient chilling and when the sap begins to flow in the local pear in the low chill area. The budwood is cut into single node pieces (Figure 1) and a cleft or side graft is done. Between 150 to 300 grafts are made on each tree with a success rate of 60-80%. At the density of trees that are used (250 tree/ha; 100 tree/acre), up to 50,000 grafts are made in each hectare (20,000/acre). Each graft costs about $US 0.50.

Bloom occurs in February about 30 days after grafting (Figure 2). The flowers are hand pollinated with pollen from the local pear cultivars: Huang-Sang-Li, Niau-Li, and Tang-Li. Once the fruit is set each cluster is thinned to three to four fruit. The leaves developing from the high chill Nashi pear are removed because these inter-

Figure 5. Brown bags are used to cover the developing fruit to protect it from pests, and chemicals and to ensure the development of a good finish.

fere with the bagging of the fruit (Figure 3). About 30 days after pollination, GA in a lano]lin paste (2.7% gibberellic acid 3, 4, 7, and 9) is applied to the peduncle of each fruit with a double brushed applicator (Figure 4). The GA is acquired from Japan and hastens the ripening of the fruit by two weeks.

Fruit is bagged 50-60 days after pollination with bags constructed of 4 layers of brown paper—20 cm x 60 cm—that are folded over to half the length, and sewn together along the long sides. A bag is put over a spur with 3-4 fruit and fastened at the base with wire (Figure 5). Bagging protects the fruit from the weather which gives it a better color, avoids the formation of russetting, protects it from birds, the golden beetle, and the oriental fruit fly, and avoids contamination with pesticide residues. Fruit certified as bagged can sell for a premium of up to 50%.

The fruit remains bagged until harvest which begins in early June, 6 to 12 weeks before Nashi harvest in Japan. The first fruit harvested can be sold for a high price of $US 5.70-10.30 per kg or $US 1.15-2.10 per fruit ($NT 150-270 per kg for 'Hosui' and 'Kosui') and as the harvest volume increase the price decreases to about $US 3.5 per lb. ($US 0.70 per fruit). This high price for early fruit justifies the intensive management required to produce high chilling Nashi in a low chill region.

A final and essential step in this process is to develop new wood on which to graft the following year. New shoots are encouraged to grow from the trunk, scaffolds, and sub-scaffolds in the spring and summer months. Shoots forming in August or later are too tender for grafting. The selection of shoots is done during winter pruning at which time 150 to 300 graftable shoots are left per tree, depending on the vigor and health of the tree.

The present situation in Taiwan (i.e. high land prices, small intensively worked farms, high price of fruit, and the lack of high quality, low chill Nashi pear cultivars) make this intensive production system profitable. As work progresses in the development of high quality, low chill Nashi pear cultivars, the need for annual grafting of high chill pear cultivars in the low chill regions of Taiwan will diminish.

Literature Cited

1. Chang, Jung-Son. 1979. Observations on top-grafting of New Century pear buds on native Huang-Shan pear trees, *Pyrus serotina* Rehder. Scientific Agr.27(1-2):52-55.
2. Taiwan Provincial Govt. 1994. Taiwan Agricultural Yearbook. Dept. of Agric. and Fores., Nantou, Taiwan, p. 132.

Wood and Tree Age Affect Fruit Set

The capacity of flower buds on young wood was considerably less than on older wood and although fewer fruits were retained until final set, it was the lack of initial set that limited cropping. Flower clusters on young wood typically had smaller leaf areas and flower weights than those on older wood. Reduction in flower cluster size did not appear to be due to competition between reproductive and vegetative growth for mineral nutrients. Flowers on both young wood and trees showed reductions in the effective pollination period and ovule condition. Directly after pollination the proportion of degenerate ovules was shown to decline significantly, indication that the eggsacs were beyond fertilization. From Robbie and Atkinson (1994) 69:609-623.