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Sour Cherry-Tree Vigor As Related To Higher Yields and Better Fruit Quality

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THE CONCEPT that yield of sour cherry can increase without loss of fruit quality has not been commonly accepted. More generally, it is believed that, as yield approaches maximum or exceeds a certain level, fruit quality decreases with a further increase in yield. Usually, there is an increase in yield with increased use of nitrogen fertilizers. The belief that higher rates of applying nitrogen will result in decreased fruit quality has resulted in a reluctance to apply nitrogen fertilizers at rates required for optimum fruit production.

Larger applications of nitrogen fertilizers to apple trees will usually result in decreased fruit quality observed as oversized fruit, reduced red (or yellow) color, increased russetting, softer fruit, shorter storage life, increased incidence of physiological or post-harvest disorders, etc. Similar observations may be made for peach.

Sour cherry, however, does not appear to respond in this manner. Table 1 shows that applications of large amounts of nitrogen (4 lb N per tree, 1200 lb ammonium nitrate per acre) increased yield 30 lb per tree (3000 lb per acre), reduced the percent of large fruit (over 6/8-inch diameter), and lowered fruit removal force. Table 2 shows that 4 lb N per tree did not result in lower fruit firmness, either when harvested mechanically or after soaking prior to processing. Fruit color was increased and the grade of fruit (raw or pitted) was not reduced. In addition, the percent yield of pitted fruit was higher with 4 lb N per tree.

Observations made each year of treatment showed that using larger amounts of nitrogen never did reduce fruit quality. Although the differences shown in Tables 1 and 2 were not significant statistically, certain practical implications are apparent in the data. The high rates of nitrogen fertilizer appeared to increase yield and did not reduce fruit quality (as indexed by measurements recorded in Tables 1 and 2).

The fact that sour cherry responds differently than apple and peach to nitrogen fertilizers is related to a distinctly different flowering and fruiting habit and crop potential as related to vigor. A study of the relationship between vigor and flower bud formation

Table 1. Influence of nitrogen applications on fruit quality. Sour cherry. Pre-harvest (a).

	N(b) per tree - lbs.		
	0	1.33	4.00
Yield, lbs/tree	140.7	150.1	172.1
Fruit diameter (in.)			
% 4/8-5/8 inch	5.1	6.2	8.1
% 5/8-6/8 inch	87.0	88.4	89.5
% 6/8-7/8 inch	7.8	5.4	2.8
Fruit Removal Force, g	417	407	374

(a) Average for 24 trees. 4 years of treatment (1968-1972). Yield-average for 1971-1972. Other values for 1972.

(b) Actual N applied as ammonium nitrate in spring.

shows that both crop potential and fruit quality should increase as any cultural practice increases terminal growth or vigor of sour cherry trees.

Table 2. Influence of nitrogen applications on fruit quality. Sour cherry. Post harvest. 1972

	N(a) per tree - lbs.		
	0	1.33	4.00
Firmness (b)			
after harvest	40.0	39.6	42.8
after 15 hr soak	48.9	47.3	48.9
Color index (c)	.732	.738	.766
Raw Fr. Grade (d)	87.0	88.5	88.5
USDA Score (e)	96.0	95.5	96.0
% Yield-pitted (f)	73.3	—	75.8

(a) Actual N applied as ammonium nitrate in spring. Four years of treatment. 1972 data.
(b) Durometer readings. 100=4 ounces
(c) Absorbance. 1.00=maximum color.
(d) As graded by a state inspector at processing plant.
(e) Pitted products as scored by a trained graduate student.
(f) Percent of raw product processed as pitted product.

Leaf/Fruit Ratio

Observations and research have proved that if a tree has too many fruit and not enough leaves (a low leaf/fruit ratio) the fruit will be small, will not mature properly, and be of poor quality—lacking flavor and other desired characteristics. This has been seen often as low vigor sour cherry trees carrying a full crop. Usually, some factor (winter injury, drought, virus, not enough nitrogen, etc.) has reduced vigor but the tree still has ample bearing surface as spurs or short terminal growths. As a result, the tree can set a large number of fruit but have only a few leaves per fruit.

A high leaf/fruit ratio is most often seen on young vigorous (non-bearing) sour cherry trees. These trees are growing vigorously, only a few flower buds develop, lateral branching is predominant. Such a condition is desired on young cherry trees to develop a good frame for the tree. However, because vigor is reduced somewhat, the tree begins producing more spurs and fewer lateral branches. As these spurs begin bearing fruit, the leaf/fruit ratio is reduced although the tree shows good vigor or terminal growth. It is on such trees that the most desirable quality fruit is usually found. The best quality crop is usually found on young (up to 14 years of age) vigorous (10 inches or more terminal growth) sour cherry trees. Therefore, the most desirable leaf/fruit ratio must exist under such conditions of vigor.

Fruit characteristics resembling a condition of high leaf/fruit ratios are more often found on old trees of low vigor (less than 10 inches of terminal growth). Fruit quality is not related to tree age but to tree vigor. For many reasons, it is difficult to maintain good vigor on older trees.

Flowering and Fruiting Characteristics

The sour cherry produces flower buds laterally on last year's wood. Each leaf on last year's terminal growth produced a bud at its base. This bud is either a flower bud or a vegetative bud. The buds are never mixed. A flower bud will produce flowers but no leaves. A vegetative bud will produce a shoot but no flowers.

The terminal bud on each shoot, regardless of vigor, is always a vegetative bud. Sometimes, depending upon vigor, one or more of the most terminal lateral buds on a shoot may be vegetative buds. If a lateral vegetative bud produces a short shoot (less than 2 inches), it is called a spur. However, if the terminal vegetative bud produces a short shoot, it is referred to as low vigor.

The lateral flower buds may produce from 1 to 5 flowers each with 2 or 3 flowers being most frequent. The number of flowers per bud is related to vigor. Trees of low vigor will more likely produce flower buds containing 1 to 3 flowers each. With higher vigor, the flower buds will more likely contain 3 or more buds.

The likelihood of lateral buds being flower buds is related to relative vigor. On an individual tree, terminal growths may vary widely on individual shoots (Fig. 1). Thus, all levels of vigor are present. There is no precise measurement of vigor that can be used. However, approximate rough groupings can be made:

1. *Shoots less than 10 inches in length (Fig. 2).*

   Nearly all lateral buds will be flower buds. There may be a vegetative bud near the base and/or near the terminal. As vigor approaches 10 inches of terminal growth, lateral vegetative buds are more likely to be present near the base and/or the terminal.

   The flower buds each contain 1, 2 or 3 flowers. As vigor increases, the number of flowers per bud increase.

   If all lateral buds are flower buds, no branches or spurs will be produced. The terminal bud elongates into another shoot. The branch may become long and barren of branches or spurs. Such a procedure may continue for many years (Fig. 3).

Fig. 1. Terminal growths from sour cherry trees ranging from approximately 18 inches (left) to a spur (right). Vigor of twig on left should result in multiple branching and spur production next year. Vigor of the next two twigs should result in predominantly spur production. Vigor of the other twigs should result in flowering of lateral buds and no spurs or branches.

Fig. 2. One-year-old twigs showing low vigor (below 10 inches) the previous year. All lateral buds the previous year were flower buds. Absence of vegetative buds prevented spur production and/or branching. These twigs will remain barren of any lateral growth.

Fig. 3. Twigs showing low vigor that has continued several years. The white band on the twig shows the location at which growth stopped and/or started. Twig on left shows spur development during the year when terminal growth was approximately 12 inches. Other twigs show lack of spurs or branches. The center four twigs are 5 years-old. The right five spur-like growths are each 6 years-old.

2. *Shoots 10 to 18 inches in length (Fig. 4).*

On these shoots, many of the lateral buds are vegetative buds. As vigor increases, the percentage of vegetative buds increase. At approximately 12 inches or more terminal growth, all of the lateral buds are most likely vegetative buds.

Vegetative buds on shoots of this vigor usually produce short growths, called spurs, (Fig. 4) rather than longer (over 2-inches) shoots. As 18 inches of vigor is approached, there is an increase in the likelihood of one or more of the more terminal lateral buds producing new shoots too long to be called spurs.

In such instances, the length of shoot growth produced by the lateral bud is likely to be less than that produced by the terminal vegetative buds. This results in less vigor than the previous year.

For example, last year's terminal growth may have been 18 inches. This year, if one or more of the more terminal lateral buds produce shoots as long as produced by the terminal bud, all

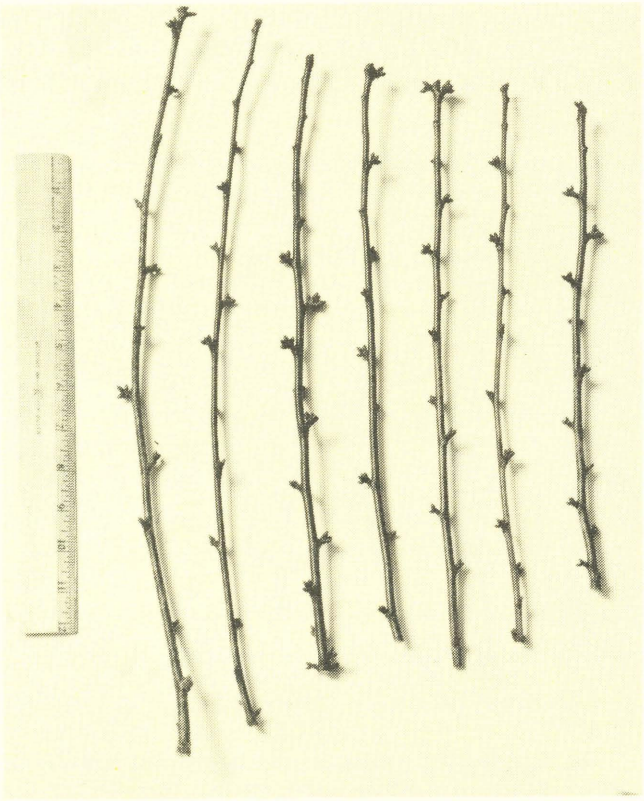

Fig. 4. Growth resulting from moderate vigor (10-18 inches) the previous year. All twigs (except one on the left) showed no branching and predominantly spur development. This resulted from vegetative buds formed the previous year.

shoots may be less than 10 inches. Thus, relative tree vigor decreases.

The spurs produced behave as short shoot growth; i.e. the lateral buds are flower buds and the terminal bud is a vegetative bud. Each lateral flower bud will have 2, 3 or 4 flowers. The spur may have 3 to 8 such buds. Therefore, the fruiting potential is large for the number of leaves. The leaf/fruit ratio actually decreases as vigor of the tree increases to the level of spur production.

3. *Shoots over 18 inches in length (Fig. 5).*

On such shoots, nearly all of the lateral buds will be vegetative. Some may produce spurs and others will produce shoots too long to be called spurs (Fig. 5). As vigor increases, fewer spurs and longer shoots are produced.

This growth pattern is most often seen on young vigorous non-bearing trees. However, if the young tree is not vigorous, lateral flower buds may be produced—even during the year planted.

As the vigorous branches produce shoots, the relative vigor is reduced (diluted) by the additional number of shoots. Thus, a tree having 18 inches of terminal growth this year will have less terminal growth the following year. If terminal growth decreases to 10 to 18 inches, spurs will be produced. If terminal growth decreases to less than 10 inches, spurs will not be formed and conditions of low vigor may develop.

This analysis of the flowering and fruiting characteristics as related to vigor of the sour cherry indicates, that for best fruit quality and highest yield, practices that promote vigor (up to 18 inches of terminal growth) must be used. Thus, any practice (pruning, irrigation, nitrogen applications, mild fungicides, herbicides, nematode control, etc.) that promotes vigor of a desired level should improve fruit quality and increase yield simultaneously.

Vigor may best be judged by observing the tops of older trees. If last year's terminal growth produced spurs this year, vigor may be judged as being at a desirable level.

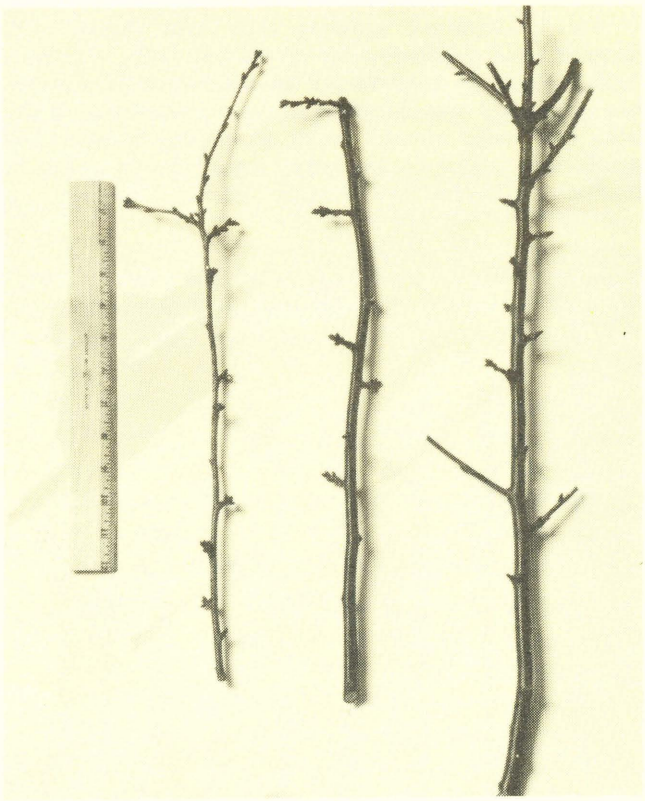

Fig. 5. Growth of sour cherry twigs of high vigor (18 inches or more) the previous year. Right—twig shows multi-branching (five cut short) and spur development. Basal spurs contain no flower buds. Center—twig shows spur production. Apical spur may be considered as a short shoot. Branches (4) were cut flush with the twig. Basal spurs not fruitful. Left—previous seasons growth less than 18 inches and shows predominantly spur development. This resulted from vegetative buds formed the previous year.