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Red Tart Cherry Fruit Quality: As Related to Location, Season, Fungicides and Nitrogen
Michigan State University Agricultural Experiment Station and Cooperative Extension
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Research Report

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Issued September 1974

8 pages

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RESEARCH REPORT

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FARM SCIENCE

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Red Tart Cherry Fruit Quality: As Related to Location, Season, Fungicides and Nitrogen

by A. L. Kenworthy and Lowell Silsby¹

INTRODUCTION

Opinions differ regarding the effect of using organic fungicides and greater amounts of nitrogen upon the quality of red tart cherry fruit. Some contend these practices reduce fruit quality. Others contend there is no effect.

PROCEDURE

In a research program initiated in 1970 to resolve this question, commercial practices were followed. The growers applied the fungicides and nitrogen, harvested and cooled the fruit. Processing was done in commercial plants using two tanks (approximately 2000 lb of fruit) for each treatment. Pie filling-mix and frozen cherry pies were made (in 1972) by commercial plants using 30 30-lb tins of frozen cherries.

Three orchards located near Watervliet, Ludington and Traverse City were selected. Each orchard was divided into blocks for applications of fungicides ac-

ording to the usual spray schedule. Fungicides used were fixed copper, dodine (cyprex) and Difolatan (in only two orchards). In each orchard, the fungicide blocks were divided for two levels of nitrogen application: 1) normal grower application and 2) twice the grower application.

During harvest, two tanks of harvested fruit from each treatment were marked and, after cooling, processed. As the lots were processed, 60 30-lb tins of pitted fruit were labeled for later use in making pie filling and frozen cherry pies. As the pie filling and pies were manufactured, samples were collected from the line for later evaluation.

Fruit quality was evaluated as follows:

- A. Pre-harvest (1 day before harvesting)
 1. Fruit removal force (grams)
 2. Firmness (Durometer units. 100 = 4 oz)
 3. Size (number per 500g)
 4. Red color (index using disc of fruit peel)
 5. Soluble solids (%)

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- B. After cooling - before processing
 - 1. Raw product grade (by inspectors)
 - 2. Firmness (Durometer units)
- C. After pitting - before freezing
 - 1. USDA score (by inspectors)
 - 2. Firmness (Durometer units)
- D. Cherry products
 - 1. Drained weight (per unit)
 - 2. Fruit size (number per oz)
 - 3. Defective fruit (%)
 - 4. Red color (brightness)
 - 5. Red color (redness)
 - 6. Integrity (%)

In addition, leaf nitrogen was used to measure the response to additional nitrogen fertilizer application.

RESULTS

Pre-harvest fruit quality evaluations are presented in Tables 1, 2, 3, and 4. These data show that there were significant differences for all factors (except leaf nitrogen) between locations. All factors, except soluble solids, showed significant differences between years. The use of copper resulted in fruit that were significantly smaller than when Difolatan was used. Fruit color was higher (more red pigment per unit fruit peel) for copper than for dodine or Difolatan. Soluble solids were highest for copper. Amount of nitrogen applied affected only leaf nitrogen.

Raw product grade and post cooling firmness are shown in Tables 5, 6, and 7. The only difference between orchards was for fruit firmness. Orchard 3 had a lower percentage of soft fruit. Neither fungicides nor amount of applied nitrogen had a significant effect on any factor or grade.

USDA score and firmness of pitted product are shown in Tables 8, 9 and 10. The only significant difference between orchards was in the score for pits. Orchard 2 showed more pits but this may have been due to plant operation. The fungicides showed no significant effect on any factor. The amount of applied nitrogen significantly affected only firmness. Doubling the amount of nitrogen applied resulted in significantly firmer fruit.

Evaluations of pie mix and frozen pies relative to fungicides are shown in Tables 11 and 12. The only factor to show a significant difference was redness for color in the pie mix.

Evaluation of pie mix and frozen pies in relation to applied nitrogen is shown in Tables 13 and 14. Doubling the amount of nitrogen applied resulted in less defective fruit for the pie mix and lower drained weight and greater fruit integrity for frozen pies.

SUMMARY

These data demonstrate that red tart cherry fruit quality is not influenced consistently by use of different fungicides or additional nitrogen fertilizers. Significant variation does occur in fruit quality between orchards and between years.

The significant variation between years confirms the marked effect of each season upon fruit quality. The significant variation between orchards suggests that the multiple factors involved in production can have a significant effect on fruit quality. However, the possibility of climatic differences between the locations studied cannot be ignored.

ACKNOWLEDGMENTS

This research was supported, in part, by the Michigan Cherry Commission. The project was initiated by the late Dr. A. E. Mitchell.

We thank the growers - Alton Wendzel and Rodney Winkel, Elwyn Olmstead and Roy Hackert, and Peter Morrison - for use of their orchards and help in spraying, fertilizing and harvesting. Thanks also to Coloma Coop., Mason County Packers, and Morgan McCool, Inc., for processing facilities; and to Chef Pierre, Inc., and Michigan Canners, Inc., for manufacturing facilities.

We would also like to thank Dr. Charles Kesner for his cooperation; Dr. C. L. Bedford and his staff for their time and effort in collecting data and use of the M.S.U. Food Science Laboratories; and the many graduate students and summer employees in the Department of Horticulture who helped collect and process the data over the three-year period.

Table 1. Pre-harvest quality of red tart cherry fruit as related to location (1970-1972)

Factor	Orchard(a)		
	1	2	3
Removal Force (grams)	255.4b	273.3a	256.7b
Firmness (Durometer units)	58.2a	56.5b	27.0ab
Size (No. per 500g)	145.5a	111.3b	114.4b
Red Color (Index)	1.55a	1.45a	1.05b
Soluble Solids (%)	16.5a	14.8b	13.4b
Leaf Nitrogen (%)	2.49	2.49	2.30

(a) Values for a factor followed by different letters differ significantly ($P = .05$). Orchard 1 — near Watervliet, Orchard 2 — near Ludington, and Orchard 3 — near Traverse City.

Table 2. Pre-harvest quality of red tart cherry fruit as related to year (three locations)

Factor	Year(a)		
	1970	1971	1972
Removal Force (grams)	233.1b	236.1b	316.2a
Firmness (Durometer units)	57.8a	55.1b	58.7a
Size (No. per 500g)	117.5b	137.0a	116.7b
Red Color (Index)	0.99b	1.99a	1.06b
Soluble Solids (%)	14.8	14.9	15.1
Leaf Nitrogen	2.49a	2.49a	2.30b

(a) Values for any factor followed by different letters differ significantly ($P = .05$).

Table 3. Pre-harvest quality of red tart cherry fruit as related to fungicide use (two orchards, 1970-1972)

Factor	Fungicide(a)		
	Copper	Dodine	Difolatan
Removal Force (grams)	272.9	257.1	270.6
Firmness (Durometer)	56.7	56.8	56.8
Size (No. per 500g)	115.7a	110.0ab	102.7b
Red Color (Index)	1.33a	1.17b	1.11b
Soluble Solids (%)	14.9a	13.3b	13.2b
Leaf Nitrogen (%)	2.39	2.44	2.40

(a) Values for any factor followed by different letters differ significantly.

Table 4. Pre-harvest quality of red tart fruit as related to nitrogen application (two orchards, 1970-1972)

Factor	Nitrogen applied(a)	
	1X	2X
Leaf Nitrogen (%)	2.41b	2.52a
Removal Force (grams)	266.4	272.6
Firmness (Durometer)	56.7	56.9
Size (No. per 500g)	109.6	111.7
Color (Index)	1.20	1.15
Soluble Solids (%)	13.8	13.5

(a) Nitrogen applied: 1X-normal grower practice, 2X-twice grower practice. Only leaf nitrogen differed significantly

Table 5. Red tart cherry fruit quality (raw product defects, grade and firmness as related to location; after harvest and cooling)

Factor (%)	Orchard(a)		
	1	2	3
WW-LR(b)	6.8	10.0	14.0
Att. Stems	3.2	3.8	4.8
Under Color	0.1	0.1	0.0
Decay	0.0	0.4	0.1
Grade(c)	89.8	86.8	81.1
Firmness(d)			
Below 40 (%)	42.8a	29.5ab	17.0b
Below 30 (%)	7.0a	2.5b	1.0b

(a) Values for a factor followed by different letters differed significantly (P = .05).

(b) WW-LR: wind whip and limb rub fruit.

(c) Grade = 100 — total defects

(d) Durometer units.

Table 6. Red tart cherry fruit quality (raw product defects, firmness and grade as related to fungicide applications; after harvest and cooling)

Factor (%)	Fungicide(a)	
	Copper	Dodine
WW-LR(b)	11.6	8.8
Att. Stems	3.0	4.8
Under Color	0.1	0.1
Decay	0.2	0.1
Grade(c)	85.2	86.2
Firmness(d)		
Below 40 (%)	32.0	27.5
Below 30 (%)	4.2	2.8

(a) Nitrogen applied: 1X-grower practice, 2X-twice grower practice. No significant differences for any factor.

(b) WW-LR: wind whip and limb rub

(c) Grade = 100 — total defects

(d) Durometer units

Table 7. Red tart cherry fruit quality (raw product defects, firmness, and grade as related to applied nitrogen; after harvest and cooling)

Factor	Nitrogen applied(a)	
	1X	2X
WW-LR(b)	10.1	10.5
Att. Stems	3.2	4.6
Under Color	0.1	0.1
Decay	0.2	0.1
Grade(c)	86.5	84.7
Firmness(d)		
Below 40 (%)	28.2	31.3
Below 30 (%)	3.7	3.3

(a) Nitrogen applied: 1X — grower practice, 2X — twice grower practice. No significant differences for any factor.

(b) WW-LR: wind whip and limb rub

(c) Grade = 100 — total defects

(d) Durometer units

Table 8. Red tart cherry fruit quality (pitted product score as related to location)

Factor	Orchard(a)		
	1	2	3
Color (30)	28.6	28.5	28.5
Absence of Pits (20)	18.8a	17.0b	19.0a
Absence of Defects (20)	18.9	16.5	17.0
Character (30)	28.1	28.1	26.8
Total Score	94.0	90.1	91.3
Packout (%) (b)	74.1	78.3	78.3
Firmness(c)			
Below 20 (%)	23.8	21.8	12.0
Below 10 (%)	7.0	1.5	5.8

(a) Value in parentheses represents maximum score for that factor. Values for a factor followed by different letters differed significantly (P = .05).

(b) Packout = [(lb pitted fruit/lb raw fruit) X 100]

(c) Durometer units

Table 9. Red tart cherry fruit quality (pitted product score as related to fungicide use)

Factor	Fungicide(a)	
	Copper	Dodine
Color (30)	28.4	28.7
Absence of Pits (20)	18.2	18.3
Absence of Defects (20)	18.0	17.0
Character (30)	27.6	27.7
Total Score	91.9	91.7
Packout (%) (b)	78.3	75.5
Firmness (c)		
Below 20 (%)	18.0	20.3
Below 10 (%)	4.0	5.5

(a) Values in parentheses after a factor represents maximum score. No significant differences for any factor.

(b) Packout = [(lb pitted fruit / lb raw fruit) X 100]

(c) Durometer units

Table 10. Red tart cherry fruit quality (pitted product score as related to applied nitrogen)

Factor	Nitrogen applied(a)	
	1X	2X
Color (30)	28.8	28.3
Absence of Pits (20)	18.7	17.8
Absence of Defects (20)	17.7	17.2
Character (30)	27.6	27.8
Total Score	92.7	90.9
Packout (%) (b)	78.2	75.6
Firmness (c)		
Below 20 (%)	24.0a	14.3b
Below 10 (%)	6.3	3.2

(a) Nitrogen applied: 1X — grower practice, 2X — twice grower practice. Numbers in parentheses after a factor represents maximum score. No significant differences for any factor.

(b) Packout = [(lb pitted fruit / lb raw fruit) x 100]

(c) Durometer units

Table 11. Red tart cherry fruit quality factors of cherry pie mix filling as related to fungicide (three orchards, 1971)

Factor	Fungicide(a)	
	Copper	Dodine
Drained wt. (oz)	8.09	7.33
Size (No. per oz)	13.5	13.9
Defective fruit (%)	25.6	28.4
Color (brightness)	20.4	20.2
Color (redness)	2.24b	2.32a
Integrity (%)	95.9	96.1

(a) Values for a factor followed by different letters differ significantly (P = .05).

Table 12. Red tart cherry fruit quality factors of frozen cherry pies as related to fungicide (three orchards, 1971)

Factor	Fungicide(a)	
	Copper	Dodine
Drain wt (oz)	11.03	10.70
Size (No. per oz)	11.5	11.5
Defective Fruit (%)	29.4	33.0
Color (brightness)	18.93	19.33
Color (redness)	2.14	2.14
Integrity (%)	90.5	91.9
Drained wt (30 lb can)	21.4	21.1

(a) No significant differences between values for any factor.

Table 13. Red tart cherry fruit quality factors of cherry pie-mix filling as related to nitrogen applications

Factor	Nitrogen applied(a)	
	1X	2X
Drained wt. (oz)	8.13	8.09
Size (No. per oz)	11.1	12.0
Defective Fruit (%)	40.3a	32.9b
Color (brightness)	21.0	21.1
Color (redness)	2.17	2.18
Integrity (%)	95.7	96.7

(a) Nitrogen applied: 1X-grower practice, 2X-twice grower practice. Values for a factor followed by different letters differ significantly (P = .05).

Table 14. Red tart cherry fruit quality factors of frozen cherry pies as related to nitrogen applications

Factor	Nitrogen applied(a)	
	1X	2X
Drained wt. (oz)	11.44a	11.10b
Size (No. per oz)	9.4	9.5
Defective Fruit (%)	39.3	39.4
Color (brightness)	19.4	19.7
Color (redness)	2.02	1.97
Integrity (%)	85.8b	91.7a

(a) Nitrogen applied: 1X-grower practice, 2X-twice grower practice. Values for a factor followed by different letters differed significantly (P = .05).