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REDUCING WINTER INJURY **IN RED RASPBERRIES**



HORTICULTURE - FORESTRY DEPARTMENT
Agricultural Experiment Station
SOUTH DAKOTA STATE COLLEGE ♦ BROOKINGS

REDUCING WINTER INJURY

IN RED RASPBERRIES

S. A. McCrory¹

Winter injury is an important problem in South Dakota raspberry growing. Even the most hardy varieties now available may be damaged so extensively that no fruit is produced the following summer.

It has been observed that a mild winter will cause more injury than will one that is continuously cold. Because of the uncertainty of winter survival, covering the plants with soil has become a standard practice. While this is an effective way of preventing winter injury, the method has some disadvantages. Covering the canes breaks off some buds and canes. The labor cost is also rather high.

It was believed that some cultural practice might affect winter survival. Four such practices were started in 1953 and are the basis for this report.

FINDINGS OF OTHERS

Studies on the winter behavior of the raspberry suggest that winter injury may be reduced by cultural means. Brierley² studied the development of cold resistance in

the fall. He reports that a fairly high cold resistance develops when plants are exposed to cool frosty nights for 10 days. By December the plant is fully hardened as we might normally expect.

Brierley also studied growth responses and found that Latham raspberries have completed the rest period by early December and that growth may start when plants are exposed to temperatures of 45°F. This suggests that a warm spell in mid-winter could stimulate early stages of growth. Such plants would be subject to low temperature injury should cold weather follow.

Harvey³ studied heat absorption by brownish-red twigs and found that they reach a temperature as much as 18°F. higher than the surrounding temperature in bright winter sunlight. This suggests that bright sunny days may warm the raspberry canes and start activity

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²Brierley, W. G. and Landon, R. H., *A.S.H.S. Proc.* 47:224-33, 1946.

³Harvey, R. B., *Ecology* 4:391-94, 1923.

even though the winter temperature remains fairly low.

Brierley⁴ found 2 days exposure at 43 and 45°F. was long enough to stimulate such growth with raspberries. Plants exposed to 4 days of such treatment had two-thirds of their canes killed by late winter low temperatures. There is no evidence that growth is not started at temperatures even lower than 43°F. These studies suggest that weather may frequently be such as to cause winter injury to Latham raspberries.

There are two periods when plants may be vulnerable. A mild fall followed by a sudden severe cold spell might kill the plants before they harden. Such injury would be more severe in tips of canes.

A second period when injury might be severe to canes would be a mild temperature in mid-winter ("January thaw") followed by severe cold weather. All of the canes could be killed by this kind of weather. It would therefore seem logical to apply cultural practices that would induce hardening of plants in the fall and also prevent breaking of the rest period in mid-winter.

RESEARCH PROCEDURE

To measure the influence of cultural treatment on winter survival, a planting of Latham raspberries was made in the spring of 1953. The treatments used were irrigation, fertilizer, and tip covering in addition to the check.

A randomized arrangement with four replications and four treat-

ments was used. The site was a garden area on which vegetable crops had been grown for many years. Twenty feet south of the planting a caragana hedge grows to a height of 15 feet. While this distance was great enough to prevent root competition, the south row of raspberries was 30 feet closer to the hedge planting than was the north row. Six plants from a commercial source were planted in a 12-foot plot with four plots per row. Plots were uniform in stand and were kept so by thinning.

Dry weather frequently stops growth and as a result plants may enter a rest period prematurely. Should this happen the plants might break the rest period early, following a mid-winter warm spell. One plot in each row was watered every time the soil appeared to show signs of drying. A "soaker" type garden hose restricted water to the desired area.

Fertilizer might also stimulate growth and prevent premature rest. Two pounds of a 6-10-4 fertilizer as a surface application was used on these plots in mid-July. This rate would require 725 pounds per acre.

In another treatment the canes were bent over and the tops cov-

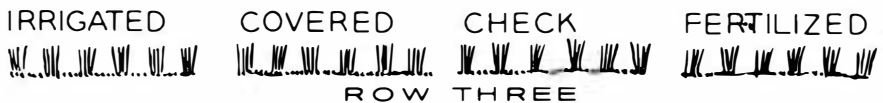
Snow cover in January 1955. Tips of canes in foreground have been covered.



⁴Brierley, W. G., *Minn. Horticulturist* 73:119-21, 1945.



CARAGANA HEDGE



Layout of plots for the experiment.

ered to about one-third of the cane length. This was done just before the ground froze, generally about November 1.

The check plots received the same cultivation and general care that the other plots received.

At the end of the growing season all the canes were measured for height. The following spring the amount of the cane failing to pro-

duce leaves was removed and measured. Yield was taken and the size and quality of fruit noted.

RESULTS OBTAINED

By the end of the first growing season it was obvious the plants in the row adjacent to the caragana hedge were taller and more vigorous than those receiving less protection. Since they had not gone

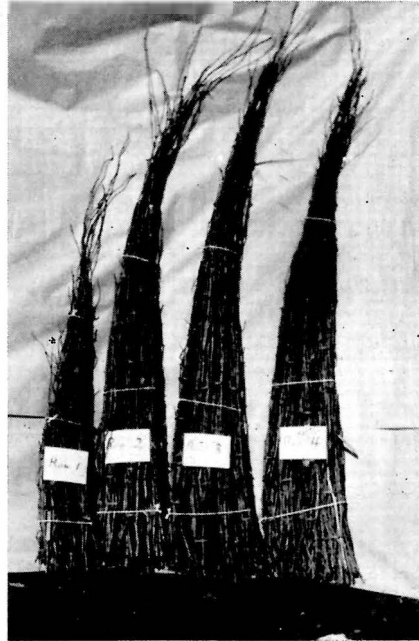
through a winter season, it is assumed that there was some summer protection. This greater length was associated with treatment, but its row location was also important. Averages are presented in table 1.

Table 1. The Influence of Wind Protection During the Growing Season on Cane Length of Latham Raspberries (All Treatments)

| Row | Distance from Protection (ft.) | Average Length of Canes (in.) |
|-----|--------------------------------|-------------------------------|
| 1 | 20 | 59.5 |
| 2 | 30 | 55.3 |
| 3 | 40 | 55.2 |
| 4 | 50 | 52.3 |

The effect of summer growth on winter survival could not be measured. The extent of winter killing was determined by pruning out the dead part of each cane. These were measured for length and tied in bundles. The weight of the prunings gives as accurate a measure as the length and is presented in table 2. Figures are so arranged as to give the average by treatment as well as by rows.

It will be noticed that fertilizer, applied in July, resulted in greater winter loss than any other treat-



Winter-killed canes by row (1 through 4, left to right). All dead material was pruned out and weighed.

ment. The least amount of injury occurred where the tips were covered. Irrigation also appeared to reduce winter injury.

Here again there is little loss in the row next to the caragana and only slightly more in the second row. Since all plants were to the

Winter shade cast on raspberries by caragana hedge.

WINTER KILL



Table 2. The Weight of Winter-Killed Canes in 1954-55 as Influenced by Treatment and Location of Plot

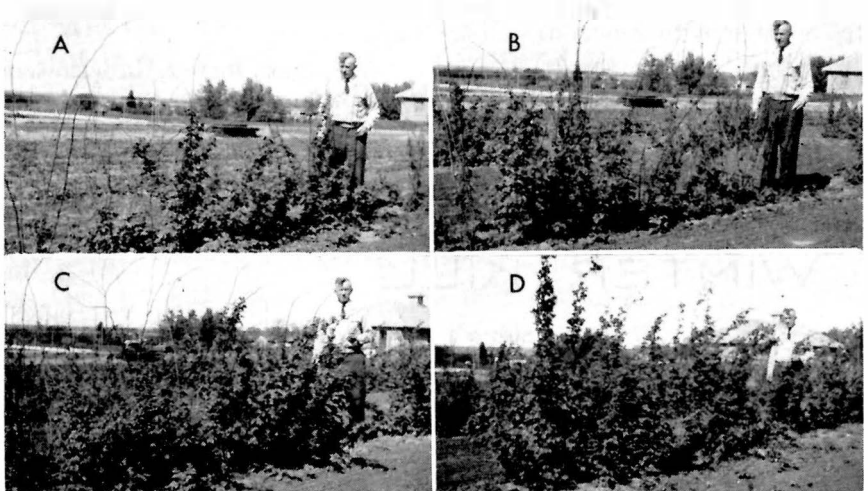
| Row | Treatment | | | | Total |
|-------------|-----------|------------|-------|------------|-------|
| | Covered* | Irrigated* | Check | Fertilized | |
| | (oz.) | (oz.) | (oz.) | (oz.) | (oz.) |
| 1 | 1 | 3 | 9 | 8 | 21 |
| 2 | 8 | 2 | 16 | 19 | 45 |
| 3 | 8 | 10 | 16 | 31 | 65 |
| 4 | 9 | 17 | 20 | 30 | 76 |
| Total | 26 | 32 | 61 | 88 | |

*Statistically significant at 1% level.

Table 3. Raspberry Yield as Influenced by Location and Treatment

| Row | Treatment | | | | Total |
|-------------|-----------|-----------|-------|------------|-------|
| | Covered | Irrigated | Check | Fertilized | |
| | (pt.) | (pt.) | (pt.) | (pt.) | (pt.) |
| 1 | 23 | 18 | 24 | 19 | 84 |
| 2 | 25 | 25 | 17 | 12 | 79 |
| 3 | 23 | 24 | 14 | 7 | 68 |
| 4 | 12 | 12 | 9 | 6 | 39 |
| Total | 83 | 79 | 64 | 44 | |

Effects of treatments on winter survival. A—Fertilized, B—Irrigated, C—Check, D—Covered.



north of the caragana hedge and received equal snow covering, the benefit can not be credited to winter wind protection. However, there may have been benefit from the shade cast in mid-winter by the caragana hedge. During the winter season the first row was in the shade of the dormant caragana. The second row was also shaded but by only the tips and therefore received less shading for a shorter time. This may explain the better survival in rows 1 and 2.

The yield was inversely proportional to the amount of winter killing as is shown in table 3.

Size of fruit is generally considered a measure of quality. Since there was a noticeable difference in fruit size as influenced by treatments, the number of berries required to fill a pint container was determined. Fruit taken from rows 1 and 4 was used, since these rows received the maximum and minimum of protection from the caragana planting (table 4).

From data collected following winter of 1954, it is apparent that covering the tips of the canes with soil reduced winter injury and resulted in a greater yield. For that year, plants supplied with adequate water suffered much less winter in-

jury. Plants that were fertilized in mid-July suffered the greatest winter injury. In all cases the yields were reduced as winter injury increased.

From information shown in table 2, it is evident that some influence other than the treatments applied was responsible for protection to rows 1 and 2, or something was responsible for injury to rows 3 and 4. The protection from the caragana hedge suggests an answer.

During the summer of 1955, the temperature, relative humidity, and wind velocity were measured on 4 days. The maximum temperature averaged 1 degree higher in the row nearest the caragana than it did in the row the greatest distance away. The relative humidity was from 1 to 2 percent higher in the row receiving the greatest protection. The wind velocity was always greater in the row farthest from the protection.

These differences, even though slight, may be responsible for the increased growth. Since the protective planting is to the south of the raspberry plants it would appear to offer no winter protection. It is highly suggestive that winter survival may be associated with shading or reflected sunlight.

Table 4. Number of Berries Required to Fill Pint Container

| Row | Treatment | | | | Average |
|---------------|-----------|---------|------------|-------|---------|
| | Irrigated | Covered | Fertilized | Check | |
| 1 | 149 | 197 | 199 | 208 | 188 |
| 4 | 170 | 173 | 218 | 238 | 199 |
| Average | 159 | 185 | 208 | 223 | — |

SUMMARY AND RECOMMENDATIONS

Since no known raspberry variety is dependably winter hardy in South Dakota, the practice of covering the entire plant with soil has been necessary to avoid losses. The labor cost as well as breakage loss leaves much to be desired with this practice. In an attempt to find a better way to provide winter protection, other methods were investigated. The following information has resulted from this research.

- (1) By covering the top third of the canes with soil, winter injury may be greatly reduced and labor cost and breakage lessened, as compared to covering the entire plants.
- (2) By keeping the plants watered during the dry part of summer less winter injury may result.
- (3) Fertilizer applied in mid-July does not appear beneficial.
- (4) Plant growth may be increased as a result of summer wind protection.
- (5) There appears to be some reduction in winter injury associated with winter shading.

It would seem that a planting made to the north side of a shelter-belt would receive some of the benefits of summer wind protection, accumulated soil moisture, and winter shading from the tops of taller trees. Care should be used to locate the planting far enough away to avoid root competition and summer shading but close enough to get the winter shade.