

# Recovery and Viability of Macartney Rose Seeds Fed to Cattle

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THE INVASION and spread of noxious woody plants over the 93.5 million acres of range lands in Texas have resulted in lowered grazing capacity, increased livestock handling costs and lowered returns to the operator. This infestation includes an estimated 40,000 acres (Allred, 1948) of Macartney rose, *Rosa bracteata* Wendl. in the upper coastal region. This species also is known locally as Chickasaw rose, hedge rose, and wild rose.

The noxious character of the Macartney rose in grazing land was recognized by Hume (1943) and again by Taylor (1949). Both attributed the increase and spread of Macartney rose on range lands to seed disseminated by livestock and by birds. This rose species also reproduces vegetatively, sprouting profusely from the base of the main stem and from shallow lateral roots if the top is killed or removed. Taylor believes that birds are the most important agents of seed dispersal.

A native of China, the Macartney rose was introduced into England prior to 1800 by a diplomatic mission headed by Lord Macartney (Keays, 1942; Hume, 1943). It was subsequently introduced into the United States, and is believed to have spread westward into Texas from the port city of New Orleans (letter from S. W. Geiser, Oct. 12, 1948). At one time it was recommended as a hedge plant because of the high cost of initial fencing (Webb, 1931). Relics of many of these old hedges may still be seen in south Texas, many apparently furnishing the nucleus for local infestation.

Individual plants of Macartney rose form dense clumps ten or more feet in height and several yards wide (Fig. 1A). These clumps may coalesce to form dense impenetrable thickets along fence lines and drainage ditches and in river bottoms. Loudon (1880) states that the plant grows best on loam soil in England, but it is often found in Texas on clay or sandy soils.

A study has been made by the Department of Range and Forestry of the Texas Agricultural Experiment Station to determine some of the factors relating to the spread and establishment of Macartney rose on land used for grazing. This study consisted of four phases: (1) to determine the proportion of recovered seeds of the Macartney rose which is physically damaged in the bovine digestive tract; (2) to determine the viability of apparently sound seeds after passage through the digestive tract of cattle; (3) to determine the influence of retention within the fecal material on the viability of the seeds; and (4) to determine the necessity for cold stratification, a standard nursery practice with ornamental roses, in germinating seeds of the Macartney rose.

Rose seeds are known to pass through certain mammals and birds unharmed. Harmon and Keim (1934) recovered 13.3 percent of *Rosa arkansana* seeds fed to yearling calves during the four days following ingestion. No germination was obtained by these authors, possibly because the seeds were not subjected to cold stratification for after-ripening. Seeds of a rose species in Minnesota passed through

a sharp-tailed grouse gave eight and one-half times the germination of those collected directly from the plants (Aldous, 1941). Schultz (1949) was unable to germinate apparently sound Macartney rose seed fed to chickens.

Rose seeds of the temperate zone species are dormant and require stratification at a low temperature to prepare them for germination (Crocker and Barton, 1931). The most effective stratification temperature is 41°F., but individual species have reacted favorably to temperatures rang-

been found to germinate readily at the recommended stratification temperature (Crocker and Barton, 1931).

Green seeds of Macartney rose germinated better without stratification than seeds which were air-dried and subjected various scarification and stratification measures (Schultz, 1949). Crocker and Barton (1931), in their work with *Rosa rugosa*, found that fresh green seed germinated better than seed allowed to dry on the plant. After three years of dry storage seeds dried on the bush gave the same

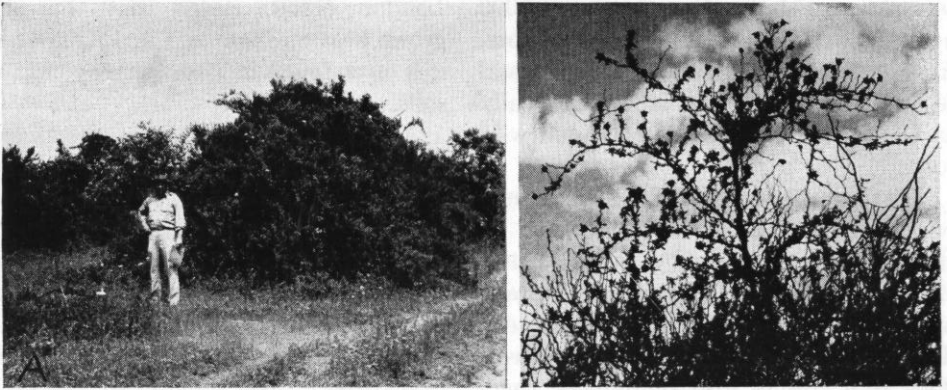


FIG. 1A. Macartney rose is a noxious plant on an estimated 40,000 acres of grazing land in Texas. Individual clumps as shown above often coalesce to form dense thickets of considerable size. 1B. The rose hips (fruits) are borne on the short flower pedicels. The large number produced by an individual plant during a single season is shown on this branch. Cattle take hips within reach during the latter part of the summer.

ing from 32 to 50°F. (Afanasiev, 1942). The time required for this after-ripening has been found to vary considerably depending upon the species. *Rosa multiflora* germinated 72.5 percent and completed germination in four months whereas *R. rubifolia* required 24 months to complete germination with a final percentage of 10.1 (Crocker and Barton, 1931). Species common to southern regions are considered less exacting in their requirements of stratification temperature than species more northern in distribution (Crocker, 1927). Seeds of most rose species have

percentage germination as the green seed in two-thirds the time. Calvino (1930), working with Italian roses, obtained a higher germination from ripe than from green seeds. These results of Crocker and Barton and of Schultz indicate that seed coat permeability may not affect germination adversely prior to the hardening of the coat. Storage over an extended period following collection apparently increased the permeability of the *R. rugosa* seed coats to water and oxygen as signified by the acceleration of germination.

## METHODS

Macartney rose hips (fruits) were fed to four mature cows kept in separate cement-floored stalls during each of the six feedings. The feedings were initiated in August, 1948, when fresh seeds appeared in the droppings of range cattle, and were repeated at six-week intervals. Hips used in each feeding were collected not more than two days previous from Macartney rose plants growing on range land in Brazos County, Texas (Fig. 1B). Fifty hips were randomly selected from the collection and the number of seeds and weight of each hip determined to provide an estimate of the number of seeds ingested.

Each cow was hand-fed 25 randomly-selected hips from the collection made just prior to the feeding. The fecal material from each animal was collected and weighed twice daily for a period of six days after the initial feeding and for seven days following each subsequent feeding. Duplicate 500-gram samples were taken from these individual fecal collections and the seeds extracted by washing to provide an estimate of the number of seeds passed by each animal. An additional 500-grams of dung was retained for use in germination trials.

Germination trials were made to compare the viability of fed and unfed seed collected for each feeding. Samples of seed and dung taken from individual cows were consolidated for germination. The fed seed was further segregated into seeds removed from the dung (washed seed) and seeds remaining within the fecal material (contained seed). Unfed seed and washed seed were germinated in duplicate 100-seed lots on moist filter paper in the dark. Six thousand grams of dung with contained seed were placed in trays of moist sphagnum moss for germination. One set of seed treatments was germinated at room temperature and

another at a constant temperature of 41°F.

All germination trials were concluded April 4, 1950, notwithstanding the varying periods of germination.

## RESULTS AND DISCUSSION

### *Recovery of fed seeds*

Approximately 50 percent of the seeds fed were recovered. This is considerably higher than the 13.3 percent recovery of *Rosa arkansana* seeds from yearling calves reported by Harmon and Keim (1934). An average of 25.5 to 55.7 seeds were passed for each hip eaten. The mean number of seeds per hip ranged from 68.1 to 86.9 with corresponding correlation coefficients of 0.4784 and 0.7731. The standard errors of estimate of the number of seeds per hip in a regression of seed number on hip weight were 25.00 and 23.77 respectively. All correlation coefficients were highly significant. However, these correlations are not sufficiently strong to permit a satisfactory estimate of the number of seeds fed on the basis of hip weight.

The daily percentage recovery, the total number of seeds recovered and the percentage of visibly damaged seeds for each of the six feedings are listed in Table 1. Between 66.2 and 83.7 percent of the seeds recovered were in the two fecal collections made on the second day and the morning collection of the third day following feeding. The recovery after the third day was considerably less and was erratic. In two feeding trials individual animals failed to pass seed after the fourth day following feeding.

A variable amount of damage was exhibited by 4.2 to 11.5 percent of the recovered seeds. Date of feeding could not be associated definitely with the increase in seed damage. Damaged seed varied in appearance from cracked seed coats remaining in place to only portions of seed

coats. An insufficient number of damaged seeds with cracked seed coats was available for germination tests.

TABLE 1

*Percentage of seeds recovered by days from four mature cows fed twenty-five Macartney rose hips on the dates indicated between August, 1948, and April, 1949*

| DAYS FOLLOW-<br>ING FEEDING          | FEEDING DATES |           |            |           |            |           |
|--------------------------------------|---------------|-----------|------------|-----------|------------|-----------|
|                                      | Aug.<br>17    | Oct.<br>2 | Nov.<br>15 | Jan.<br>6 | Feb.<br>15 | Apr.<br>5 |
| 1                                    | 1.4           | 2.6       | 19.2       | 2.7       | 10.4       | 3.3       |
| 2                                    | 42.3          | 38.0      | 41.5       | 58.5      | 65.0       | 62.3      |
| 3                                    | 38.7          | 37.9      | 31.6       | 29.9      | 20.1       | 20.6      |
| 4                                    | 10.7          | 15.2      | 4.7        | 6.4       | 2.9        | 9.5       |
| 5                                    | 5.9           | 4.9       | 1.4        | 1.5       | 0.5        | 2.6       |
| 6                                    | 1.0*          | 1.2       | 1.3        | 0.8       | 1.0        | 1.3       |
| 7                                    | †             | 0.1*      | 0.3*       | 0.2*      | 0.1*       | 0.3*      |
| Total.....                           | 100.0         | 99.9      | 100.0      | 100.0     | 100.0      | 99.9      |
| Total no. of<br>seeds re-<br>covered | 5211          | 2553      | 4165       | 4056      | 5566       | 5126      |
| Percentage<br>of dam-<br>aged seeds  | 4.2           | 6.4       | 8.8        | 11.5      | 8.2        | 8.8       |

\* Fecal collection in morning only.

† No collection made.

### *Germination*

The percentage germination for various treatments of fed seed is shown in Table 2. None of the 2400 unfed seeds, half of which were stratified, showed any germination. These results are not entirely in agreement with those of Schultz (1949) in that the seeds collected in August when somewhat green did not germinate.

The greatest response was obtained from seeds used in the earlier feedings. The seed treatments involving seed used in the two initial feedings may be given the following relative rank from highest to lowest germination: (1) unstratified contained; (2) stratified contained; (3) stratified washed; and (4) unstratified washed. This ranking of treatments and the greater germination from the earlier

feedings support the conclusions advanced by others (Schultz, 1949) that the seed coat is a major factor in germination of Macartney rose seed. Failure of unfed seed to germinate and the relatively greater germination of contained over washed seed add further support to this reasoning and demonstrate the role of cattle in promoting the germination of Macartney rose seed.

Stratification at 41°F. appears to be of minor significance in promoting germination in this rose species. Unfed seed did not respond to stratification, and only a slight advantage in germination was obtained from the stratified portion of the washed seed. A combination of the effects of the manure and stratification within the contained class produced an interaction which gave a significantly lower germination in 18 months than was obtained in unstratified contained seed. The sudden rise in germination of unstratified contained seed from both the August and October feedings after 12 to 14 months suggests an internal response to some condition, perhaps stratification at a higher temperature than was employed in this study.

There are several implications from this study. The high percentage germination of unstratified contained seed from the first two feedings becomes even more significant when it is considered that the hips are taken in greatest quantity by range cattle during this period. Cattle droppings on ranges infested with Macartney rose have been observed to contain so many seeds as to appear to consist almost entirely of them. Given favorable conditions, a large number of these seeds germinate (Fig. 2). The increase in the rate of germination the second year indicates that Macartney rose seeds may retain their viability for a considerable time when stored in dung. Thus, seeds passed by cattle feeding on Macartney rose hips during a single season may con-

TABLE 2

Percentage germination of contained and washed seed of Macartney rose fed in the hip to mature cows at six-week intervals beginning in August, 1948

| COLLECTION DATE AND TREATMENT | NUMBER OF SEEDS USED | TOTAL PERCENTAGE GERMINATION IN MONTHS AFTER FEEDING DATES |     |     |     |     |      |      |      |      |
|-------------------------------|----------------------|------------------------------------------------------------|-----|-----|-----|-----|------|------|------|------|
|                               |                      | 2                                                          | 4   | 6   | 8   | 10  | 12   | 14   | 16   | 18   |
| <i>August 17</i>              |                      |                                                            |     |     |     |     |      |      |      |      |
| Stratified contained.....     | 76                   | 0                                                          | 0   | 3.9 | 3.9 | 7.9 | 9.2  | 10.5 | 11.8 | 11.8 |
| Unstratified contained.....   | 62                   | 0                                                          | 1.6 | 4.8 | 9.7 | 9.7 | 11.3 | 11.3 | 50.0 | 53.2 |
| Stratified washed.....        | 200                  | 0                                                          | 0.5 | 0.5 | 2.0 | 2.0 | 4.0  | 5.0  | 5.0  | 5.0  |
| Unstratified washed.....      | 200                  | 0                                                          | 0   | 0   | 0   | 0   | 0    | 0    | 0    | 0.5  |
| <i>October 2</i>              |                      |                                                            |     |     |     |     |      |      |      |      |
| Stratified contained.....     | 107                  | 0                                                          | 1.9 | 4.7 | 4.7 | 4.7 | 5.6  | 7.5  | 7.5  | 7.5  |
| Unstratified contained.....   | 91                   | 0                                                          | 0   | 0   | 0   | 0   | 0    | 6.6  | 16.5 | 20.9 |
| Stratified washed.....        | 200                  | 0                                                          | 0   | 0   | 0.5 | 1.0 | 1.0  | 1.0  | 1.5  | 1.5  |
| Unstratified washed.....      | 200                  | No germination in 18 months                                |     |     |     |     |      |      |      |      |
| <i>November 15</i>            |                      |                                                            |     |     |     |     |      |      |      |      |
| Stratified contained.....     | 3                    | (Insufficient sample)                                      |     |     |     |     |      |      |      |      |
| Unstratified contained.....   | 3                    | (Insufficient sample)                                      |     |     |     |     |      |      |      |      |
| Stratified washed.....        | 200                  | No germination in 16 months                                |     |     |     |     |      |      |      |      |
| Unstratified washed.....      | 200                  | No germination in 16 months                                |     |     |     |     |      |      |      |      |
| <i>January 6</i>              |                      |                                                            |     |     |     |     |      |      |      |      |
| Stratified contained.....     | 155                  | No germination in 14 months                                |     |     |     |     |      |      |      |      |
| Unstratified contained.....   | 78                   | 0                                                          | 0   | 0   | 0   | 0   | 0    | 2.6  |      |      |
| Stratified washed.....        | 200                  | No germination in 14 months                                |     |     |     |     |      |      |      |      |
| Unstratified washed.....      | 200                  | No germination in 14 months                                |     |     |     |     |      |      |      |      |
| <i>February 15</i>            |                      |                                                            |     |     |     |     |      |      |      |      |
| Stratified contained.....     | 101                  | No germination in 12 months                                |     |     |     |     |      |      |      |      |
| Unstratified contained.....   | 68                   | 0                                                          | 0   | 0   | 0   | 0   | 1.5  |      |      |      |
| Stratified washed.....        | 200                  | No germination in 12 months                                |     |     |     |     |      |      |      |      |
| Unstratified washed.....      | 200                  | No germination in 12 months                                |     |     |     |     |      |      |      |      |
| <i>April 5</i>                |                      |                                                            |     |     |     |     |      |      |      |      |
| Stratified contained.....     | 88                   | No germination in 10 months                                |     |     |     |     |      |      |      |      |
| Unstratified contained.....   | 86                   | No germination in 10 months                                |     |     |     |     |      |      |      |      |
| Stratified washed.....        | 200                  | 0                                                          | 0   | 0   | 0.5 | 0.5 |      |      |      |      |
| Unstratified washed.....      | 200                  | No germination in 10 months                                |     |     |     |     |      |      |      |      |

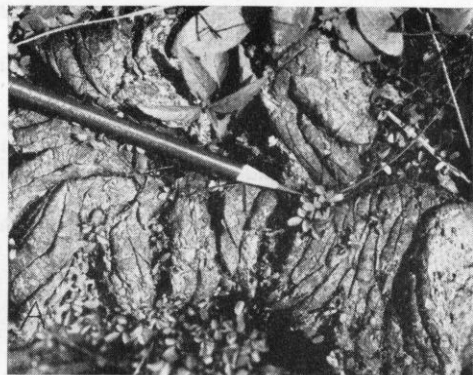


FIG. 2A. Seedlings of Macartney rose emerging from a cow dropping collected on the range.  
2B. A section through a cow dropping showing the density of germinating seedlings.

tinue as a source of infestation for several years.

During the periods when hips are eaten cattle should not be moved directly from infested to clean pastures. Such movement likely would result in the infestation of additional areas by this plant. Retention of animals on areas undergoing treatment for control of Macartney rose is likewise impractical. Deferment of grazing on treated areas during the season cattle take the hips would have the further advantage of permitting the more important forage species to mature seed. Such a procedure might well be the start of a range improvement program on the poor condition ranges so often associated with an infestation of Macartney rose.

#### SUMMARY

Twenty-five hips of Macartney rose containing a variable number of achenes were fed to each of four mature cows at six-week intervals beginning in August, 1948, and continuing until the following spring. Slightly more than 50 percent of the seeds fed were recovered. Approximately 90 percent of the seeds recovered suffered no apparent damage within the animal digestive tract.

More than 90 percent of the seeds recovered were passed by the fourth day. In some instances individual animals did not pass seeds after the fourth day following feeding.

Fed and unfed seed from each feeding were germinated at room temperature and at a constant stratification temperature of 41°F. The fed seed were segregated into seed washed from the dung following passage and seed remaining in the fecal material.

Stratification at 41°F. did not increase germination in the unfed or the washed seed an appreciable amount. Germination in the contained class appeared to be inhibited by stratification.

Permeability of the seed coat seems to

be the primary factor influencing germination of Macartney rose seed. This is illustrated by the successively greater germination in the washed and in the contained seed over the unfed class.

The results of this study emphasize the importance of proper livestock management to prevent the spread of the Macartney rose to new areas or the reinfestation of grazing lands undergoing treatment for the control of this noxious plant.

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