

# 24

## Rose Clover

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Rose clover (*Trifolium hirtum* All.) is one of the most recent wild species to be domesticated and propagated for the benefit of man and his grazing animals. This is one of those rare instances in agriculture where there is exact information concerning the origin, trials, and first commercial sowings (both in California and Western Australia, two important livestock areas) of a forage crop. This information has been an advantage to those interested in research on community and population ecology and evolutionary genetics. It is also one of those rare instances in which scientists, not farmers, introduced the crop.

Acceptance by farmers of this new, winter-growing, reseeding annual clover was very good. The first field plantings of 'Wilton' rose clover on California rangelands were made in the late forties and were substantial by the mid-fifties. It was sown with grain and on abandoned grain land, annual grassland, and brush-burned areas with remarkably few failures. It continues to be important in California. The first field planting of Wilton in Western Australia was made in 1956. In the Fifties and Sixties, it was popular with Wheat Belt farmers in Western Australia (W. H. Biglin, 1958, personal communication). As recently as 1979 it was recommended by the Western Australian Department of Agriculture as "useful in low rainfall areas" (Anon., 1979). But only 2 years later, Gillespie et al. (1981) stated that although rose clover has been successful in their Zone 2 (sandplain country), "its general use is not recommended due to susceptibility to heavy grazing." It may have a place in other parts of Australia (Wallens, 1979) and elsewhere (Wasserman and Wicht, 1972).

Cattle, sheep, and deer thrive on rose clover even during the summer and fall months when the plants are completely dried up. Doves (*Columba livia* Gmelin), quail (*Callipepla californica* Shaw), robins (*Turdus migratorius* L.), and undoubtedly other birds consume and spread the seeds. It is also excellent as a low-maintenance, soil-stabilizing plant on disturbed sites and it is aesthetically pleasing (Graves et al., 1980).

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### DISTRIBUTION AND ADAPTATION

Rose clover is native to the Mediterranean region (Hegi, 1909) and Asia Minor (Gardner, 1957). It is generally found above 200 m elevation "in dry, sterile fields, on slopes, on sandy steppes, on roadsides, waste places in the Mediterranean region. . ." (Tutin, 1968), but it does well up to 1300 m, 41°N latitude in California.

Rose clover has been noted in North Carolina as a weed in lawns (Ahles and Radford, 1959) and it is adventive in Virginia (Fernald, 1950).

Rose clover may well be given more attention where subclover (*Trifolium subterraneum* L.) and crimson clover (*T. incarnatum* L.) are adapted, especially on less fertile soils and where the microtopography includes a mixture of poorly and well-drained sites. In such fields it would be expected to occupy sites where subclover is less well adapted.

### ECOLOGY

Rose clover differs markedly from subclover in a number of critical ecological characteristics. It has greater rooting depth (Humphries and Bailey, 1961), rooting to a depth of 2 m (J. E. Street, 1964, personal communication). It is thus more drought-tolerant than subclover. Most grassland ranges in California are dominated by early-maturing, weedy annual grasses which generally mature before soil moisture is exhausted, so summer weeds are prevalent. As many California range soils do not exceed 1 m in depth, rose clover plants exhaust all available soil moisture during maturation. This prevents the occurrence of obnoxious summer weeds such as tarweeds (*Holocarpha* spp. (D.C.) Grene), which depend on residual soil moisture for germination in late spring (Fig. 24-1). On deeper soils where brush has been burned, rose clover, with its deep rooting habit, helps reduce brush seedling development (Fig. 24-2).

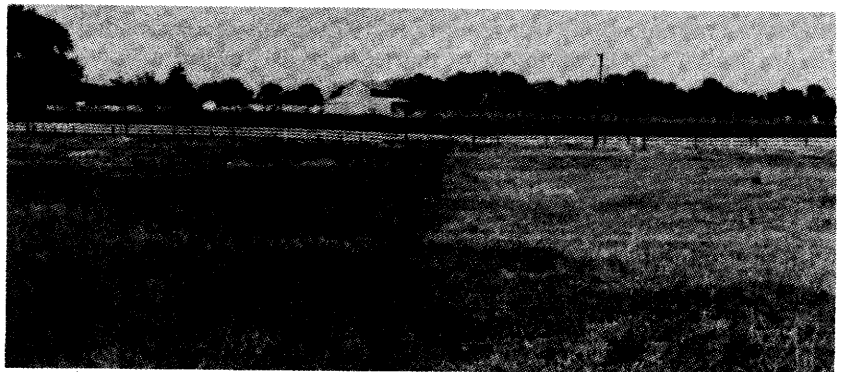


Fig. 24-1. Left, recently cultivated area with abundance of tarweed; right, 6-year stand of rose clover (Love and Sumner, 1952).

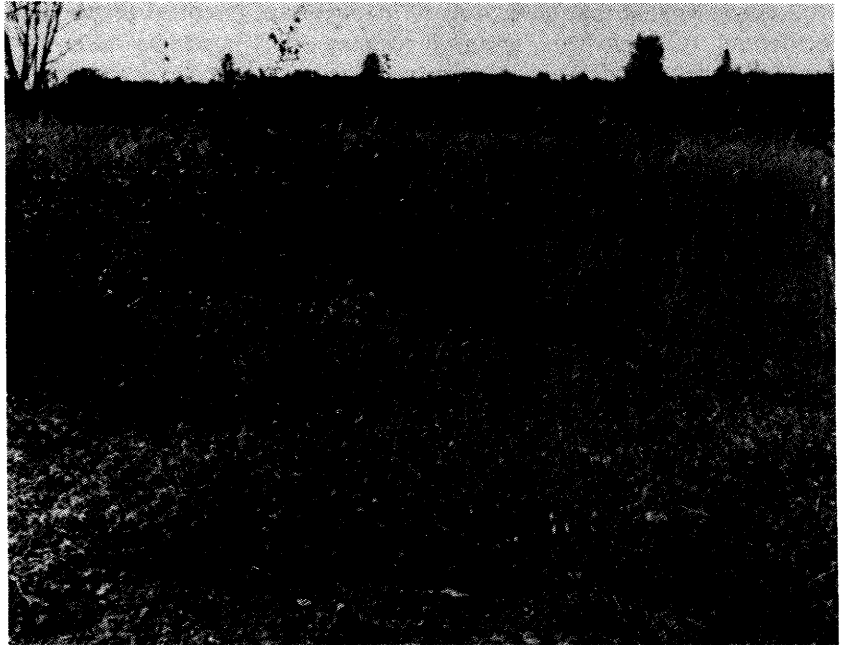


Fig. 24-2. Rose clover does well sown with perennial grasses following a control brush burn (Love and Sumner, 1952).

Rose clover has a high percentage of hard seed. Williams and Elliott (1960) compared this characteristic in range plantings of 'Dixie' crimson clover, 'Mt. Barker' subclover, and Wilton rose clover. They collected seeds monthly from the standing heads of all three cultivars. The percentage of impermeable seeds collected month by month from the heads of crimson clover declined during the summer months from about 60% in June to 5% in October. Subclover followed a similar though somewhat delayed pattern, with impermeable seed declining from 78% to 10%. In the standing heads, however, rose clover maintained the high percentage of 98% impermeable seed throughout the observation period. Summer grazing causes shattering of the dry heads and the seeds fall to the ground. Under these circumstances, seeds of rose clover are no harder than those of many of the subclovers (Quinlivan, 1968), thus ensuring ample germinable seed for the ensuing crop year. Commercial harvesting and processing methods scarify enough of the seed to ensure initial stand establishment.

Many seeds pass undigested through grazing animals, which may then spread the seed widely. Counts of seeds in droppings of cattle grazing on rose clover during the summer showed an average of 6500 undigested seeds/dropping and 85% of these were still impermeable. These seeds remain viable for many years (Helphinstine et al., 1983). Longevity of impermeable seed means that the species can survive years of drought or overgrazing.

symptoms (sterility) have been observed in sheep fed on rose clover in Australia or California.

The ecogenetic approach has been useful in determining the colonizing strategies of rose clover. This includes comparative demographic studies of range and roadside populations, assays of genetic variation, founding of colonies using samples with known polymorphisms, and analysis of seed dispersal and dormancy (Jain, 1975, 1977; Jain and Martins, 1979; Martins and Jain, 1979, 1980; Martins, 1981). Roadside colonies showed a greater amount of reproductive effort as indicated by a larger number of heads per plant, larger calyx, lower rate of seed carryover, greater stalk density lower on the plant, lower seedling survivorship, and earlier flowering. The fact that the calyx was more hirsute in roadside collections and remained attached to the seed would account for higher germinating probabilities on the soil surface or in litter, in contrast to on the range where grazing animals trample the seed into the soil.

### UTILIZATION

In California, mixtures of two or three clover species are commonly sown. In such mixtures rose clover is generally at a disadvantage due to its erect growth habit. Although rose clover does not withstand continuous heavy grazing as well as subclover, in one 5-year experiment Kondinin rose clover outperformed 'Geraldton' subclover and 'Yamina' cupped clover. There were no significant differences in sheep body weight gains but there was some evidence for ranking Kondinin first. Mean relative fleece weights for the first four years were: rose, 114; sub, 100; cupped, 95; and mixture, 107. In the last grazing season, however, Geraldton out-performed Kondinin. In fact, Kondinin and Yamina had practically disappeared by the end of the experiment (Rossiter et al., 1972).

### Seeding

The same seeding procedure should be followed as is used with other small-seeded legumes. Where P and S are limiting factors, single superphosphate should be applied at a rate of 100 to 300 kg/ha before autumn rains begin. Just before sowing, seed should be treated with the appropriate inoculum (e.g., Nitragin's "R" or K10 (Burton, 1979)). If drilled, 5 kg/ha of seed should be used; if broadcast, 10 to 15 kg/ha is recommended. The fertilizer treatment should be applied at least once every 3 years.

If the soil is extremely infertile, supporting little growth of resident plants, rose clover may be used alone. If there is a fairly good cover of weedy annual grasses and forbs, a mixture of 75% rose clover and 25% subclover is recommended. Bur medic (*Medicago polymorpha* Gaertn.) is not recommended in this original mixture in California, because if it is not already present it is probably not adapted to existing soil conditions.

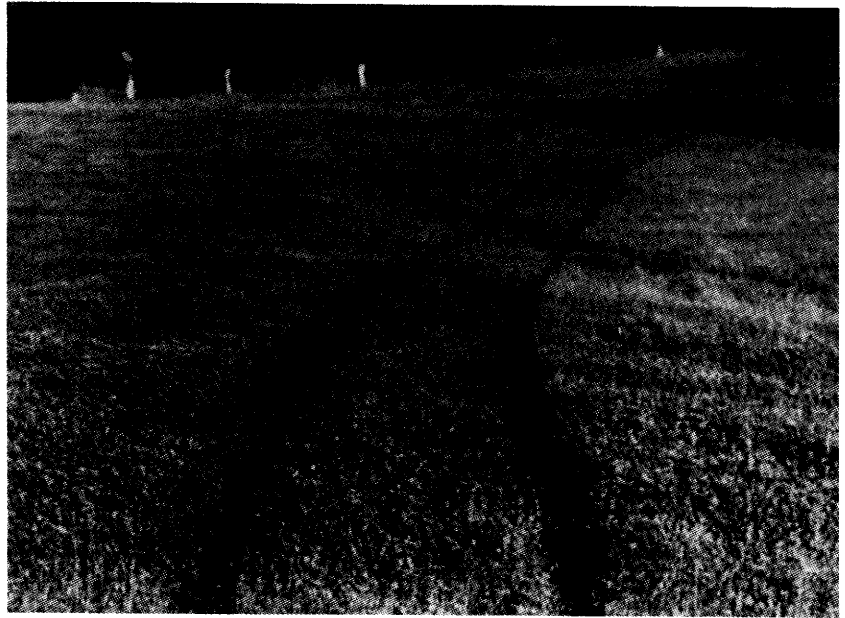


Fig. 24-3. Three-year stand of Wilton, kept for summer grazing (Johnson et al., 1956).

grazing period. By comparison, unimproved rangelands in the area produce from 30 to 55 kg/ha of weight gain during a brief grazing period in winter and early spring (W. Emrick and L. J. Berry, 1968, personal communication). Not only was beef production per hectare excellent, but probably even more important is the fact that excellent forage was available during the hot, dry summer. Such an improved field can significantly reduce the grazing pressure on areas less amenable to improvement.

On abandoned grainland rose clover should be given the same treatment as that described for annual-type rangeland. On grainland, rose clover seed may be broadcast after the grain is planted and the clover seed may be harvested with the grain. In one such planting in San Joaquin County, CA, 300 kg seed ha<sup>-1</sup> were harvested with the oat.

On burned brushland rose clover should be included with the seed mixture of perennial and annual grasses and sown before the winter rains set in. A fresh seeding should not be grazed until mature because the plants are not firmly rooted in the loose ash and will be pulled up by the livestock (Fig. 24-2). The area should be grazed during the summer to take advantage of the forage and to trample the seed into the soil (Love and Jones, 1947).

## GENETICS AND BREEDING

### General

Few genetic studies have been conducted on rose clover. Early attention in California was devoted to determining its range of adaptation, particularly with respect to soils and topography, and to animal-plant inter-

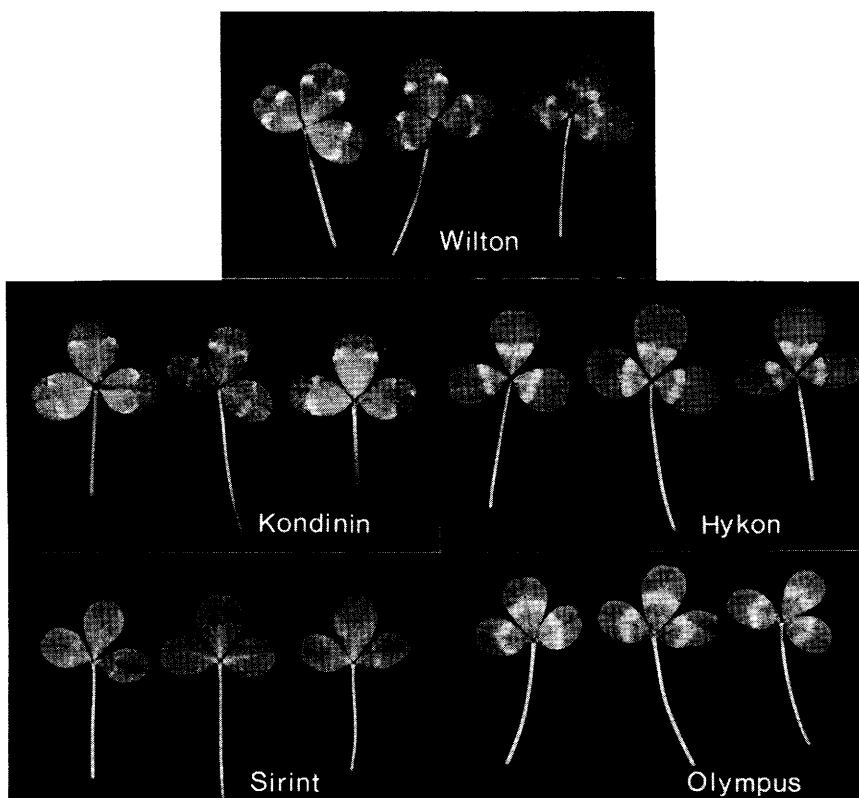


Fig. 24-4. Leaflets of rose clover cultivars (courtesy C. A. Raguse).

Grazing stimulates even more profuse branching and consequent increased seed production. The seed is yellowish, smooth, and about 1.5 mm long with a scar on the end. Very faint striate lines converging on the scar can be seen with a hand lens. There is a very high percentage of hard seed and there are about 390 000 seeds/kg.

It was certified by the California Crop Improvement Association in 1948 (Love, 1952) and registered by the Crop Science Society of America (Reg. No. 6) as Wilton rose clover, named after the town in Sacramento County, CA, near where the first trials were made (Ray, 1967).

#### *Kondinin*

This cultivar resulted from the increase of one exceptionally early flowering plant in the first seeding of Wilton rose clover near Kondinin, Western Australia in 1956 (Bailey, 1965, 1967).

Kondinin is distinguished from Wilton by its semi-erect growth habit in spaced plants, fairly long internodes, large leaflets averaging 1.8 cm long

and 1.2 cm wide, and long petioles. The leaflets are more rounded at the top and there is a distinguishing pale crescent with a dark line above it high on the leaflet. The crescent is often incomplete at the midrib, especially if shaded. In full sunlight it is usually a distinct pink. Kondinin usually flowers in March in California. Seed matures about 4 to 5 weeks later. There are about 308 000 seeds/kg.

### *Hykon*

This cultivar originated as a single plant selected in 1961 from a number of seedlings derived from a hybrid plant which occurred as the product of a natural cross within the cultivar Kondinin in 1960. The selection was based on time of maturity, productivity, and leaf markings (Bailey, 1966).

Grown as spaced plants, Hykon is similar in habit to Kondinin. The middle of the leaflet has a pale crescent bordered above by a conspicuous narrow chocolate or reddish zone or line, but there is no reddish central point as in Kondinin. Near flowering time the crescent may take the form of a shallow V. There are about 245 000 seeds/kg.

Hykon flowers about 7 to 10 days earlier than Kondinin. Forage yields are slightly less than those of Kondinin.

### *Sirint and Olympus*

Bailey (1966) certified these additional varieties, both of which flower earlier than Kondinin. Sirint is the earliest flowering cultivar of rose clover (Malcolm, 1969). It originated from Wilton, but the progenitor of Olympus originated in Cyprus (Bailey and Gayfer, 1968). In spite of their earliness, they apparently were not superior enough in other agronomic traits to compete with Kondinin and Hykon.

## SEED PRODUCTION

Certified seed production of Kondinin and Hykon has been concentrated in Australia. The last certified seed of Wilton was harvested in California in 1967. Since then most California harvests of rose clover have come from range seedings. Stands are combined and harvested yields vary from 300 to 500 kg/ha. With more than 200 crops available, rarely does the California farmer find the production of certified range clover or grass seed profitable.

## DISEASES AND INSECTS

To date, rose clover has been amazingly free of disease and insect damage. A search of the literature failed to reveal any papers on the subject,

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nor have farmers or cooperative extension agents reported any in California.

### RELATED SPECIES

*Trifolium cherleri* L. (cupped clover) is being tested in forage trials.

### ACKNOWLEDGMENTS

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