

## ROSE CLOVER - A PREFERRED QUAIL FOOD

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**Abstract:** Diets of California quail (*Callipepla californica*) were sampled from 1979 to 1981 (n = 287) during the fall and winter on cleared and seeded foothill ranges on the east side of the Sacramento Valley. Rose clover (*Trifolium hirtum*) comprised 43% to 96% of the crop sample by dry weight. It was used both as seed and leaves, and in amounts proportionally greater than its occurrence in the range cover.

Vegetation is often drastically altered by range improvement practices, and the range manager is sometimes criticized for altering the landscape. It should be pointed out that these drastic changes may benefit more than just livestock grazing. Wildlife, including some popular game species, may benefit from the resulting change in cover and altered forage composition. An example on the brush covered foothill ranges of California is the practice of brush removal by fire or mechanical means followed by seeding of desirable forage species. Such seeding is a general practice on many private rangelands in California. Patches of brush usually persist because of their location in gullies, riparian, or rocky areas, and provide desirable cover.

Legumes, because of their ability to utilize atmospheric nitrogen and produce relatively high protein forage, are usually included in seeding mixtures. Rose clover (*Trifolium hirtum*) is a legume commonly used for range improvement in California (Love 1985.) Here, I show it to also be a preferred food plant of California quail (*Callipepla californica*).

#### METHODS

I obtained quail crops from birds killed by hunters during fall and winter months. Age and sex of the bird were recorded for each sample. Crops were preserved in 1979 by storing them in formalin, and in 1980 and 1981 by freezing. The entire crop contents were later separated, oven dried, and weighed to determine the relative amounts of the most common components.

I obtained samples from three ranches located on the east side of the Sacramento Valley from 1979 to 1981. Samples were collected for three years at the Aldridge Ranch, at an elevation of 1500-2500 feet in eastern Shasta County. Brush and trees were cleared by repeated controlled burning starting in 1950. The burn was originally seeded to a mixture which contained rose

clover at 0.5 lb/acre, resulting in an excellent stand which still persists.

The University of California Sierra Foothill Range Field Station is located at an elevation of 500-2000 feet in Yuba County. Samples at Sierra were collected for three years from three cover types: oak woodland which was cleared for firewood and the brush piled, sprouting brush (mostly poison oak (*Toxicodendron diversilobum*) which resulted from burning, and undisturbed brush (mostly *Ceanothus cuneatus*). Only the burned area was seeded to rose clover. Ground cover by species was measured one year on the Sierra Field Station using the step-point method (Evans and Love 1957).

The third area was sampled one year only. This was the Crook Ranch in Tuolumne County at an elevation of 2000-3000 feet. This study site had been mechanically cleared and seeded.

#### RESULTS

##### Aldridge Ranch

All 102 quail sampled for diet in the three-year period had some rose clover in their crop either as seed or green leaves, and usually both (Table 1). Rose clover seed comprised 61% to 70% of the diet. Rose clover leaves were also heavily used when present in the range cover. Acorns were important in only one sample, the sample taken on 31 October 1981, when acorn fragments were found in 50% of the birds (rose clover was found in 100%). Seeds of another legume (*Lotus micranthus*) were very important in 1980, but not in the previous or following year.

##### Sierra Field Station

Rose clover and acorns were the most common food species, accounting for 94%, 68%, and 100% of the samples in the three years of study. There were no consistent differences in diet among the three cover types sampled. Considerable other seed including grasses plus inert matter were consumed in 1980, a very dry fall when

Table 1. Summary of quail diets by percent weight and frequency.

	Aldridge Ranch			Sierra Field Station			Crook Ranch
	1979	1980	1981	1979	1980	1981	1981
-----Percent by weight-----							
Rose clover seeds	70	62	61	31	20	71	11
Rose clover leaves	26	1	8	20	1	21	32
Grass seeds	1	1	--	--	7	--	4
Other seeds	1	31	--	4	10	--	50
Acorns	--	1	30	43	48	16	3
Insects	1	1	1	1	--	--	--
Inert	1	3	1	2	10	--	--
-----Percent frequency-----							
Rose clover seeds	94	100	100	71	68	100	100
Rose clover leaves	97	79	95	86	31	100	95
Acorns	0	4	35	40	49	19	5
Insects	6	15	--	11	--	--	--
Mean weight of crop (g)	1.44	3.21	1.19	1.16	1.15	0.86	1.72
Sample size	34	48	20	69	77	19	20
Juveniles/100 adults	100	164	161	270	330	138	200

almost no green feed was present. The ground cover of rose clover in February of 1980 was 11% in the seeded area, and less than 1% in either unseeded area.

#### Crook Ranch

Rose clover was found in all of the birds sampled, totaling (seeds plus leaves) 43% of the diet. One-half of the diet was a large seeded, non-legume, non-grass species which was never identified.

#### DISCUSSION

Quail are highly selective in choosing among the food sources present. Rose clover is clearly a preferred species as it is selected over the many non-seeded resident species which persist after the range clearing. This is not surprising as legumes are well recognized as a preferred food plant. Measurements at the U.S. Forest Service's San Joaquin Experimental Range (located in the foothills of the east side of the San Joaquin Valley) showed legumes (mostly native *Lotus*, *Lupinus*, and *Trifolium* species) to be important on the years when they were present (Shields and Duncan 1966, Duncan 1968). However, native legumes are notoriously inconsistent between years, being very responsive to the amount and distribution of rainfall

(Shields and Duncan 1966). Rose clover appears to have the advantage over native legumes of being more consistently available from year to year. For example, it was important as quail food all three years at the Aldridge Ranch, but the native *Lotus micranthus* was important only one year.

Rose clover is renowned for its hard seed content, with hard but viable seed persisting for up to 23 years (Helphinstein et al. 1983). Germination may be less than 5% shortly after maturity, and as low as 33% when the first fall rains come. This is an important defense against false starts when early rains do not continue and the germinated plants perish. This high percentage of hard seed assures year-long availability to quail, and is also an important component in the diet after most other seeds have sprouted. Following rains, the leaves of rose clover are also preferred by quail and make up a large part of the diet.

Legume seed may also be a stimulus to breeding. Erwin (1975) hypothesized from studies at Shandon, California, that food quality, particularly the availability of clover seed during the summer, may stimulate the quail to continue vigorous nesting efforts. However, Leopold et al.

(1976) showed that there was an inverse relationship between the incidence of inhibitory estrogenic substances in the diet and success of reproduction in quail. Subterranean clover (*Trifolium subterraneum*) has been shown to cause fertility problems with sheep which eat the green forage (Bennetts et al. 1946). Forage samples of rose clover contain only negligible amounts of estrogens (Marshall 1974), and have not been reported to be a problem with any grazing animals. It is not known if seeds of legumes have a high estrogen content, or if it is only the green forage which is sometimes a problem. The reproductive measurements of the quail populations in the study reported here do not indicate abnormally low values. The age ratio of immature to adult birds varied from 100 to 300 per 100 adults (Table 1). This compares to reports by Leopold (1977) of ranges of 123-214 per 100 adults sampled near the Sierra Field Station, and 4-430 in arid southern California.

The three cover types selected for study at the Sierra Field Station varied greatly in the amount of rose clover present and in the type of cover, although all had considerable escape cover. The ground cover of rose clover was 11% on the burned and seeded area dominated by poison oak sprouts, while the amount present on unseeded areas where oak firewood was cut and the branches piled or in the areas dominated by *Ceanothus cuneatus* the ground cover of rose clover was less than 0.5%. Still, the amount of rose clover in the crop samples was not significantly different among the areas, indicating that the quail were definitely seeking the clover. This compares to reports at the San Joaquin Experimental Range where *Lotus strigosus* made up 53% of the fall diet, but it made up less than 1% of the total plant composition (Shields and Duncan 1966). It is unlikely that the quail ranged any considerable distance to seek higher concentrations of rose clover as there were no such nearby areas. Quail rarely venture more than fifty feet from cover to forage (Summer 1935, Emlen and Gladling 1945).

Leopold (1977:182) suggests that on most ranges food supply is the key element that must be supplied to sustain a high population of California quail. If this is true, rose clover seems to be an ideal species. It is accepted by both quail and range manager, is widely adapted, is tolerant of both heavy and light grazing, and is easy to establish and manage.

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